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Track-I

NANO-DRUG DELIVERY SYSETEM

ETPS_FP_NDDS - 01

Formulation and Evaluation of Mosquito Repellent Herbal Cream

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Herbal mosquito repellent creams offer a promising solution to prevent mosquito bites and associated diseases, minimizing health risks compared to conventional repellents. To create a safe, eco-friendly, and affordable alternative to chemical repellents, which often pose health and environmental risks. The cream was prepared (F1, F2, F3) using water in oil emulsion method with ingredients including beeswax, borax, liquid paraffin, coconut oil, rosewater, glycerine, turmeric oil, lemongrass oil and rosemary oil. F1 consists of turmeric oil, lemongrass oil and rosemary oil; F2 consists of turmeric oil, lemongrass oil; F3 consists of rosemary oil, turmeric oil. The evaluation of cream effectiveness will be carried out by estimating pH, phase separation and irritancy. Repellent activity will be evaluated by using cage test method.

Keywords: Herbal cream, *Cymbopogon citratus*, *Salvia rosmarinus*, *Curcuma longa*

ETPS_FP_NDDS - 02

Development and Characterization of Microencapsulated Sublingual Strips of *Carica Papaya* Leaf Extract

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Dengue fever is a widespread mosquito-borne disease that often leads to complications like thrombocytopenia, a condition where the platelet count drops significantly. This can result in fatigue, delayed healing, and an increased risk of infections if not managed properly. Natural remedies, such as *Carica papaya* leaf extract, have shown potential in increasing platelet counts, making them a promising option for managing dengue complications.

Existing treatments for thrombocytopenia include supportive care, platelet transfusions, oral tablets or capsules containing *Carica papaya* leaf extract. However, platelet transfusions are invasive, expensive, and not accessible in many areas, while tablets and capsules often suffer from poor bioavailability, slow absorption, and inconsistent dosing. To address these limitations, *Carica papaya* leaf extract formulated as a microencapsulated sublingual strip offers an innovative and effective alternative, ensuring therapeutic benefits.

The formulated microencapsulated sublingual strip provides rapid absorption, bypasses the digestive system, and delivers a standardized dose of active compounds. Its advanced formulation enhances bioavailability, reduces variability in dosing, and ensures controlled release of the extract. In addition to being user-friendly and convenient, the strip supports patient compliance and provides a fast-acting, safe, and effective solution for platelet restoration. This novel approach offers timely and consistent treatment option for individuals requiring effective management of thrombocytopenia.

Keywords: Dengue Fever, Thrombocytopenia, Carica papaya, Platelet Restoration, Microencapsulated Sublingual Strip.

ETPS_FP_NDDS - 03

**Development of Nano composite to facilitate the treatment of Body
Dysmorphic Disorder**

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Body Dysmorphic Disorder (BDD) is a mental health disorders marked by persistent and excessive anxiety about perceived defects in appearance, leading to severe emotional distress and impairment in daily functioning. It lowers individuals' quality of life, generally culminating in despair, anxiety, and social disengagement. Current treatment approaches largely incorporate cognitive-behavioral therapy (CBT) and medication medicines, such as selective serotonin reuptake inhibitors (SSRIs). While these treatments produce symptom reduction, they are not always effective, and their delayed onset of action and side effects pose issues in obtaining optimal therapy outcomes. Existing medications for BDD therapy, mainly SSRIs, have limitations such as poor absorption, non-specific action, and systemic side effects include nausea, insomnia, and weariness. These pharmacological drugs often require weeks to achieve noticeable therapeutic benefits. Furthermore, their inability to target certain brain circuits implicated in BDD leads to disappointing outcomes. Similarly, while psychotherapy is effective for some, it typically demands long-term commitment, making it less accessible to all patients. These restrictions underscore the urgent need for fresh and efficient treatment strategies. By improving medication absorption, facilitating regulated release, and avoiding systemic adverse effects, Nano composites provide a major advance over traditional therapy. This new strategy has the potential to change BDD therapy, offering quicker, safer, and more effective therapeutic results. The Nano-composite in question is a protein base Nano composite because of its wide range of solubility and bio- compatibility.

Keywords: BDD; MDD; Nano-composite; Green Synthesis

ETPS_FP_NDDS – 04

Formulation and Evaluation of Herbal Antimicrobial Cream Containing Calotropis Procera Extract

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Skin infections are a common global concern, often caused by microbial pathogens that affect the skin's health and integrity. These infections can lead to discomfort and complications if not treated effectively. *Calotropis procera*, a medicinal plant known for its therapeutic properties, has shown promising antimicrobial activity. Its natural compounds make it a potential candidate for treating skin infections by preventing microbial growth. Existing synthetic antimicrobial creams, commonly used for skin infections, often cause irritation and reduced efficacy over time due to microbial resistance. These issues compromise patient safety, especially in those with sensitive skin. The overuse of chemical-based agents also contributes to the global challenge of antimicrobial resistance. In response, an antimicrobial cream has been developed using *Calotropis procera*, a plant known for its antimicrobial properties, offering a natural alternative for effective treatment. The formulated antimicrobial cream using *Calotropis procera* will minimise the current limitations of synthetic creams, such as irritation, reduced efficacy, and risk of microbial resistance. This herbal cream provides a natural alternative with potent antimicrobial properties, offering a safer option for treating skin infections. By using *Calotropis procera*, the cream not only meets the need for more effective treatments but also helps in reducing the overuse of chemical-based antimicrobial agents, contributing to a more sustainable approach to skin infection care.

Keywords: *Skin Infection, Calotropis Procera, Antimicrobial Cream, Effective Treatment*

ETPS_FP_NDDS – 05

Formulation and evaluation of herbal shampoo for prevention of baldness

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Hair care is essential for personal hygiene and self-confidence, with shampoos playing a crucial role in cleansing the scalp and hair while addressing diverse needs such as hydration, repair, and growth stimulation. At present conventional shampoos, frequently uses synthetic surfactants and preservatives which can remove natural oils from the hair, leading to dryness, irritation, and long-term damage. Natural shampoos are available in the market with less cleansing efficacy or specific benefits for hair growth. In line of this, a herbal shampoo has been formulated with potent active constituents from medicinal plants such as Hibiscus (*Hibiscus rosa-sinensis*), Amla (*Emblica officinalis*), Shikakai (*Acacia concinna*) and Reetha (*Sapindus mukorossi*) which are known for their hair nourishing and strengthening properties. The formulated herbal shampoo will offer gentle cleansing without use of harsh chemicals, promotes hair growth through natural ingredients, and maintains scalp health while minimizing the risk of irritation. By aligning with sustainability goals and consumer demand for eco-friendly products, this formulation not only addresses hair loss but also enhances overall hair quality, making it an ideal alternative to conventional shampoos.

Keywords: *Herbal Shampoo, Alopecia, Hibiscus rosa sinensis, Hair Growth*

ETPS_FP_NDDS – 06

Formulation and Evaluation of Chewable Tablets and Gummies for Improving Hemoglobin Levels

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Iron deficiency anemia (IDA), a common nutritional disorder, affects more than 1.62 billion people worldwide and is recognized as the result of insufficient iron levels, leading to reduced hemoglobin synthesis and various health complications. Hence, to improve hemoglobin levels in individuals with IDA, this work focuses on the formulation and evaluation of chewable tablets and gummies of natural ingredients such as beetroot, dragon fruit, and prickly pears. These formulations can enhance iron absorption and may minimize gastrointestinal side effects commonly associated with traditional iron supplements. The tablets are formulated by a direct compression method and characterized for post-compression studies such as size, shape, organoleptic properties (color, odor), hardness, friability, weight variation, disintegration, and nutritional analysis. The gummies are formulated using agar-agar with natural ingredients. They are characterized for physical appearance, texture analysis, weight variation test, pH Measurement, gummies dimension test, swelling ratio test, dissolution time test, and nutritional analysis. The findings will contribute to better management strategies for IDA patients, particularly children and women with a higher risk of iron deficiency, and promote treatment adherence.

Keywords: Haemoglobin, chewable tablet, prickly Pears, dragon fruit, beetroot, agar-agar, direct compression, powder.

ETPS_FP_NDDS – 07

Novel solid self-nanoemulsifying Drug delivery system of fimasartan

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The objective of the present study was to prepare a solid self-nano emulsifying drug delivery system (S-SNEDDS) of Fimasartan Potassium Trihydrate (FPT), a poorly water-soluble antihypertensive agent. Equilibrium Solubility study and ternary phase diagram study were conducted for screening of excipients. D-optimal Mixture design was employed to optimise the formulation variables, X₁ (amount of oil; Capmul MCM C8), X₂ (amount of surfactant; Labrasol) and X₃ (amount of co-solvent; Transcutol HP). Self-emulsification time (Y₁), percentage transmittance (Y₂) and mean globule size (Y₃) were set as response variables. Optimised liquid SNEDSS (L-SNEDDS) formulation was further assessed for robustness to dilution, thermodynamic stability study, cell viability and TEM analysis. L-SNEDDS was converted into free-flowing powder (S-SNEDDS) by adsorption on the porous carrier like Neusilin US2 and further evaluated solid state characterization. The optimized L-SNEDDS formulation consists of 20% oil, 40% surfactant, and 40% co-solvent, demonstrating strong thermodynamic stability and safety for cellular use. TEM analysis demonstrated that the nanoemulsion comprised spherical, uniformly sized globules. When testing the in vitro dissolution of FPT-loaded S-SNEDDS, there was a noticeable increase in the drug's dissolution rate, achieving 98% drug release within 30 min. Based on the results obtained, it has been concluded that S-SNEDDS, with its ability to create a nano globules of controllable size, enhances the solubility and dissolution. In conclusion, the results of this study indicate the potential use of the developed S-SNEDDS formulation for delivering the active ingredient.

Keywords: Fimasartan, Liquid SNEDDS, D-Optimal Mixture Design, Dissolution Enhancement.

ETPS_FP_NDDS – 08

Development and Characterization of Nanoemulsion Based Mucoadhesive Gel of Luliconazole Comprising Chamomile Oil for the Treatment of Vulvovaginal Candidiasis (VVC)

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Luliconazole (LUZ) being drug of choice is very slightly water soluble (0.0659 mg/ml) BCS class II azole efficiently treating fungal infection if available locally in therapeutic dose. In present work In the present research work, To formulate nanoemulsion of Luliconazole (LUZ) using Chamomile oil for the treatment of vulvovaginal candidiasis nanoemulsion based gel containing 1.5% w/v Luliconazole. Chamomile oil was chosen as oil as it is known for its antifungal activity. surfactants (Tween-80,20) and co-surfactants (PEG-400, IPA, Propylene glycol) was evaluated. After that Construction of Pseudo-Ternary Phase Diagram was done to study the phase behaviour of nanoemulsion. Pseudo ternary phase diagrams were developed using the aqueous titration method. The nanoemulsion system was optimized through D-optimal design and an equivalent amount of nanoemulsion was incorporated in Carbopol 934P to form a mucoadhesive gel. D optimal design was used to optimise the nanoemulsion based on a pseudo ternary phase diagram with three variables: oil(X1), Smix(X2), and water(X3). The results of optimized batch (batch 10) of nanoemulsion shows 109.2% transmittance, -0.9 mV zeta potential, 206 nm globule size, 0.358 PDI, 30.2cP viscosity and 99.91% drug content. Also, the optimized batch of nanoemulsion based gel shows gelling time and having 181cP, 99.1% drug content with 25.5 gm mucoadhesion strength. The in vitro drug release study and ex vivo permeation study shows 94.75% and 86.45% at 4 hours respectively. The nanoemulsion based gel shows larger zone of inhibition. The nanoemulsion and nanoemulsion based gel were stable at both 4 °C and room temperature.

Keywords: *nanoemulsion, chamomile oil, vulvovaginal candidiasis.*

ETPS_FP_NDDS - 09

Development of Biphasic calcium phosphate Scaffold Decorated with Hyaluronic Acid-Chitosan Microspheres Hydrogel for Bone Regeneration

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Bone tissue engineering aims to induce new functional bone regeneration via the synergistic combination triad of biomaterials, cells and regulatory signals. A novel bone replacement was fabricated to enhance bone Regeneration by combining bioceramics, polymer materials and hydrogel. In this study, hydrogel containing Hyaluronic acid (HyA)-Chitosan (Ch) microspheres were loaded onto biphasic calcium phosphate (BCP) scaffold to achieve high bioresorption rate. Fabricated scaffold was then evaluated for development of porous and microporous environment, proliferation and cell cytotoxicity. Resulting scaffold showed high interconnected porosity with high compressive strength of 2.67 ± 0.5 MPa. In vitro bioactivity was seen very well by immersing the scaffolds in simulated body fluid. In vitro cytocompatibility studies were conducted using Bone marrow mesenchymal stem cells. BCP scaffolds loaded with HyA-Ch nanoparticles hydrogel resulted in a significant increase in cell proliferation on day 4 ($p < 0.05$) and day 7 ($p < 0.001$) and high alkaline phosphatase activities at Day 14 and 21. A bone matrix formation was confirmed by positive immunostaining results for osteopontin, osteocalcin and F-Actin. In vitro expression of extracellular matrix proteins demonstrated that this novel bone substitute holds great promise for use in stimulating new bone regeneration.

Keywords: Bone Tissue Engineering, Scaffold, Biomaterials, Biphasic calcium phosphate, Chitosan, Microspheres

ETPS_FP_NDDS - 10

Formulation and evaluation of famotidine-loaded nanosponges for the treatment of peptic ulcer: *In vitro* and *in vivo* evaluation

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Famotidine (FAM), a potent H₂ receptor antagonist for managing peptic ulcers, suffers from low oral bioavailability (40%–50%) due to gastric degradation and poor solubility. To address this limitation, FAM-loaded nanosponges (NSs) were developed using the emulsion solvent evaporation method to enhance its therapeutic efficacy. Four nanosponge formulations (NS1-NS4) were designed with varying ratios of ethyl cellulose from 0.5% to 2%w/v and 0.2%w/v PVA that form a three-dimensional structure that enables the system to accommodate FAM. The particle size, PDI, ZP, %yield and EE% was found to be in the range of 195.46-295.58nm, 0.095-0.161, -12.5-20.6mV, 60.46%-87.64% and 47.18-66.59% respectively. The optimized formulation exhibited a particle size of 204.88 nm and an entrapment efficiency of 66.59%, with a sustained drug release of 76.75% ± 0.68% over 12 hours along with a yield of 87.64%. The antiulcer study was established utilizing the alcohol-induced ulcer model. *In vivo* pharmacokinetic studies demonstrated that the mean maximum concentration (C_{max}) and area under the curve (AUC₀₋₁₂) for the NS3 group were significantly higher-1.78 and 1.70 folds, respectively than those groups administered with pure FAM group, indicating improved oral bioavailability of FAM when loaded into NSs. Moreover, in animals administered with optimized FAM-loaded NSs, the ulcer index was notably reduced to 5.77% ± 0.69% as compared to 19.23% ± 0.82% in the group administered with FAM solution and 28.72% ± 0.97% in the ulcer control group. These results suggest that nanosponges are a promising approach for enhancing the oral bioavailability of famotidine, potentially improving its effectiveness in peptic ulcer treatment.

Keywords: Famotidine, bioavailability, nanosponges, peptic ulcer, antiulcer activity.

ETPS_FP_NDDS - 11

Progress in drug delivery and diagnostic applications of carbon dots: a systematic review

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Carbon dots (CDs), which have particle size of less than 10 nm, are carbon-based nanomaterials that are used in a wide range of applications in the area of novel drug delivery in cancer, ocular diseases, infectious diseases, and brain disorders. CDs are biocompatible, eco-friendly, easy to synthesize, and less toxic with excellent chemical inertness, which makes them very good nanocarrier system to deliver multi-functional drugs effectively. A huge number of researchers worldwide are working on CDs-based drug delivery systems to evaluate their versatility and efficacy in the field of pharmaceuticals. As a result, there is a tremendous increase in our understanding of the physicochemical properties, diagnostic and drug delivery aspects of CDs, which consequently has led us to design and develop CDs-based theranostic system for the treatment of multiple disorders. In this review, we aim to summarize the advances in application of CDs as nanocarrier including gene delivery, vaccine delivery and antiviral delivery, that has been carried out in the last 5 years.

Keywords: Carbon dots, Progress in drug delivery, Applications of carbon dots

ETPS_FP_NDDS - 12

Implantable systems for drug delivery to the brain (Review)

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Most diseases and disorders of the brain require long-term therapy and a constant supply of drugs. Implantable drug-delivery systems provide long-term, sustained drug delivery in the brain. The present re- view discusses different type of implantable systems such as solid implants, in situ forming implants, in situ forming microparticles, depot formulations, polymericlipid implants, sucrose acetate isobutyrate and N-stearoyl L-alanine methyl ester systems for continuous drug delivery into brain for various brain diseases including glioblastomas, medulloblastoma, epilepsy, stroke, schizophrenia and Alzheimer's diseases. Implantable neural probes and microelectrode array systems for brain are also discussed in brief.

Keywords: Biodegradable implant, brain delivery, CNS delivery, in situ forming implant. in situ forming microparticles, solid implants

ETPS_FP_NDDS - 13

**Preparation and Evaluation of microemulsion containing Berberine HCl
and Callistemon citrinus oil for wound healing**

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The study focused on the development and evaluation of a microemulsion formulation using the spontaneous emulsification method. Stability and compatibility studies were performed, and the formulation was characterized for globule size, polydispersity index, and surface morphology using TEM. An optimized formulation, named F3, was selected after preparing primary and secondary phase mixtures in various ratios (1:9 to 5:5). Stability studies confirmed F3 as the best formulation, comprising Callistemon citrinus oil, Berberine HCl, Tween 80, ethanol, glycerol, Cremophor® RH 40, propylene glycol, Labrasol® ALF, and water. The spherical globules of F3 had a mean size of 24.33 nm, and the formulation exhibited excellent stability and compatibility. F3 was further incorporated into Carbopol 940 (0.75% w/w) to develop a microemulsion gel (MG1) to enhance contact time and viscosity. MG1 demonstrated pseudoplastic rheological behavior, crucial for better spreadability during wound application. Ex vivo studies using a Franz diffusion cell revealed superior skin permeation and retention of MG1 compared to plain gel. In vivo wound healing studies on animals indicated that MG1 significantly enhanced wound contraction and reduced epithelization time compared to plain gel. In conclusion, the Berberine HCl and Callistemon citrinus-based microemulsion gel (MG1) demonstrated improved wound healing potential, suggesting it as a promising formulation for effectively treating excision-type wounds. The results highlight its advantages over conventional plain gels, offering enhanced therapeutic efficacy and application benefits.

***Keywords:* Callistemon citrinus, Berberine HCl, microemulsion, spontaneous emulsification, wound healing.**

ETPS_FP_NDDS - 14

**Formulation and Evaluation of Epigallocatechin-3-O-gallate loaded
Mucoadhesive Microbeads for Bioavailability Enhancement.**

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The EGCG Loaded Mucoadhesive Microbeads were prepared using the Ionic gelation method and characterized for compatibility, drug-polymer ratios, and surface topography. They were subjected to in vitro wash-off tests and in vivo bioavailability studies to determine their mucoadhesive properties and the effectiveness of different drug polymer ratios. The study developed mucoadhesive gastro-retentive microbeads for controlled EGCG delivery. The microbeads were prepared using polymers like Sodium Alginate, k-carrageenan, and Chitosan. The 1:4 formulation showed the highest drug yield (63.8%), excellent entrapment efficiency and the highest swelling index. The in vitro release profile showed sustained release for up to 8 hours. Release kinetics followed the Higuchi model and Korsmeyer-Peppas model, with non-Fickian diffusion observed. The mucoadhesive property of the 1:4 formulation was the best, along with its improved oral bioavailability, attributed to its retention in the acidic stomach environment and protection from degradation in the intestine. The developed gastro-retentive mucoadhesive microbeads loaded with EGCG significantly improve oral bioavailability, with a 1:4 drug-to-polymer formulation showing maximum mucoadhesive properties, high drug entrapment efficiency, sustained release, and superior swelling index, enhancing therapeutic potential.

Keywords: Mucoadhesive microbeads, Gastro-retentive, Oral bioavailability, Korsmeyer-Peppas model, Ionic gelation method.

ETPS_FP_NDDS - 15

Phospholipid Magnesomes for Brain Drug Delivery

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Phospholipid magnesomes serve as a novel non-carrier drug delivery system via the nasal route to the brain. This system consists of soft phospholipid vesicles formulated from phospholipid, water, propylene glycol, magnesium salts, and the mucoadhesive polymer alginate. The magnesomal structure comprises multilamellar nanosized vesicles capable of encapsulating both lipophilic and hydrophilic drugs. The inclusion of phospholipid enhances absorption through various mechanisms, such as disrupting cell membranes, opening tight junctions, and inhibiting enzymatic drug degradation. The small size of the magnesomes is crucial for overcoming mucociliary clearance, enabling effective penetration through the mucus barrier and ensuring prolonged retention at the cell surface. This results in improved bioavailability and therapeutic efficacy of drugs delivered nasally. Studies indicate that phospholipid magnesomes can significantly enhance drug effects by promoting absorption and extending contact time with the nasal mucosa, thereby facilitating efficient delivery to the brain compared to traditional delivery systems.

Keywords: Phospholipid magnesomes, bioavailability, drug delivery, brain

ETPS_FP_NDDS - 16

Development and Evaluation of Abiraterone Acetate Loaded Emulsomes for Enhancement of Oral Bioavailability

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Abiraterone acetate belongs to BCS Class IV and therefore, has poor aqueous solubility and poor permeability. The aim of the present study was the development and evaluation of Abiraterone acetate loaded Emulsomes to enhance the solubility. The compatibility of the drug and various excipients were evaluated by using Fourier Transformed Infra-Red Spectroscopy (FTIR). The presence of distinctive drug peaks in the excipient and drug spectra indicated the drug's compatibility with other excipients. Abiraterone acetate loaded Emulsomes were prepared using Stearic acid, Cholesterol, Soya Lecithin. Screening of final formulation was carried out based on particle size, zeta potential and Entrapment efficiency. The results of *In vitro* dissolution study proved that Abiraterone acetate loaded Emulsomes have better dissolution profile as compared to pure Abiraterone acetate. The percent drug release was found to be $31 \pm 2.3\%$ for pure Abiraterone acetate and $88 \pm 1.7\%$ from the F5 formulation at the end of 10 hours of study.

Keywords: *Abiraterone acetate (ABA); Entrapment Efficiency (EE); Stearic acid (SA); Soya Lecithin (SL); Fourier Transformed Infra-Red Spectroscopy (FTIR)*

ETPS_FP_NDDS - 17

Formulation and Evaluation of Aegle Marmelos Gummies for Antimicrobial activity

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The tropical fruit Aegle marmelos, commonly referred to as Bael, is indigenous to the Indian subcontinent and has been utilized frequently in traditional medicine due to its many therapeutic uses. Bioactive substances like alkaloids, flavonoids, and terpenoids are found in the plant and have a range of biological actions, such as antioxidant, antibacterial, and anti-inflammatory qualities. The formulation of Aegle marmelos in contemporary, consumer-friendly delivery forms may contribute to improving patient compliance and the therapeutic efficacy of this plant, which has substantial medicinal potential. Gummies, which provide a tasty and practical means of delivering the plant's beneficial chemicals, is the main emphasis of this work. Aegle marmelos formulations that are readily accessible, such as powders, capsules, and extracts, have drawbacks such as bad taste, low bioavailability, and trouble with accurate dosing. These problems can impair the plant's medicinal potential and patient adherence to therapy. Furthermore, conventional antimicrobial treatments may only be effective against specific bacteria or frequently have adverse consequences. These disadvantages underscore the need for a more practical and efficient alternative that maintains Aegle marmelos's entire range of therapeutic advantages. The proposed solution is the formulation of Aegle marmelos-infused gummies, designed to address the challenges of traditional delivery forms. The gummies will be created using natural sweeteners and gelling agents to enhance taste, making them more appealing and easier to consume. This innovative approach ensures the stability and bioavailability of the plant's active ingredients, offering an effective alternative to conventional medicinal forms while improving patient compliance and satisfaction.

Keyword: *bael gummies, aegle marmelos, herbal gummies, antimicrobial gummies, gummies, gummy candy*

ETPS_FP_NDDS - 18

Cervical cancer treatment: gold nanoparticles; applications, synthesis & characterization

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The fourth most frequent cancer among women worldwide is cervical cancer. Recently, many AuNP varieties have been developed with the goal of enhancing both their in vitro and in vivo effectiveness in cervical cancer cells. The majority of this review's attention is given to the production of gold nanoparticles and their uses in the treatment of cervical cancer through targeted medication delivery. One of the most intriguing and cutting-edge subfields of this research is nanotechnology. Due to their distinct characteristics, small size, and high surface area-to-volume ratio, gold nanoparticles stand out among other nanoparticles in this field. These particles' beneficial nature, stability, high dispersity, lack of cytotoxicity, and biocompatibility have made them widely used in a variety of biomedical applications and drug delivery systems.

Keywords: Gold nanoparticles, SPR, Magnetic resonance, Green chemistry.

ETPS_FP_NDDS - 19

**Formulation Design and Characterization of Self Micro Emulsifying Drug
Delivery System for Pravastatin**

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The Pravastatin (PRAVA) self-microemulsifying drug delivery system (SMEDDS) was developed to address the issues with poor solubility. Because PRAVA is almost completely insoluble in water, it exhibits irregular oral absorption and has an impact on bioavailability. According to saturated solubility studies, the oil phase was chosen for the formulation, and surfactants and co-surfactants were screened according to their capacity for emulsification. The self-emulsifying area was identified using ternary phase diagrams. It was determined that polyethylene glycol 200 (20%), almond oil (20%), and tween 80 (60%) were the components that were optimised. The droplet size, zeta potential, emulsification time, and rheological analysis were used to characterise the prepared SMEDDS. The trial validated PRAVA SMEDDS's potential for oral administration. The conclusion is that poorly water-soluble drugs like PRAVA can have their solubility and dissolution improved using the SMEDDS formulation technique.

Keywords: Pravastatin, SMEDDS, Phase Diagram, Dissolution Rate.

ETPS_FP_NDDS - 20

**Formulation and Evaluation of Nanostructured Lipid Carriers for
Intranasal Delivery of Donepezil HCl and Novel Seed Extract to treat
Alzheimer's Disease: In vitro and In vivo evaluation**

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This study aimed to formulate Nanostructured Lipid Carriers (NLCs) containing Donepezil Hydrochloride (DNZ HCl) and Novel Seed Extract (PEF-A) for improved treatment of Alzheimer's Disease (AD). High Pressure Homogenization (HPH) and Ultrasonication were used to develop the NLCs. LCMS Analysis of PEF-A reveals that it contains compounds like Neostigmine with a 93.16% similarity. A zeta potential (ZP) of -47.86 mV, a polydispersity index (PI) of 0.2242 ± 0.04 , and a particle size (PS) of 144.3 ± 2.64 nm were all displayed by the optimized Nanostructured Lipid Carriers (NLCs). The results showed that the drug loading, drug content, and entrapment efficiency were 12.94%, 81.59%, and 79.41%, respectively. Transmission Electron Microscopy confirmed the NLCs morphology. Ex-vivo studies showed slower release from the DNZ solution compared to the NLCs, indicating improved permeability of the NLCs through biological membranes. Histopathological studies revealed that the NLCs were non-toxic to goat nasal mucosa. The synergistic potential of NLCs formulation with additional PEF-A is confirmed by in vivo studies. The study found that DNZ NLCs formulated with PEF-A showed significant improvement in memory impairment in Alzheimer's-induced rats, demonstrating a potential synergistic effect through intranasal delivery for effective Alzheimer's disease management.

Keywords: Alzheimer, Donepezil HCl, Novel seed extract, NLCs, In vivo.

ETPS_FP_NDDS - 21

Development of Growth Factor Laden Chitosan Based Tri-layered Burn Wound Dressing

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Burn injuries remain a significant global health concern, contributing to approximately 180,000 annual fatalities and representing a leading cause of morbidity, especially in resource-limited regions. Developing advanced strategies for managing burn wounds is crucial to enhancing patient outcomes and mitigating associated complications. This study examines the development of a tri-layered burn wound dressing. The dressing consists of a porous polyethylene sheet, a chitosan scaffold loaded with growth factors and lidocaine, and a non-permeable polyethylene sheet. The dressing is designed to promote angiogenesis, provide localized anaesthetic effects, and deliver antimicrobial protection for enhanced wound healing and patient comfort. Comprehensive analytical and biological evaluations, including UV spectroscopy, FTIR, DSC, SEM, XRD, swelling studies, and porosity measurements, collectively validate the dressing's structural integrity, chemical stability, and functional suitability for burn wound management, aligning with its intended therapeutic objectives. In vitro drug release studies demonstrated controlled lidocaine release for localized pain management, reducing systemic toxicity. Angiogenesis studies confirmed enhanced blood vessel formation, essential for wound healing, while the MTT assay verified biocompatibility by ensuring no cytotoxic effects. In vivo animal studies demonstrated the dressing's efficacy, with complete wound healing achieved within 20 days, significantly outperforming control treatments in promoting tissue regeneration and reducing inflammation. The results highlight that this innovative dressing has the potential to significantly improve burn wound healing, making it a valuable asset in clinical wound care. Overall, it combines antimicrobial, regenerative, and protective properties for effective clinical application.

Keywords: *Burn wound dressing, Chitosan scaffold, Angiogenesis, Lidocaine release, antimicrobial properties*

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Development and Characterization of Electroconductive Wound Healing Dressing

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The study addresses the increasing public health concern of injuries, which account for millions of deaths and significant morbidity. It explores the intricate structure and vital functions of human skin, emphasizing the role of endogenous electric potential in wound healing.

However, study aims to develop and characterize an innovative electroconductive wound healing dressing that integrates silver nanoparticles, lidocaine, chitosan, and polyaniline to enhance healing through electrical stimulation. Using solvent casting, formulation is optimized for effective film formation and characterized for swelling, mechanical property and biodegradation study. Comprehensive analyses include FTIR, DSC, XRD and cytotoxicity assessments, validate effectiveness of dressing and confirm the structural integrity. In vitro study demonstrated most significant cell growth, biocompatibility and angiogenesis in growth factor containing electroconductive Patch. The electroconductive dressing demonstrates broad-spectrum antimicrobial properties, and accelerated healing rates. In vivo study reveals that the electroconductive patch significantly reduces the complete epithelization period to 18 days.

The findings suggest that multifunctional electroconductive patch could represent a significant advancement in wound care, addressing limitations of current treatments, promoting faster and more efficient healing processes.

Keywords: wound healing, electroconductive, polyaniline, chitosan

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Overcoming solubility challenges of griseofulvin: development of melt-spun solid dispersion using sucrose and lactose as carriers

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The antifungal agent Griseofulvin (GSF) is poorly water-soluble drug, and its absorption from oral route is also poor, as a result, it has less bioavailability on conventional oral administration. This study aims to overcome the solubility challenges of Griseofulvin by melt-spun solid dispersion and formulate it into a tablet dosage form for the treatment of fungal infections. Sucrose and Lactose were used as carriers and investigated for their effectiveness in solubility enhancement. Microfibres loaded with 10% ^{w/w} drug were fabricated using centrifugal melt spinning and evaluated for % yield, drug loading capacity, microscopic examination, Scanning Electron Microscopy, saturation solubility, PXRD, DSC, FTIR. In vitro drug release was performed on pure drug, physical mixture of GSF + sucrose, GSF + lactose, GSF loaded sucrose microfibres and GSF loaded lactose microfibres. Microfibres showed significantly faster release rates compared to pure drug and physical mixture due to increased solubility. Then these microfibres were formulated into tablet and evaluated for various parameters. This study suggests potential of microfibres to enhance the rate and amount of drug release, ultimately improving oral bioavailability. This also suggests that Sucrose is superior carrier than lactose for producing solid dispersion using melt-spun.

Keywords: *Griseofulvin, Melt-spun, Microfibres, Solid Dispersion, Solubility.*

ETPS_FP_NDDS - 24

Formulation and evaluation of moxifloxacin nanoparticle loaded ocular inserts

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This study aims to develop sustained-release nanoparticulate ocular insert for moxifloxacin delivery. Moxifloxacin nanoparticles were prepared and loaded into ocular insert. The insert was prepared using HPMC, XG, GG, Na-A, CMC, PEG 400, Poloxamer and PVP as matrix-forming polymers via solvent casting method. Total seven batches of ocular inserts were prepared. Then drug loaded ocular insert were characterized for thickness, weight uniformity, folding endurance, moisture absorption/loss, surface pH, swelling index, drug content uniformity, *in vitro* drug release, DSC, HET-CAM test. The nanoparticle formulation showed a particle size of 370.5 nm, zeta potential of -15.7 mV, and an entrapment efficiency of 83.6% $\pm$ 1.20%. The optimized batch F7 showed thickness of 0.35 $\pm$ 0.05 mm, weight uniformity of 12.1 mg, folding endurance of 230, and a swelling index of 28.21 $\pm$ 0.54% and drug release of F5 batch showed 55.76 $\pm$ 0.54 up to 420 min. DSC thermograms revealed uniform distribution of nanoparticles into polymer matrix of insert. HET-CAM test showed no irritation. These results suggested that moxifloxacin nanoparticle loaded ocular insert enhanced the residence time, improved permeation, reduced irritation and achieved controlled release of drug.

Keywords: moxifloxacin, nanoparticles, ocular insert, solvent casting evaporation, sustained release, HET CAM test

ETPS_FP_NDDS - 25

**Formulation Development and Evaluation of Fast Dissolving Film of
Venlafaxine HCL**

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Fast-dissolving films (FDFs) are solid dosage forms designed to disintegrate rapidly in the mouth, releasing active ingredients for oral mucosal or gastrointestinal absorption. Venlafaxine HCl, an antidepressant, serotonin-norepinephrine reuptake inhibitor (SNRI) class, increases serotonin and norepinephrine levels in the brain. Psychotic patients may face challenges with oral medications due to taste, swallowing difficulties, or the unacceptability of injectable, particularly during agitation. Formulating Venlafaxine HCl as an FDF enables rapid absorption, partially avoids first-pass metabolism, improves bioavailability, and enhances patient compliance. Fifteen formulations (F1–F15) were prepared using the solvent-casting method using HPMC, PVA, GG, MTD, XG, Na-A, Dextrose, PVP, PEG400, CA and water. These formulations were evaluated for parameters including weight variation, thickness, folding endurance, surface pH, moisture loss, drug content, disintegration time, and in vitro drug release. F13 formulation containing was selected as optimized formulation. F13 demonstrated a thickness of 0.38–0.45 mm, a weight of 29.8 mg, and moisture loss below 2%, effectively preventing hardening and cracking. Folding endurance was within acceptable limits (150–200), and the surface pH ranged was from 6 to 7. Swelling index was 1.38, a disintegration time was 78 seconds, and the fastest drug release within 30 minutes. F13(containing XG, Dextrose, PVP, PEG 400, CA, water) batch showing most satisfactory result among all formulations. These results suggested that Venlafaxine HCl FDF is a promising option for rapid oral administration, particularly when fast action is required.

Keywords: Venlafaxine HCL, fast dissolving films, solvent casting method, film properties, drug release.

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Development and Evaluation of Chitosan/Silk/Carbonated Hydroxyapatite Scaffolds for Bone Regenerating Application

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Bone defects caused by trauma, tumors, congenital anomalies present challenges in clinical management. Traditional treatments like autografts, allografts, and xenografts face limitations, including donor site morbidity, immune rejection, and poor integration. Recent advances in bone tissue engineering offer promising alternatives by leveraging biomaterials, growth factors, and cells to create biocompatible scaffolds that mimic natural bone structures. Study focuses on development and evaluation of composite scaffolds made from chitosan, silk fibroin, and carbonated hydroxyapatite (CHA) for regenerative bone applications. Scaffolds fabricated using freeze-drying techniques and characterized for porosity, swelling, mechanical properties, degradation rates. Analytical methods, including FTIR, DSC, XRD, confirmed structural integrity and material compatibility. In vitro studies demonstrated excellent biocompatibility, with enhanced cell proliferation and angiogenesis observed in scaffolds containing growth factors. Biodegradation tests indicated controlled degradation rates suitable for tissue regeneration. The results highlight synergistic effects of chitosan, silk and CHA in creating a scaffold that supports cell growth, promotes vascularization, and facilitates bone tissue regeneration. Study provides foundation for advancing bone graft substitutes, offering scalable and effective solution for treating critical-sized bone defects.

Keywords: *scaffolds, chitosan, silk fibroin, carbonated hydroxyapatite*

ETPS_FP_NDDS - 27

Development, optimization and evaluation of ophthalmic polymeric nanoparticles of moxifloxacin HCL

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Enhanced drug delivery to the ocular site possess significant challenges due to their unique anatomy and physiological barriers. The conventional eye drops have limited efficacy and very less amount of drug penetrates the cornea and reach intraocular tissues, which thereby results in lower bioavailability. To overcome the problems associated with conventional drug delivery systems, novel drug delivery systems such as nanoparticles were developed. Nanoparticles were prepared to provide sustained drug delivery, to improve the residence time of drugs on the corneal surface. In this study, nanoparticles were prepared using combination of polymers like poly vinyl alcohol, chitosan, eudragit RL100 by solvent evaporation method. Drug polymer compatibility study was performed using IR and DSC. The optimization of batches was done using Box Behnken design. Prepared nanoparticles were evaluated for various physicochemical properties including pH, particle size, zeta potential, entrapment efficiency, drug content, *in vitro release*. The particle size of optimized batch F9 was found to be 370.5nm, zeta potential of -15.7 mV, and an entrapment efficiency of 83.6%. The drug content was found to be 72.74% and drug diffusion was around 59.43%. Thus, the optimized formulation offers the potential for improved retention and drug release over the period of time which may help in improving bioavailability of moxifloxacin HCL.

Keywords: Moxifloxacin hydrochloride, Ocular bioavailability, Polymeric nanoparticles, Sustained drug delivery

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**Formulation and optimization of ropinirole hydrochloride loaded
mucoadhesive niosome for intranasal delivery**

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Neurologic disorders such as Parkinson's disease requires targeted delivery of therapeutic agents. Long term exposure of the certain medications leads to significant motor complications. The nasal delivery of Ropinirole HCl has lower retention time in nasal cavity due to mucociliary clearance which results in less transfer of drug. To overcome the problems, nasal route offers a promising approach for targeted drug delivery to CNS which bypasses the limitations associated with oral and intravenous routes and addresses the blood brain barrier. Nanovesicles, such as niosomes, have shown a great interest in drug delivery system, particularly for nasal delivery of therapeutic agents. The aim of this study is to enhance the bioavailability, avoid the patient discomfort and to enhance the intranasal delivery of ROP-HCl by formulation of niosomes. Polycarbophil (Noveon AA1) used as polymer and surfactants (sorbitan monostearate and monolaurate) were used to enhance the bioavailability. Niosomes were prepared by ethanol injection and evaluated based on their physicochemical properties including, particle size, zeta potential, entrapment efficiency, nasal mucosal permeation study, DSC, FTIR. The optimization of batches was done by using ANOVA. The particle size of optimized batch was found to be 158 nm, zeta potential of -13.5 mV, PDI of 0.3 and an entrapment efficiency of 90.68%±2%. The mucin binding efficacy was found to be 83%. The Ex vivo study was performed on nasal goat mucosa which was found to be 95.16%. Thus, it can concluded that mucoadhesive ROP HCl niosomes show promise in enhancing residence time.

Keywords: Ropinirole HCl, mucoadhesion, niosomes, intranasal drug delivery

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Development and Optimization of Sustained-Release Guaifenesin Multi-Unit Pellet System (MUPS)

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The present study focuses on the formulation, optimization, and evaluation of sustained-release (SR) Guaifenesin Multi-Unit Pellet System (MUPS). Matrix pellets were prepared using hot melt extrusion and spheronization method. MUPs were followed by compression into tablets. A 3² full factorial design was employed to study the effects of polymer concentration and extrusion speed on responses like abrasion resistance and dissolution profile. Nine experimental batches were evaluated for physical parameters, drug content, and in vitro drug release. Results indicated that the finalized formulation, containing 4% HPMC K-15 and 1.7% PVP K-30, achieved 100% drug release within 12 hours, demonstrating an ideal sustained-release profile. Quality control tests, including hardness, friability, and weight variation, confirmed the robustness of the tablets. Statistical analysis validated the significance of formulation parameters on the dissolution behaviour, while acid resistance tests highlighted the formulation's stability in gastric conditions. This study establishes an optimized approach for developing SR Guaifenesin MUPS, offering enhanced therapeutic efficacy and patient compliance.

Keywords: *Guaifenesin, Multi-Unit Pellet System (MUPS), Gastro retentive delivery, 3² factorial design, in vitro release.*

Development and Evaluation of Zanubrutinib loaded nanocrystals for Bioavailability Enhancement: In vitro and In vivo evaluations

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Zanubrutinib (ZBR) is a potent Bruton's tyrosine kinase inhibitor exhibits low aqueous solubility and low oral bioavailability due to P-gp efflux mechanism and extensive hepatic metabolism by CYP3A4. Hence, the aim of the present work is to prepare nanocrystals of Zanubrutinib (ZBR) to increase the solubility and bioavailability of ZBR. The ZBR and excipients were found to be compatible by Fourier Transform Infrared Spectroscopy study. The ZBR nanocrystals showed particle size of 258.8 ± 4.5 nm and zeta potential of -18.4 ± 1.40 mV. The nanocrystals were lyophilized using mannitol (10%) as cryoprotectant. The particle size and zeta potential of lyophilized nanocrystals was 310.2 ± 5.3 nm and -14.6 ± 1.53 mV respectively. The saturated solubility of ZBR was improved to 57 times as compared to free ZBR. The high-resolution transmission electron microscopy (HR-TEM) study revealed uniformly distributed spherical shape particles. The in vitro drug release study displayed increased release of ZBR nanocrystals (98.67 ± 3.49 % in 24 h) compared to free ZBR (35.22 ± 2.50 % in 10 h) as compared to free ZBR. The ZBR nanocrystals exhibited relative bioavailability of 4.41 as compared to free ZBR. The ZBR nanocrystals were found to be stable at refrigerated condition. Overall, the results show that the potential of nanocrystals to increases the solubility, dissolution and eventually bioavailability of poorly soluble drugs.

Keywords: *Zanubrutinib, Oral bioavailability, Poloxamer 188, Anti solvent precipitation method, Nanocrystals*

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**Formulation and Evaluation of Prolonged-release Matrix Tablet of
Melatonin for the Treatment of Insomnia**

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Melatonin is a hormone synthesized by the pineal gland and released at night; it has regulatory role in vertebrates, including humans. It has been shown to have a hypnotic action in animals and human used as an agent for restoring circadian rhythms, Jet lag, shift-work, or aging. Insomnia is common among the elderly, aged >55 years. Melatonin's short half-life necessitates the formulation of prolonged-release tablets in order to avoid the rapid decline in its plasma concentration. Using a hydrophilic polymer HPMC K4M & HPMC K100M was selected as PR polymers for the PR matrix tablet. The aim of the study was to develop a longer lasting and slower releasing formulation of Melatonin PR tablets that could be administered just once daily. In these nine formulations batches are prepared by direct compression method. Drug excipients compatibility study was confirmed by FTIR & DSC studies. Pre-formulation parameter such as identification, solubility, melting point, compatibility studies and pre-compression parameter bulk density, tapped density, angle of repose, Hausner ratio, compressibility index and post compression parameter weight uniformity, hardness, drug content, thickness, in vitro drug release. In vitro drug release melatonin of all formulation was carried out in 12 hrs in 0.1 N HCL dissolution media. Among the nine trials, formulations with optimum concentration of HPMC K4M and Low concentration of HPMC K100M i.e., F4 shows completed drug release in 12 hrs. Also, the physicochemical properties of F4 were found adequate. After comparing all dissolution data, statistical analysis and physicochemical study it was concluded that formulation "F4" is optimum and final formulation.

Keywords: Insomnia, matrix tablet, HPMC, Prolonged-release.

ETPS_FP_NDDS - 32

Regulatory pathways for genomic medicines in USA, Europe and Japan

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Genomic medicines represent a transformative frontier in healthcare, leveraging insights from genomic data to develop innovative therapies for complex and rare diseases. Regulatory pathways for genomic medicines are critical in ensuring their safety, efficacy, and quality, while fostering innovation. This abstract explores the regulatory frameworks governing genomic medicines in the United States (USA), European Union (EU), and Japan, highlighting their unique characteristics, challenges, and harmonization efforts. In the USA, the Food and Drug Administration (FDA) oversees genomic medicines through specialized centers such as the Center for Biologics Evaluation and Research (CBER). The FDA provides guidance on gene therapies, cell therapies, and pharmacogenomics, emphasizing accelerated pathways like the Breakthrough Therapy Designation and Regenerative Medicine Advanced Therapy (RMAT) designation to expedite approvals. In Europe, the European Medicines Agency (EMA) coordinates the evaluation of genomic medicines under the Advanced Therapy Medicinal Products (ATMP) framework. The EMA emphasizes centralized approval processes, involving the Committee for Advanced Therapies (CAT) for scientific assessment. Collaborative initiatives like PRIME (Priority Medicines) aim to facilitate early support for innovative therapies. Japan's Pharmaceuticals and Medical Devices Agency (PMDA) has pioneered conditional and time-limited approval mechanisms to promote rapid patient access to genomic medicines. Japan's regulatory approach is notable for its emphasis on post-marketing surveillance and adaptive licensing strategies, particularly for gene and cell therapies. Harmonization efforts through global organizations like the International Council for Harmonization (ICH) seek to streamline regulatory requirements across these regions. However, challenges persist, including ethical considerations, data privacy, and the need for robust pharmacovigilance systems. This comparative analysis underscores the importance of regulatory convergence in advancing genomic medicine while ensuring public health and safety.

Keywords: Genomic medicines, Complex diseases, Rare disease, Pharmacogenomics, ATMP, CAT, FDA, EMA, PMDA, ICH

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In-situ depot formulation of Tofacitinib for mitigating Rheumatoid Arthritis

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Due to its debilitating nature and increased risk of morbidity and premature mortality Rheumatoid arthritis (RA) poses a significant challenge. This study aims to investigate the feasibility of an in-situ depot formulation of Tofacitinib, a promising therapeutic agent for RA. Conventional anti-inflammatory drugs often exhibit limited effectiveness and may induce drug-related toxicity. Hence, there is a critical need for advanced delivery systems. It was formulated and optimized with 32 factorial designs (Design of experiment®) utilizing key ingredients like PLA (Polylactic acid), PLGA 50:50 (Poly Lactic Glycolic Acid), PLGA 75:25 (Poly Lactic Glycolic Acid) as polymers and NMP (N-methyl pyrrolidone), DMSO (Dimethyl sulfoxide) as solvent system. Various parameters were characterized to optimize the formulation. The efficacy of the optimized formulation (M13) was evaluated using ANOVA for the Response Surface Quadratic model, demonstrating its effectiveness in mitigating RA symptoms. Biocompatibility assessment through histopathological studies further confirmed the safety profile of the formulation. The optimized in-situ depot exhibited desirable characteristics, including clarity, appropriate viscosity (428.9 ± 23 cPs), neutral pH (7.3 ± 0), Syringibility (9 ± 0.07 sec), and suitable gelation time (31.28 ± 0.2 sec). Moreover, the formulation showed a significant % drug release at 24 hours was $13.34 \pm 0.21\%$, and showed $99.05 \pm 0.77\%$ after 8 days. Stability studies indicated that the in-situ depot remained stable under various storage conditions, including $25^\circ\text{C} \pm 2^\circ\text{C}/60 \pm 5\%$ RH and RT $40^\circ\text{C}/75\%$ RH. Overall, present study systematically designed, Tofacitinib in-situ depot for the effective management of RA, which may enhance drug efficacy while minimizing adverse effects.

Keywords: *Tofacitinib, Rheumatoid arthritis, in-situ depot, PLGA*

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**Development & characterization of herbal niosomes from *costus igneus* leaves
for management of diabetes**

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Diabetes mellitus is a chronic condition characterized by high blood glucose levels. The prevalence of type 2 diabetes is increasing due to factors like obesity and decreased physical activity. Diabetes can lead to serious complications like renal disease, ischemic heart disease (IHD), and blindness. While there are treatments available to manage diabetes, there is currently no permanent cure. However, research has shown that certain plant extracts from medicinal plants & their novel formulations have anti-diabetic properties and can potentially improve the function of pancreatic beta cells. *Costus igneus*, commonly known as insulin plant in India, belongs to the family Costaceae. Consumption of the leaves are believed to lower blood glucose level, and diabetics who consumed the leaves of this plant did report a fall in their blood glucose levels. This study includes development of Niosome from *Costus igneus* leaves and evaluate it for either improved its ability to treat or prevent diabetes. Niosome from the extract has been developed, standardized, and tested for comparative antidiabetic study in an *in-vitro* assay using alpha amylase. Results has been compared for formulated niosome and conventional extract of *Costus igneus* leaves.

Key words: Diabetes, Costus igneus, Niosome, blood glucose level

Herbal drugs regulation in India, USA, Europe: An overview

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Herbal medicines are characterized as substances derived from plants, which are formulations that employ either singular or multiple herbs that are believed to possess therapeutic properties. The World Health Organization recognizes herbal medicines as fundamental elements of primary health care for a substantial segment of the global population. In India, the Drugs and Cosmetics Act of 1940, along with the regulations established in 1945, oversee the regulation of herbal products. The Department of AYUSH serves as the regulatory authority in this domain. In the United States, the Food and Drug Administration regulates herbal medicines, requiring that these products be marketed under a New Drug Application. In Europe, the European Medicines Agency and the European Food Safety Authority oversee the regulation of herbal products, with their registration being categorized into two types: full marketing authorization and simplified procedures. The regulatory frameworks governing herbal drug products in Europe and the United States are generally more stringent in comparison to those in India. These disparities have been linked to safety concerns associated with Indian herbal products, highlighting an urgent need for enhanced regulatory oversight in that region. Furthermore, the FDA classifies botanical items based on their intended use, which further complicates the regulatory landscape.

Keywords: World Health Organization, Food and Drug Administration, New Drug Application.

Dendrimer conjugated isotretinoin for controlled transdermal drug delivery

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In this paper, a novel isotretinoin delivery paradigm for the treatment of skin conditions was carefully examined, evaluated, and reviewed. It made use of emerging nanomolecules called dendrimers, which have also shown promise for targeted therapy and drug delivery. A self-assembly approach seemed convenient under this study, a dendrimer with a well-defined nanoarchitecture was exerted to create a spherical, homogeneous molecule with many surface functions. A clear branching structure for nanomedical devices served as the foundation for dendrimer implementation. To distribute isotretinoin (13cRA-D) transdermally, a self-assembled dendrimer-conjugated method was developed and used during the course of experimentation. The study of 13cRA-D revealed remarkable controlled release that was slow in healthy tissues but elevated in low-pH tissues, such as inflammatory areas. These releasing qualities proved to successfully permeate the skin and stop the negative nonteratogenic effects of isotretinoin. Furthermore, 13cRA-D showed great efficacy which sought to be therapeutically active on acne models. In vitro as well as In vivo experiments were carried out, which lead to the following observations that concluded 13cRA-D provided lesion targeting and superior skin penetration compared to isotretinoin and 13cRA-D also caused very little skin irritation which would be suitable for patients dealing with the drug.

Keywords: *Dendrimers, Nanoarchitecture, Isotretinoin, Nonteratogenic, Dendrimer-conjugation.*

Nanoflowers: A Promising Approach for Controlled Drug Delivery Systems

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Nanoflowers, known for their unique 3D structures, have attracted considerable attention due to their exceptional properties and diverse applications in catalysis, energy storage, and gas sensing. Typically synthesized through hydrothermal, solvothermal, and microwave-assisted methods, these nanostructures feature a high surface area, excellent adsorption capacity, and superior catalytic performance, making them ideal for advanced technologies. In supercapacitors, they offer high energy storage capacity, long-term stability, and reliable cycling performance, while in lithium-ion batteries, they enhance energy storage and durability. Metal and metal oxide nanoflowers, such as CuO, NiO, and Co₃O₄, demonstrate remarkable sensitivity and selectivity in gas sensing, effectively detecting gases like acetone, NO₂, and ammonia, which is vital for environmental monitoring and industrial processes. The development of alloy and core-shell nanoflower structures has further expanded their potential in energy conversion and storage technologies. Current research focuses on improving synthesis techniques to enhance uniformity, electrochemical performance, and scalability for industrial use. Future advancements aim to develop multi-metallic nanoflowers with customized properties to tackle challenges in environmental remediation, renewable energy, and biomedicine. These advanced materials hold immense potential to deliver innovative, sustainable solutions for addressing global challenges.

Keywords: *Nanoflower, Energy storage, High surface area, Adsorption capacity, alloy structure*

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Nutraceuticals pathway regulation in India

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Nutraceuticals can be characterized as any entity that is regarded as food or a component of food, which provides health advantages that extend beyond its conventional nutritional value. In India, the Food Safety and Standards Authority of India (FSSAI) establishes regulatory frameworks for the endorsement of nutraceuticals in accordance with the food safety and standards regulations of 2022. The market size for nutraceuticals in India was projected to reach USD 30.37 billion by the year 2024. The regulatory stipulations encompass product assessment, licensing requirements, health and labeling assertions, as well as the diverse registration processes mandated by FSSAI, including both State FSSAI Registration and Central FSSAI Registration. However, the continued reliance on out-dated regulations has resulted in a convoluted environment for nutraceutical manufacturers. There exists a pressing necessity for enhancements in market entry strategies and regulatory frameworks. Furthermore, the implementation of nutrivigilance and the bridging of clinical evidence gaps may significantly contribute to the enhancement of India's market presence on a global scale, thereby promoting superior consumer safety standards.

Keywords: Nutraceuticals, FSSAI, Nutrivigilance, Labeling assertions.

ETPS_FP_NDDS - 39

Development of polyherbal niosome for the anti- diabetic activity

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Diabetes mellitus is one of the mostly common metabolic disorders which is having effect around the 2.5% of the world's population and is expected to cross 5.4% by the year 2025. Since long back herbal medicines have been the most reliable source of medicine therefore, they are becoming a part of modern, high-tech medicine. There are many different herbal plants which are used in the reduction in blood glucose (insulinomimetic or insulin secretagogues activity) and active phytoconstituents which are having insulin mimetics activity, plant which are having the hypoglycemic activity mainly belongs to the family Leguminosae, Lamiaceae, Liliaceae, Cucurbitaceae, Asteraceae, Moraceae, Rosaceae and Araliaceae. The most active plants are *Allium sativum*, *Gymnema sylvestre*, *Citrullus colocynthis*, *Trigonella foenum greacum*, *Momordica charantia* and *Ficus bengalensis*. There are some new bioactive drugs and isolated compounds from plants like roseoside, epigallocatechin gallate, beta-pyrazol-1-ylalanine, cinchonain Ib, leucocyandin 3-O-beta-d-galactosyl cellobioside, leucopelargonidin-3-O-alpha-L rhamnoside, glycyrrhetic acid, dehydrotrametenolic acid, strictinin, isostrictinin, pedunculagin, epicatechin and christinin-A showing significant insulinomimetic and antidiabetic activity with more efficacy than conventional hypoglycaemic agents. The antidiabetic activity of medicinal plants is mainly due to the presence of polyphenols, flavonoids, terpenoids, coumarins and other constituents which show reduction in blood glucose levels. Herbal plants are now playing the important role in the global context today. In the last century, around 121 pharmaceutical products were discovered based on the information found from the plants used in Ayurveda, the Indian traditional system of medicine. Phytoconstituents which are being isolated from the natural sources have been contributing significantly to the development of novel drugs which are found from the medicinal plants. Various instrumental analysis were done in this project work including the UV analysis, IR Analysis, HPLC analysis, ZETA analysis and SEM microscopy.

Keywords: Diabetes, Herbal Drugs, Niosome, Medicinal Plants

ETPS_FP_NDDS - 40

Development, Optimization, and Evaluation of Nano Polymeric Amorphous Solid dispersion for Sunitinib.

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Among the existing approved oral anticancer drugs, about 65 % have poor water solubility and thus they do not achieve their potential therapeutic outcomes with maximum efficacy and minimum toxicity. Poor water solubility is an inherent property of many anticancer drugs. ASDs aid the dissolution of poorly water-soluble drugs primarily by presenting the drug in an amorphous form, thereby lowering the total energy required for the solubilization of the crystalline drug, according to the spring and parachute approach. Hence, in the current study, the polymeric nano amorphous solid dispersion of sunitinib malate is prepared, optimized & evaluated for enhancement of its solubility & *in-vitro* dissolution. The solvent antisolvent nanoprecipitation method was used for the preparation with the help of excipients HPMC-AS, HPMC phthalate & PEG 4000 which was selected based on solubility study & thorough BIOVIA software. The optimized batch was further evaluated with the help of FTIR, PXRD, and Raman spectroscopy. The results showed that the optimized batch was a stable amorphous formulation.

Keywords: *Nanoprecipitation, Solubility enhancement, BIOVIA software, HPMC Pthalate*

ETPS_FP_NDDS - 41

Design, development of microspheres

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The objective of any drug delivery system is to deliver a therapeutic dosage to the right location in the body while sustaining the required drug concentration. A well-thought-out controlled drug delivery system can improve the therapeutic efficacy of the prescribed medication and solve some of the issues with traditional therapy. There are several methods for delivering medicinal substances in a controlled and sustained release manner to the intended place. One approach involves the use of microspheres as carriers for medication. Microspheres are naturally occurring, flowing powders composed of proteins or synthetic polymers that can be broken down biologically, ideally having a particle size smaller than 200 μm . Microspheres are made from a variety of natural and manmade materials. These are made using techniques such as solvent diffusion, phase separation coacervation, polymerization, single and double emulsions, and emulsion solvent evaporation. Because of their controlled and prolonged release, microspheres have a wide range of uses. The most significant usage is in the targeting of tumors with anticancer medications. For safe and efficient in vivo medication administration, it is a crucial carrier.

Keywords: microspheres, controlled drug delivery system, in vivo medication, prolonged release.

ETPS_FP_NDDS - 42

A comparison of regulatory approval of clinical trial protocol with different countries

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We conducted a comparative study to analyze the regulatory requirements, timelines, and guidelines for clinical trial protocol approvals across four major regulatory authorities: the Central Drugs Standard Control Organization (CDSCO) in India, the Therapeutic Goods Administration (TGA) in Australia, the US Food and Drug Administration (FDA), and the European Medicines Agency (EMA). The objective of the study was to compare the clinical trial approval processes across these countries. This involved reviewing the regulatory guidelines, safety requirements, and essential documentation needed for clinical trial approval. The study also identified and compared the timelines for different stages of the approval process, as well as the associated application fees. Specifically, fees in India were compared to those in Australia, the US, and Europe. Additionally, the timelines for safety reporting were analyzed and compared across the four regions. The study revealed that each regulatory body has unique requirements, timelines, and processes for approving clinical trial applications. These differences were evident in the stages of review and the time taken for approval. The methodology enabled a detailed comparison, highlighting variations both within and between these regulatory agencies.

Keywords: Regulatory guidelines, clinical trial approval, FDA, TGA, EMA, CDSCO, timelines, safety requirements, application fees.

ETPS_FP_NDDS - 43

Nanotechnology in Forensic Science

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This abstract explores the innovative applications of nanotechnology in forensics, focusing on its potential to enhance crime scene investigations, evidence analysis, aiding the criminal justice outcomes. Nanomaterials include particles such as, nanoparticles, nanowires, and nanotubes, offering significant advancements in areas like trace evidence analysis, DNA profiling, toxicology, and drug detection. It can detect and analyze evidence in nanoscale in various forensic science fields such as the analysis of latent finger- prints, drug crimes, DNA analysis, GSR detection, post-blast residue analysis, counter terrorism, security measures, questioned document, toxicology, blood stain age estimation. Additionally, nano-enabled sensors and imaging technologies help to provide higher-resolution visualization and faster processing, reducing time delays in criminal investigations. With the continuous evolution of nanotechnology, its integration into forensic science promises to not only streamline investigative procedures but also to offer new pathways for solving complex criminal cases, therefore improving the accuracy and reliability of forensic evidence. However, challenges related lack of standardization, high costs, ethical concerns, integration with existing systems, potential interference with biological evidence, legal issues, and the need for specialized training. Author's review poster will provide valuable insights in the use of nanotechnology in forensic science, challenges and future perspective.

Keywords: Nanotechnology, Forensic Science, Nanomaterials, DNA Analysis, Drug Detection

ETPS_FP_NDDS - 44

Nano encapsulation probiotics for gut health

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Probiotics are good bacteria that provide health benefits when taken in the right amounts. Taking probiotics orally can improve gut and overall health, but their effectiveness is sometimes questioned in research. This could be because the probiotics may not survive the harsh conditions in the stomach and intestines, which reduces their effectiveness. To solve this, microencapsulation, a method of protecting probiotics, has been suggested. Recently, nanomaterials, or tiny particles, have shown great potential in helping to protect and improve the delivery of probiotics. By combining nanotechnology with microencapsulation, we can better control the release and delivery of probiotics to the right part of the gut. These different types of nanomaterials used to protect probiotics and how they help deliver probiotics more effectively to where they are needed.

Keywords: *Nano-encapsulation, Probiotic delivery system, Gut health, Probiotic protection*

ETPS_FP_NDDS - 45

Advancement in transdermal delivery of protein and peptide drugs

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Peptide and protein drugs (PPDs) are highly valued for their superior therapeutic potential, including high specificity, low immunogenicity, and excellent tolerability. These drugs are pivotal in treating conditions such as diabetes, osteoporosis, cancer, and genetic disorders. However, their large molecular size and limited stability present challenges, particularly in oral administration, where low bioavailability is a major concern. Similarly, the frequent use of subcutaneous injections results in poor patient compliance, restricting their broader clinical adoption. Transdermal drug delivery emerges as a promising alternative, offering minimal invasiveness, cost-effectiveness, ease of use, and enabling patients to self-administer treatments while reducing infection risks and improving adherence. However, the stratum corneum, acting as a robust barrier, makes it challenging to deliver hydrophilic and macromolecular PPDs effectively through the skin. Recent advancements have led to innovative approaches to enhance the transdermal delivery of PPDs into systemic circulation. These strategies include microneedle systems, chemical permeation enhancers, physical delivery techniques such as iontophoresis and sonophoresis, and novel carrier systems like lipid-based vesicles and nanoparticles. Each technique addresses specific challenges, offering advantages like improved delivery efficiency and reduced degradation risks while presenting certain limitations. This review discusses these strategies comprehensively, analyzing their mechanisms of action, benefits, and constraints. These developments represent significant progress in overcoming the challenges associated with transdermal delivery of PPDs, potentially transforming their clinical application and accessibility.

Keywords: Peptide and Protein Drugs, Transdermal drug delivery, Oral bioavailability, Drug stability, Microneedle systems

Microfluidic Devices for Evaluation and Synthesis of Nanoparticle

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Nanoparticles (NPs) hold significant potential in nanomedicine, offering innovative solutions for treating diseases where traditional therapies face substantial challenges. Additionally, NPs can revolutionize early diagnosis and monitoring of numerous medical conditions. However, to fully unlock their potential, precise design, production, and evaluation in appropriate models are essential. Microfluidic systems present a cost-effective and efficient strategy for both the synthesis and screening of NPs by replicating dynamic fluid flows, gradients, specific microenvironments, and complex multiorgan interactions. Microfluidic technologies enable the controlled synthesis of NPs, ensuring improved reproducibility between batches. Furthermore, these systems' adaptability allows the creation and customization of diverse platforms for rapid and efficient in vitro and in vivo evaluation of NP performance. These devices also demonstrate remarkable potential for advanced manipulation and immobilization of small organisms. This review highlights the key microfluidic platforms designed for precise NP synthesis. It also explores cutting-edge microfluidic systems that replicate in vitro environments and delves into the concept of organism-on-a-chip, emphasizing their potential for screening NPs. Finally, the review critically evaluates the challenges and future directions for integrating microfluidic systems into NP synthesis and screening, underscoring their transformative impact on nanomedicine.

Keywords: Microfluid, organ on a chip, nano medicine, nano particle synthesis

ETPS_FP_NDDS - 47

Characterization of Solid Betamethasone Acetate and Effect of Particle Size on Drug Release

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Current study provides characterization of polymorph of betamethasone acetate and its use for the preparation of extended release suspension for injection of betamethasone sodium phosphate (BSP) and betamethasone acetate (BA). Different formulation compositions are prepared using crystalline betamethasone acetate with different particle size and different methods of sterilization. The particle size betamethasone acetate (BA) and methods of sterilization plays important role in the stability and dissolution of extended release suspension of betamethasone sodium phosphate and betamethasone acetate. All prepared formulations are analysed by using different analytical techniques viz. HPLC. All prepared formulations are tested for different parameters like dissolution, stability and results are compared with reference formulation.

Keywords: *Corticoids, Betamethasone Sodium Phosphate (BSP), Betamethasone Acetate (BA), Suspension, Extended Release, Polymorph, Particle Size.*

Track-II

PHARMACOLOGY AND TOXICOLOGY

ETPS_FP_PT - 01

Evaluation of *Mangifera Indica* against selected dermatological creams for antioxidant activity

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Medicinal plants have been used for many years by different ethnic groups and have given hope for treating several disorders including cancers and rheumatism caused by oxidative stress. However, some phytochemicals work synergistically with both physical and chemical mutagenic agents. The screening for medicinal properties of plants is therefore of utmost importance. Treatment of diseases caused by oxidative stress is carried out mostly with synthetic antioxidants such as butylated hydroxytoluene but these synthetic compounds impose serious health concerns and medical complications due to their xenobiotic nature to the body. Due to their complex chronic progression, non-communicable diseases caused by oxidative stress also impose severe drawbacks to the economic growth of the country. The prolonged hospital stay and treatment of these maladies can adversely affect the economy of any country. It is therefore necessary to develop cheap treatments and dosage forms that are accessible to the general population including people who cannot afford the gargantuan medical bills that come with the treatment of non-communicable diseases. Screening medicinal plants such as *Mangifera indica* for medicinal properties like antioxidant activity is essential. This helps in the identification of plants that possess potent medicinal properties such as antioxidant, and anti-inflammatory activities. A hydrogen peroxide scavenging assay was used to evaluate the antioxidant activity of *Mangifera indica*. Results showed that the dermatological creams labeled SC1 and SC3 had significantly higher antioxidant activity compared to *Mangifera indica* methanolic extract while dermatological cream labeled SC2 had similar antioxidant activity to *Mangifera indica* at 0.05 significance level.

Keywords: *Mangifera indica*, antioxidant, anti-inflammatory, non-communicable diseases.

ETPS_FP_PT - 02

**Role of cancer drugs in autophagy and ROS generation in
breast cancer cells**

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Breast cancer is one of the most prevalent cancers affecting women globally, with its molecular mechanisms still not fully understood. This research investigates the impact of anticancer drugs on autophagy and Reactive Oxygen Species (ROS) generation in breast cancer cells, focusing on the role of NRF2 (Nuclear factor erythroid 2–related factor 2) in modulating cell death and autophagy. The study also examines the relationship between NRF2, p62, and LC3, key autophagic markers, using data from TCGA and GEO databases. To evaluate these interactions, molecular experiments were conducted by inhibiting NRF2 activity with brusatol, an NRF2 inhibitor. Findings revealed that inhibiting NRF2 increased cell death and autophagy in treated breast cancer cells. Notably, p62, a marker of autophagy, showed decreased expression, while LC3 expression increased significantly, highlighting an essential role of these markers in the autophagic process induced by the drug. The study further demonstrated a positive correlation between NRF2 and autophagic markers LC3 and p62 in various breast cancer cell lines and patient data. This suggests that targeting the interaction of NRF2 with autophagy-related genes could enhance therapeutic outcomes. Additionally, DTBN (6,6'-dihydroxythiobinupharidine), the anticancer drug used, induced autophagy and ROS production, contributing to the therapeutic effect. These results underscore the potential of targeting NRF2 and autophagic pathways in breast cancer therapy, offering insights for developing more effective treatment strategies. This research highlights the interplay of ROS, NRF2, and autophagy as critical components of breast cancer cell response to therapy.

Keywords: Breast Cancer, Autophagy, ROS, NRF2, Cancer Therapy

ETPS_FP_PT - 03

Hepatotoxicity of Paracetamol: A Review

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Paracetamol (acetaminophen) is one of the most commonly used drugs for pain relief and fever control, and it is known for its safety profile when used in the appropriate amounts. However, its hepatotoxic potential at larger levels creates a considerable public health risk. This research investigates the molecular mechanisms underpinning paracetamol-induced hepatotoxicity, with an emphasis on the function of its reactive metabolite, N-acetyl-pbenzoquinone imine (NAPQI), and hepatic glutathione depletion. Key risk factors for hepatotoxicity are reviewed, including alcohol intake, malnutrition, chronic liver disease, and genetic variants that impact medication metabolism. The study also reviews developments in paracetamol toxicity management, namely the use of N-acetylcysteine (NAC) as an antidote and its mechanisms of action in restoring glutathione reserves and scavenging free radicals. Emerging techniques such as hepatoprotective drugs, new medication formulations, and bioengineering approaches are investigated. Furthermore, the significance of early diagnosis using biomarkers such as alanine aminotransferase (ALT), aspartate aminotransferase (AST), and new molecular indications is emphasized. Finally, this paper highlights the importance of public awareness efforts and legislative actions to reduce the hazards connected with paracetamol usage. Future study directions are suggested, such as investigating genetic markers for susceptibility and optimizing treatment regimens for severe instances. This comprehensive analysis seeks to improve understanding of paracetamol hepatotoxicity and contribute to better prevention and management.

Keyword: *Hepatotoxicity, N – acetylcysteine (NAC), NAPQI, Glutathione, Drug metabolism.*

ETPS_FP_PT - 04

**To study the chronic effects of whole-body radiation on the lungs of
c57bl/6mice**

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Humans are exposed to radiation from both natural as well as man-made sources. Ionizing radiation is strong enough to disrupt the connections between DNA molecules in the nucleus of live cells, resulting in chemical changes. Ionizing radiations may cause multiorgan dysfunction syndrome and these radiations can lead an animal to die. Radiation can be administered in two ways as a single dose or in multiple smaller doses over time such as hyperfractionation or accelerated fractionation. The first system to collapse is the Hematopoietic system followed by the Gastrointestinal system and Respiratory system. Pneumonitis is the first sign of radiation-induced lung damage characterized by acute lung tissue inflammation, followed by the fibrosis development in the tissue, which is considered to be life-threatening. Radiation injury to the lungs can cause blood vessel walls thicken, lymphocytes decrease, collagen builds up leading to fibrosis in lungs. Interaction of radiation to biological matters causes damage predominantly via ROS production resulting in uninhibited oxidative stress. Our study indicates that inflammation, oxidative stress, and fibrotic responses are all part of the multifactorial process that leads to radiation-induced acute and long-term lung damage and focusing on its molecular pathways might provide considerable protection against acute and chronic damage, which will aid in the development of a radio protector.

Keywords: Radiation, Lungs, Biomarkers, Acute & Chronic exposure

ETPS_FP_PT – 05

The role of paclitaxel in breast cancer treatment: efficacy, chemoresistance, and innovative approaches

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Breast cancer remains one of the most prevalent and life-threatening cancers globally. This report explores the efficacy of the chemotherapeutic drug Paclitaxel on breast cancer cell lines, addressing its potential in treating this malignancy and the challenges related to chemoresistance. The paper begins with an overview of cancer types, their classifications, and the various stages of breast cancer. Along with their corresponding clinical stages, it offers a thorough explanation of the various subtypes of breast cancer, such as inflammatory breast cancer, invasive ductal carcinoma, and invasive lobular carcinoma. Additionally, the paper presents global breast cancer prevalence figures until 2024, highlighting the rising incidence and mortality rates that underscore the need for more sophisticated treatment approaches. The mechanism of action of paclitaxel, a drug that targets microtubule mortality rates is examined, with particular attention to how it prevents cancer cells from proliferating and causes them to die. Results from various studies on the use of Paclitaxel against breast cancer cell lines indicate significant therapeutic benefits, particularly in combination with other agents to overcome resistance. Potential methods to improve the clinical results of Paclitaxel are discussed, such as personalized medicine techniques and drug delivery systems based on nanoparticles. In conclusion, the paclitaxel is still a mainstay in the treatment of breast cancer, chemoresistance must be addressed and therapeutic approaches must be improved in order to improve patient outcomes. The limitations of current treatments may be overcome with more research into combination therapies and alternative delivery methods.

Keywords: Breast cancer, Paclitaxel, Chemoresistance, Breast cancer cell lines, Invasive ductal- lobular carcinoma

ETPS_FP_PT – 06

Role of medicinal plants in the management of benign prostatic hyperplasia

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BPH, Benign prostatic hyperplasia (BPH) is indeed a common condition in older men, typically affecting those aged 50 and above. It is characterized by the non-cancerous enlargement of the prostate gland, which can lead to urinary symptoms due to the pressure on the urethra glands non-cancerous growth (usually not life threatening). Traditional treatment options often involve medications (two most common synthetic drugs are Finasteride and Dutasteride) or surgical interventions, but there is growing interest in the use of phytomedicine as an alternative or complementary approach. The commonly used medicinal plants (*Serenoa repens*): It is one of the most well-known plants for treating BPH. It helps reduce symptoms like frequent urination and difficulty in starting urination by inhibiting the enzyme 5-alpha-reductase. (*Urtica dioica*): Nettle root is used to alleviate BPH symptoms by reducing inflammation and inhibiting the growth of prostate cells. It contains compounds like beta-sitosterol that help improve urinary flow and reduce residual urine volume. (*Prunus africana*): Extracts from the bark of the African plum tree have anti-inflammatory and anti-edema properties, which help reduce prostate swelling and improve urinary symptoms. Pygeum is often used in combination with other herbal remedies for enhanced effectiveness. (*Cucurbita pepo*): this plant extract is rich in antioxidants and essential fatty acids, which help reduce inflammation in the prostate. It can also improve urinary flow and reduce symptoms like nocturia (nighttime urination). In conclusion, medicinal plants offer promising natural alternatives for the treatment of benign prostatic hyperplasia (BPH) medicinal plants can provide relief with fewer side effects compared to conventional medications.

Keywords- *HPTLC, Malignant, Benign, active principles, standardization, Synthetic drugs, Traditional medicines, Phytomedicines*

ETPS_FP_PT – 07

Joint on a chip as an alternative to Animal Models in Rheumatology

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Organs-on-chips (OoCs) are systems containing engineered or natural miniature tissues grown inside microfluidic chips. To better mimic human physiology, the chips are designed to control cell microenvironments and maintain tissue-specific functions. Combining advances in tissue engineering and microfabrication, OoCs have gained interest as a next-generation experimental platform to investigate human pathophysiology and the effect of therapeutics in the body. The chip is a microfluidic device that guides and manipulates minuscule quantities of solution (picoliters to milliliters) through networks of incredibly thin microchannels. A more applicable name for the tiny tissues that are created and housed in the microfluidic chips is "organ," which can replicate one or more tissue-specific activities. Scientists have found that these systems can frequently function as efficient models of human physiology and disease, while being far less complex than native tissues and organs. Organs-on-a-chip, a sophisticated in vitro model, are regarded as enabling technologies that offer a more physiological cellular milieu for the in vitro recapitulation of organotypic tissue function. In a similar vein, pathophysiological cues, such as biochemical and biomechanical stressors that cause onset of disease phenotypes in human-derived in vitro tissues.

Keywords: Organ-on-a-chip, microfluidic chips, recapitulation, stimuli, phenotypes

ETPS_FP_PT – 08

Clinical Trials Involving Anticancer Phytochemicals

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Plant-derived phytochemicals are emerging as potential therapeutic option to combat cancer. Their diverse mechanisms of action include antioxidant, anti-inflammatory, and antiproliferative effects that have been extensively explored in preclinical studies. However, translating these preclinical findings into effective clinical therapies remains a significant challenge. Furthermore, for certain phytochemicals the reported benefits are often confined to symptom relief or improved quality of life and not on direct antitumor activity. There is a critical need for rigorous clinical trials. Apart from this, the safety and efficacy parameters related to phytochemicals should also be critically evaluated in clinical trials. By addressing these challenges and continuing to explore the potential of phytochemicals, we can harness their power to develop novel and effective cancer therapies.

Keywords: Phytochemicals, Cancer prevention, Clinical trials, Safety, Efficacy.

ETPS_FP_PT – 09

Strategies to reduce Adverse Drug Reactions in Polypharmacy

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Polypharmacy, the concurrent use of multiple medications, is a growing concern, particularly in elderly populations and individuals with multiple chronic conditions. According to epidemiology, the aging of the population and the increase in the incidence of chronic illnesses are closely linked to polypharmacy. While managing complex comorbidities often requires polypharmacy, it significantly increases the risk of adverse drug reactions (ADRs), which can lead to mortality, functional decline, and hospitalization. Drug-drug interactions (DDIs) and drug-disease interactions are more likely to occur when treating with multiple medications, which can exacerbate patient conditions. Addressing ADRs in polypharmacy necessitates a comprehensive, multi-disciplinary approach. Routine prescription review and reconciliation are essential to assess drug regimens for appropriateness, efficacy, and potential interactions between drugs or diseases. Deprescribing, the process of systematically reducing or discontinuing unnecessary or harmful medications, plays a key role in minimizing polypharmacy-related risks. Clinical tools such as the Beers Criteria and STOPP/START criteria help identify inappropriate drugs in older adults. Personalized medicine, including pharmacogenetic testing, can further reduce ADRs by tailoring medication choices to individual genetic profiles. Multidisciplinary cooperation among doctors, pharmacists, nurses, and other specialists enhances drug management and ensures thorough ADR monitoring. Additionally, patient education and joint decision-making are crucial for improving outcomes and adherence. Advanced technologies, such as electronic health records with built-in drug interaction alarms, can help detect potentially dangerous medication combinations in real-time. Ongoing provider education about the risks of polypharmacy and ADR prevention is also critical. These combined strategies are essential for reducing ADRs and improving safety in polypharmacy management.

Keywords: Polypharmacy, Adverse Drug Reactions (ADRs), Deprescribing, Personalized Medicine, Multidisciplinary Approach

***In-Silico* Screening of Indian Ayurveda Botanicals for The Management of Breast Cancer**

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Introduction: Breast cancer (BC) is one of the most common cancers that has reported particularly among women around the world. The synthetic medication used for the cancer treatment can cause various side effects. So, in order to minimize these side effects, it is necessary to do research on the herbal plants. This study aims to determine the potential of *Dorema ammoniacum* (ushaq) seeds as an anticancer agent *in-silico*.

Methodology: Phytocompounds of ushaq were obtained from IMPPAT database. Potential active targets were retrieved from Superpred database. Breast cancer targets were collected from GeneCards database. Phytocompound-target-pathway networks were constructed to screen out the hub genes using STRING database and Cytoscape software. Finally, molecular docking was performed using Auto dock tool and PyMOL software.

Results: Out of 46 possible targets of the 16 phytocompounds, NFKB1, MAPK1, PIK3R1, CTSD and APEX1 were the key targets closely related to the Pathways in cancer, Estrogen signaling pathway, MicroRNAs in cancer, cAMP signaling pathway and Apoptosis. Molecular docking analysis revealed that most phytocompounds had a good affinity with the key targets.

Conclusion: The result of this study will enhance our understanding of potential molecular mechanism by which ushaq inhibits breast cancer and establish a framework for further experiments.

Keywords: *Dorema ammoniacum*, *Anticancer*, *Network pharmacology*, *Molecular docking*.

ETPS_FP_PT – 11

***In-Silico* Method for the Treatment of HIV using Indian Ayurveda
Botanicals**

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Human Immunodeficiency Virus (HIV) have been existing as a worldwide issue since years. Even though there has been drastic development in the treatment and prevention of virus spread, the aftereffects of current existing treatment and mutation of virus against the drugs has emerged as a severe issue. In this scenario, there is a need for novel treatment method by using the phytochemicals from Indian Ayurveda Medicinal plants. There is only a few Indian medicinal plants on which studies have been performed.

The first step was the identification of Indian medicinal plants which are particularly mentioned in the foundational text of Ayurveda “Charak Samhita” that exhibited remarkable activity against potent HIV-1 targets, among which the plant Argemone Mexicana was selected. Medicinal plants along with their phytochemically active component were included for analysing their activity against the spread of virus which would result in the reduction of mortality rate. The results from these studies highlighted the importance of network pharmacology and molecular docking as an effective method for *In-Silico* screening and in vitro analysis of bioactive components. Five major important protein targets such as MAPK1, APEX1, OTSD, CHUK, NFKB1 were selected according to their network pharmacology and on these molecular docking can be performed. The method has been used to determine the where and how the particular protein may bind to the target based on their affinity score in terms of binding energy. ADMET properties of the selected compounds is also studied to determine the most effective compound.

Keywords: Anti-HIV Treatment, Indian Ayurveda Botanicals, In-Silico screening, In vitro analysis, Network Pharmacology, Molecular Docking, ADMET Studies.

Integrating Network Pharmacology and Molecular Docking Approaches to Reveals the Multi-Target Pharmacological Mechanism of *Mesua Ferrea* *Linn* In the Treatment of Cervical Cancer

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Cervical Cancer, second most common female cancer in India causing by Human Papillomavirus (HPV). Lack of early symptoms and diverse spectra of pathophysiological mechanisms of cervical cancer make it a challenging task and a serious economic problem in health care management. *Mesua ferrea Linn* medium sized tree, commonly found in Eastern states, Eastern Himalayas, and Western Ghats. Several in vitro investigations have revealed the effectiveness of this plant in treatment of cancer. In this study, Network Pharmacology technique is used to analyze the phytochemical-target-pathway network. Identification of active protein-protein interaction afterward, molecular docking was used to verify the effective activity of the phytochemicals against the target. The results of molecular docking predicted that key targets of cervical cancer bind stably with the corresponding active ingredient of *Mesua ferrea Linn*. In the framework of this study network pharmacology with docking analysis shows that *Mesua ferrea Linn* exert great effect on Cervical Cancer by acting on cervical cancer associated signaling pathways.

Keywords: Network Pharmacology, Mesua ferrea Linn, Cervical Cancer, Molecular docking

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**Using *in-silico* methods to identify potent bio active components from
indian medicinal plants against skin cancer**

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Skin cancer is one of the most common and most active type of cancer. It is very common because our whole body is exposed to the sun and there are always chances. There have been various synthetic treatments and medications which are going all around the world, but have adverse side effects. So, there is a need for novel treatment method by using the phytochemicals from Indian Ayurveda Medicinal plants. And since there are very few Indian medicinal plants on which studies of skin cancer have been performed.

The first step was the identification of Indian medicinal plants which are specified in the foundational text of Ayurveda "Charak Samhita" and also those exhibited remarkable activity against the potent Skin cancer targets. Then the identified Medicinal plants along with their phytochemically active component were incorporated for analysing their activity against the spread of melanoma and non-melanoma type of skin cancer which would result in the reduction in deaths. The results from these studies highlighted the importance of network pharmacology and molecular docking unique as an effective method for *In-Silico* screening and in vitro analysis of bioactive components. Five major important protein targets were selected based on their network pharmacology further using which molecular docking can be performed. The method has been used to determine the where and how the particular protein may bind to the target based on their affinity score in terms of binding energy. ADMET properties of the selected compounds is also studied to determine the most effective compound.

ETPS_FP_PT - 14

Unlocking Nutrition's Role in Alzheimer's: Integrative Meta-Analysis and Molecular Docking for Therapeutic Insights

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Alzheimer's disease (AD) is a condition that causes memory loss and difficulties with thinking, making it the most common cause of dementia. While genetics play a role in its development, lifestyle factors like diet can also influence brain health. This project aims to study how different foods and dietary habits are linked to Alzheimer's disease and brain health. By combining results from various studies, it will examine how specific foods, such as fruits, vegetables, and fish, and dietary patterns like the Mediterranean Diet, affect markers of Alzheimer's, memory, and brain function. The research will also explore key nutrients, such as vitamins and healthy fats, to identify those that might help protect the brain. Using computer-based methods, the project will study how these nutrients interact with proteins linked to Alzheimer's disease to discover potential treatments. The goal is to highlight foods and nutrients that could reduce the risk of Alzheimer's and help develop new therapies. This study combines existing knowledge with new methods to better understand the connection between diet and brain health. The findings could lead to clear recommendations for healthy eating and help create new strategies to prevent Alzheimer's disease.

Key words: Alzheimer's Disease, Dietary Components, Mediterranean Diet, Meta-Analysis, Molecular Docking.

Merging Network Pharmacology and Molecular Docking Techniques for Identification of Multi-Target Pharmacological Mechanism of *Pistacia Integerrima* for Treating Tuberculosis

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Tuberculosis is a deadly disease caused by a bacterial pathogen *Mycobacterium tuberculosis*. The present regime of medications causes side-effects in human body, which is a concern among the medical fraternity. *Pistacia integerrima* is a medicinal plant native to Asia, with a potential efficacy towards the TB causing pathogen. Commonly known as zebrawood, it is used in traditional medicine for treating illnesses like cough, asthma, diarrhoea etc. Various plant parts like bark, gall, fruit, leaf and seed are having various phytochemicals which help to cure the disease. Using network pharmacology the protein-protein interaction as well as various pathways of disease targets and phytochemicals is identified. With the help of molecular docking analysed productive activity of corresponding phytochemicals against those targets. It is observed that *Pistacia integerrima* can show a great impact on tuberculosis.

Keywords: *Tuberculosis, Pistacia integerrima, Network Pharmacology, Molecular Docking*

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Quality of Life Assessment Using St. George's Respiratory Questionnaire (Sgrq) in Pulmonary Rehabilitation

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The St. George's Respiratory Questionnaire (SGRQ) is a comprehensive tool for assessing health-related quality of life in respiratory disease patients. Understanding its components - symptoms, activity, and impacts - provides valuable insights into rehabilitation outcomes.

Methods: 115 patients with respiratory conditions underwent pulmonary rehabilitation. SGRQ scores (range: 0-100, where 0 indicates best health) were analysed pre- and post-rehabilitation. The study population included patients with Asthma (25.22%), COPD (40%), and ILD (34.78%). Statistical analysis included Wilcoxon Signed Rank Test and correlation analyses with other assessment tools.

Results: Pre-rehabilitation SGRQ scores (median: 92.00; 95% CI: 90.00-94.00) decreased significantly post-rehabilitation (median: 63.00; 95% CI: 37.00-78.00), indicating improved quality of life. The Wilcoxon Signed Rank Test showed statistical significance ($Z = -8.885$, $p < 0.05$). Diagnosis-specific analysis revealed asthma patients experienced the most significant improvements in symptoms and activity scores compared to COPD and ILD patients.

Conclusion: Pulmonary rehabilitation demonstrated significant positive impact on quality of life as measured by SGRQ. The strong correlations with other assessment tools validate SGRQ's effectiveness in monitoring rehabilitation outcomes. The findings suggest that rehabilitation benefits vary by respiratory diseases.

Keywords: *SGRQ, Quality of life, Pulmonary rehabilitation, Respiratory disease, Health assessment*

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Recent Pharmacological & Non-Pharmacological Treatment Advances in Hyperpigmentation

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Hyperpigmentation is the darkening of an area of skin or nails caused by increased melanin production. Hyperpigmentation can be caused by various factors such as increased exposure to the sun, hormonal changes, inflammation, injuries, etc. Recent studies state that the prevalence of hyperpigmentation is increasing day by day globally. Low self-esteem is majorly seen among the persons affected with hyperpigmentation. The definite treatments are aimed at decreasing the production of melanin or destroying the melanin pigments. Pharmacological treatment includes inhibition of the synthesis of melanin in the various stages of the production pathway. Tyrosinase inhibitors are widely used and are responsible for decreasing tyrosine and ultimately melanin. Non-pharmacological treatment includes photoprotection, increasing keratocytes, and destroying melanin pigmentation. In this review, we discussed newly approved treatment advances in hyperpigmentation.

Keywords: *Hyperpigmentation, melanin, photoprotection, hormonal changes, Tyrosinase.*

In-silico screening of Indian Ayurveda Botanicals for the Management of Brain Stroke

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Introduction: When the blood flow to the brain is cut off, a stroke happens, which is one of the main causes of disability in the globe. The effects of both Ischemic and Hemorrhagic strokes on people and society are profound. The synthetic drugs used to treat stroke can have a number of negative consequences. Therefore, research on the herbal platform is required to reduce such negative effect. The purpose of this study is to assess *Amorphophallus paeoniifolius* (Surankand)'s potential as an in-silico anti-stroke agent.

Methodology: Surankand phytocompounds were sourced from the IMPPAT database. From the Superpred database, possible active targets were obtained. Targets for brain stroke were gathered from the GeneCards database. The STRING database and Cytoscape software were used to build phytocompound-target-pathway networks in order to filter out the hub genes. Lastly, the Auto dock tool was used to accomplish molecular docking and PyMol software. ADMET properties of the selected compounds is also studied to determine the most effective compounds.

Result: NFKB1, MAPK1, PTGS2, CTSD, and GRIN1 were the most significantly mapped targets which overlapped with the pathways in brain stroke, Alzheimer disease, Neurotrophin signalling circuit, MAPK signalling route, PI3K-Akt signalling pathway, and cAMP signalling pathway, of the 41 potential targets of the 13 phytocompounds. It was demonstrated through molecular docking studies that most of the phytocompounds interacted with important targets with high affinity. **Conclusion:** The results of this study will elucidate the molecular structures whereby Surankand prevents brain stroke, thus providing direction for future studies.

Keywords: *Amorphophallus paeoniifolius*, *Anti-stroke*, *ADMET properties*, *Network pharmacology*, *Molecular docking*.

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Evaluation of anti-inflammatory agent in cancer-induced cachexia

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Cancer-associated cachexia is a condition characterized by weight loss, anorexia, decrease in muscle mass, lipolysis, fatigue, and elevated energy expenditure. Inflammation plays a crucial role, with cytokines like TNF- α and IL-6 promoting protein breakdown in cachexia. Levels of inflammatory cytokines like TNF- α , IL-6, IL-1, and INF- γ are found elevated in cachectic patients which activates pathways of protein degradation and suppresses protein synthesis resulting in muscle wasting. This study investigated the therapeutic potential of nabumetone, an NSAID, in mitigating cancer cachexia in a mouse model of B16F10 melanoma.

Material and methods: C57BL/6 mice were subcutaneously injected with B16F10 melanoma cells. Once tumors reached a specific size, mice were treated with nabumetone for 28 days. Body weight, food intake, muscle mass, lipid and carbohydrate metabolism, inflammatory markers, and cardiac function were assessed.

Results: Nabumetone-treated mice exhibited improvements in body weight, and compared to cachectic controls. The drug effectively reduced serum glucose levels and inflammatory cytokine levels (TNF- α and IL-6). Muscle wasting was improved. Histological analysis revealed improved muscle fiber integrity and increased lipid droplet size in nabumetone-treated mice.

Conclusion: These findings demonstrate that nabumetone exerts beneficial effects on cancer cachexia by mitigating muscle wasting, improving metabolic function, and reducing inflammation. Nabumetone may represent a promising therapeutic strategy for alleviating the debilitating effects of cancer cachexia.

Keywords: *Anti-inflammatory agents, Cancer-associated cachexia, C57BL/6 mice, B16F10 melanoma cells.*

Cerbera odollam: a review of its pharmacological properties, toxicity and detection

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Cerbera odollam, commonly referred to as the "suicide tree", is a tropical plant native to regions such as southeast India, Australia, Madagascar, and the Western Pacific Islands. This plant, belonging to the Apocynaceae family, is characterized by its height of up to 12 meters, dark green leaves, and fruit resembling apples or mangoes.

The seeds contain cardiac glycosides, posing significant toxicity risks, making it infamous for its use in suicides and accidental poisonings. The phytochemical profile of *C. odollam* includes various bioactive compounds with demonstrated pharmacological properties, such as anti-cancer, antioxidant, anti-inflammatory, and antibacterial effects.

Cerberin, a glycoside found in the seeds, has been shown to inhibit cellular functions such as cancer proliferation and migration. The plant's toxicity is not widely known outside its native regions, leading to numerous poisoning cases due to its accessibility via the internet. Symptoms of poisoning includes bradycardia, hyperkalemia, and gastrointestinal distress, with treatment requiring a combination of atropine, activated charcoal, and supportive measures. This review highlights the dual nature of *Cerbera odollam* as both a source of valuable medicinal compounds and a significant public health risk due to its cardiotoxic properties. The need for increased awareness and research into its toxicology and treatment protocols is emphasized to mitigate the risks associated with this plant.

Keywords: *Plant toxin, Cerbera odollam, Cardiotoxicity, Suicidal poison, Forensic toxicology*

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Herbal phytochemicals in anemia therapy: molecular docking for drug target identification

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Reduced haemoglobin or red blood cells are the hallmark of anemia, which is still a major worldwide health concern that affects vulnerable communities. Understanding anemia has advanced historically, especially with regard to the identification of red blood cells and the function of iron. Dietary modifications and supplements are among the current therapeutic techniques. Herbal medicine is becoming more popular because it has fewer adverse effects than synthetic medications. Drug development relies heavily on bioinformatics and computational biology, which use in silico techniques to identify possible targets for drugs. By using docking experiments with the TMPRSS6 Gene Receptor, this study examined the potential benefits of ascorbic acid and eriodictyol as treatments for iron deficiency anemia. Other herbal medicines that were considered were nettle, lemon, parsley, dandelion, ginger, cinnamon, and cumin. These findings suggest that these compounds could be further investigated for developing effective treatments.

Keyword: Anemia, Herbs, Phytocompounds, Molecular docking, Bioinformatics, Nettle.

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***In-silico* screening of indian ayurveda botanicals for the management of
monkeypox virus**

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Introduction: Monkeypox is a zoonotic disease that is caused by Orthopoxvirus. It was first identified in 1958 in non-human primates and later reported in humans in 1970 in the Democratic Republic of the Congo. It is a part of Orthopoxvirus genus, which it shares with Smallpox and Cowpox virus. Now, from 1st Jan' 2022 the most affected countries are U.S, Brazil, Germany, U.K. Immunotherapy and antiviral treatments have a potential, but the lack of drugs specific to Monkeypox creates a problem. It has been promising in treating severe cases of monkeypox, especially in combination, with fewer renal side effects. However, these drugs are not without limitations since their efficacy against monkeypox is still under investigation, and long-term safety profiles are not fully understood. Vaccination strategies, while effective, also face constraints due to adverse effects and restricted vaccine supplies. Herbal medicines provide a supplement with their diversity of bioactive compounds. This study aims to determine the potential of *Triphala* as an antiviral agent *in-silico*.

Methodology: Phytocompounds of Triphala were obtained from IMPPAT database. Potential active targets were retrieved from Superpred database. Monkeypox targets were collected from GeneCards database. Phytocompound-target-pathway networks were constructed to screen out the hub genes using STRING database and Cytoscape software. Finally, molecular docking was performed using Auto dock tool and PyMOL software.

Results: Out of 13 possible targets of the 33 phytocompounds, NFKB1, PTGS1, CHRM1, DUSP3, STAT3, TERT, STING1, HTR3A, ACHE, STAT1, CXCR4, PTGS2, HDAC1 were the key targets closely related to the Pathways in Monkeypox virus, NF-kappa B signaling pathway, TNF signaling pathway and B cell receptor signaling pathway. Molecular docking analysis revealed that most phytocompounds had a good affinity with the key targets. **Conclusion:** The result of this study will enhance our understanding of potential molecular mechanism by which Triphala treats Monkeypox virus and establish a framework for further experiments.

Keywords: *Triphala, Network pharmacology, Molecular docking.*

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Carvedilol as a Treatment Modality in Type-2 Diabetes Mellitus and Hypertension

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Carvedilol, a non-selective beta-blocker with alpha-1 blocking properties, has emerged as a valuable therapeutic option for managing patients with type 2 diabetes mellitus (T2DM) and hypertension. Unlike traditional beta-blockers, carvedilol demonstrates a favorable metabolic profile by minimizing adverse effects on glycemic control, making it a safer alternative for patients with T2DM. Its antioxidant and vasodilatory properties contribute to enhanced endothelial function, reduced insulin resistance, and improved hemodynamic parameters. Clinical studies have shown that carvedilol does not significantly increase HbA1c levels, unlike other beta-blockers, and may even improve insulin sensitivity in some cases. Additionally, carvedilol effectively lowers blood pressure by reducing vascular resistance without inducing reflex tachycardia.

Evidence suggests that carvedilol can mitigate the progression of cardiovascular complications, which are prevalent in patients with T2DM and hypertension. Its ability to decrease oxidative stress and inhibit sympathetic overactivity makes it particularly beneficial in reducing the risk of cardiovascular events. Furthermore, carvedilol is well-tolerated in combination therapy, enhancing its versatility in comprehensive management plans for these patients.

Keywords: Carvedilol, type 2 diabetes mellitus, hypertension, beta-blockers, insulin sensitivity, cardiovascular risk.

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A novel approach to toxicological investigations of health hazards of indian spices

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Food adulteration with Sudan Dyes I-IV, a class of azo dyes known for their carcinogenic and mutagenic properties, poses significant public health risks. These dyes, often used for their vibrant colours and stability, are prohibited in the food industry. This study focuses on detecting and quantifying Sudan dyes in commonly used spices in Gujarat, a region known for its significant spice production and consumption.

Spice samples, including chilli and turmeric powders, are collected systematically from rural and urban areas of Ahmedabad, Gandhinagar, Junagadh, and Rajkot. A total of 24 samples, comprising branded and local varieties, are analysed using UV-visible spectroscopy. Given their poor water solubility, the methodology involves dissolving the samples in an organic solvent, such as ethanol, to extract the dyes efficiently. The extracted solution is then subjected to spectroscopic analysis, where absorbance is measured across specific wavelengths corresponding to the characteristic electronic transitions of Sudan dyes. Calibration curves are prepared using standard solutions to ensure accurate quantification.

This analytical method describes the sensitivity and precision of UV-visible spectroscopy in identifying adulterants based on their pi-pi electronic transitions. By determining the prevalence and concentration of Sudan dyes, the study evaluates regional contamination variations and assesses the effectiveness of current regulatory frameworks. The findings aim to raise public awareness, inform policy updates, and strengthen food safety practices.

Keywords: Sudan Dyes, Adulteration, UV-Visible Spectroscopy, Solvent Extraction, Gujarat

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Study of switch over from injectables to oral therapy in the surgical patients: a prospective observational study

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Background: The Indian Council of Medical Research emphasizes on rational use, providing criteria for parenteral to oral conversion after initial stabilization.

Aim: To assess therapeutic switching on surgical patients and evaluating adherence to ICMR Treatment Guidelines for Surgical Antimicrobial Prophylaxis, 2022.

Methodology: A Prospective, Observational study with 98 participants was carried out at three general surgical hospitals. Demographic details, significant information related to switch, daily progress, in-patient current therapy and discharge medications was collected of the patients who met the eligibility criteria in the case record form. **Result:** Out of 98 study participants, switch over was done in only 43 study participants with a prevalence of 44%. Sequential therapy and Switch therapy were found to be the most opted for type of switch over. Compliance to ICMR's SAP guidelines was witnessed in only 26% of cases. **Conclusion:** Switch over is evident in treatment. Prescribed antimicrobials for surgical prophylaxis were not in accordance with the ICMR guidelines, indicating an important gap in the rational use of antimicrobial therapy that needs to be evaluated on case to case base.

Keywords: *Prevalence, Switch Over, Cost Minimization, ICMR Guidelines, Surgical Antimicrobial Prophylaxis.*

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***In-silico* screening of indian ayurveda botanicals for the management of
alzheimer's disease**

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Introduction: Alzheimer's disease is a progressive chronic neurodegenerative ailment named after Dr. Alois Alzheimer in 1907. AD has a significant societal impact; it often begins as moderate cognitive impairment and progresses over time to dementia. The essential indications of AD include cognitive impairment, memory loss and abnormal changes in personality. The main lesions in AD identified are Senile Plaques that are shaped by Amyloid beta and Neurofibrillary tangles (NFTs) present in the hippocampus consists of phosphorylated tau protein. The World Health Organization (WHO) states that dementia is one of the leading causes of reliance and impairment among the elderly globally. 60–80% of dementia cases are caused by Alzheimer's disease. According to the estimates of World Health Organization (WHO) 6% of women over 60 years and 5% of males globally suffer from Alzheimer's disease. Non-pharmacological strategies for managing behavioural symptoms are essential in attending both physical and emotional well-being. Many drug approaches exist for the management of AD as well.

Methodology: Phytocompounds of *Nardostachys jatamansi* were obtained from IMPPAT database. Potential active targets were retrieved from Superpred database. Alzheimer's targets were collected from GeneCards database. Phytocompound-target-pathway networks were constructed to screen out the hub genes using STRING database and Cytoscape software. Finally, molecular docking was performed using Auto dock tool and PyMOL software.

Results: Out of 30 possible protein targets of the 22 phytocompounds, NFKB1, MAPK1, PiK3R1, STAT3 and NTRK3 and Elemol, Jatamol B, Beta sitosterol, Pinorecinol and Virolin were the key targets and compounds closely related in Alzheimer's disease. Molecular docking analysis revealed that most phytocompounds had a good affinity with the key targets.

Conclusion: The result of this study will enhance our understanding of potential molecular mechanism by which *Nardostachys jatamansi* treats Alzheimer's disease and establish a framework for further experiments.

Keywords: *Nardostachys jatamansi*, Network pharmacology, Molecular docking.

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Next generation HIV care: long acting Injectabe lenacapavir

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Lenacapavir is a novel first-in-class inhibitor of HIV-1 (Human Immunodeficiency virus) capsid function with efficacy at various stages of the viral life cycle, and it is indicated for the treatment of MDR HIV-1 infection in combination with optimized background antiretroviral therapy. In 2024, the approval of the lenacapavir injection marks a major advancement in the management of HIV offering an alternative to daily oral antiretroviral therapy (ART). By binding to two neighboring subunits of the HIV capsid protein, lenacapavir interferes with their interactions essential for multiple phases of the viral replication cycle. Various English language articles from last 3 years were reviewed on databases such as PubMed and Science Direct using standard Booleans and search terms. Lenacapavir demonstrated significant reductions in viral load, with patients experiencing viral suppression similar to traditional oral regimens. The subcutaneous injectable formulation allows for less frequent dosing (every six months), which improves adherence and convenience for patients. Its versatility extends to prophylactic applications, where it may play a key role in expanding pre-exposure prophylaxis (PrEP) options. Further research and real-world implementation will determine its full impact, but lenacapavir marks a pivotal step toward a future where HIV management is more effective, accessible, and sustainable. Lenacapavir, a long-acting injectable treatment for HIV, had not yet been officially approved for use in India. However, Lenacapavir had been granted approval by the U.S. FDA in December 2022 for use in combination with other antiretroviral in HIV treatment.

Keywords: Lenacapavir, Capsid inhibitor, MDR HIV- 1, Capella study, lenvatinib (LEN)

Antifibrotic effect of various growth factor inhibitors on high salt-induced hypertrophy and fibrosis in H9C2 (2-1) cell line.

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Cardiac fibrosis is characterized by the excessive deposition of extracellular matrix (ECM) proteins in the cardiac interstitium, which disrupts normal cardiac function. Growth Factor Inhibitors (GFIs), widely used in cancer therapy, exhibit antifibrotic properties and are under evaluation for treating various types of fibrosis. This study investigates the effects of GFIs—Imatinib, Sorafenib, Ponatinib, and Telmisartan—on salt-induced cardiac hypertrophy and fibrosis in the H9C2 (2-1) cell line. The concentration of Growth Factor Inhibitors (GFIs) that do not exhibit cytotoxicity will be determined using the MTT assay. The assay will be conducted for Imatinib, Sorafenib, and Ponatinib at concentrations ranging from 0.25 μ M to 1.0 μ M and for Telmisartan at concentrations ranging from 0.25 μ M to 40 μ M. The concentrations of these drugs that showed the least cytotoxicity will be selected to assess the anti-fibrotic potential. Induction of cell hypertrophy and profibrotic status will be carried out by exposing cells to high salt conditions for 48 hours. Alpha Smooth Muscle Actin (α SMA) and cell area will be used to determine the antifibrotic effect of GFIs. All GFIs at 0.25 μ M showed no cytotoxicity. At 0.25 μ M, all GFIs reduced significantly cell area and α SMA levels compared to alone high salt-treated cells. All GFIs exhibit significant efficacy against salt-induced hypertrophy and fibrosis in H9C2(2-1) cells. These findings highlight their potential as antifibrotic agents and recommend further investigation into their therapeutic applications.

Keywords: Cardiac Fibrosis, Growth Factor Inhibitors, Invitro Study, H9C2(2-1) cell line.

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Investigation of Drug Resistance Mutations in the HIV-1 Reverse Transcriptase and Protease Coding Regions

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Broad Classification of Poster: Pharmacology (Pharmaceutical Sciences)

Human Immunodeficiency virus (HIV), a retrovirus, is responsible for acquired immunodeficiency syndrome (AIDS). Highly Active Antiretroviral Therapy (HAART) and boosted PI treatment are recent advances for treatment of HIV. Development of resistance in drug treatment is a crucial for Antiretroviral therapy. RT Inhibitors (RTIs) and Protease Inhibitors (PIs) are used as main drug for treatment. We have analysed drug resistance associated with POL gene sequences of HIV patients, collected from Los Alamos database from 2014 to 2024. Sequences were aligned using Cluster Omega and phylogenetic tree was prepared using Mega. Stanford HIVdb Program was used to study the reverse transcriptase gene mutation in the sequences. We have collected 772 sequences of Pol gene and aligned using Cluster Omega for mutation analysis. Stanford HIVdb Program revealed more than 169 mutations among which 96 were most common mutations. Majority of the mutations including A98G, L100I, L100V, M41L and K10E lead to decrease sensitivity of reverse transcriptase inhibitors leading to resistance. The sequence alignment and mutation analysis can pay the pathway for development of new reverse transcriptase inhibitors and may help to improve the current treatment strategy.

Keywords: HIV, Drug resistance mutation, HIVdb Program

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Investigation of Pharmacological Potential of Tribulus Terrestris against Polycystic Ovary Syndrome in Female Sprague Dawley Rats, Focusing PI3K/NF- κ B pathway: Computational Approach

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Broad Classification of Poster: Pharmacology

Polycystic Ovary Syndrome (PCOS) is common endocrine pathology in female reproductive age occurring due to hormonal imbalance. This condition affects 5–20% of women, and up to 70% of cases are undiagnosed. Tribulus terrestris (TT) is used traditionally for the treatment of PCOS in various formulations. However, the probable mechanism has yet to be identified. Hence, the present study aims to identify mechanism of TT against PCOS using network pharmacology and molecular docking approach. The phytoconstituents was retrieved from IMPPAT and screened based on drug-likeness score using molsoft. Selected ones were subjected to SuperPred for target prediction. Disease targets were identified using Genecards. STRING database was used for PPI. The interaction between the phytoconstituents, proteins, and pathways was interpreted using cytoscape 3.7.2. Selected targets were subjected to docking using Auto dock vina 1.5.7. We selected Thirty-three phytoconstituents having positive score who targeted 202 proteins. Genecard showed 109 proteins having role in PCOS. Venny showed 32 proteins of PCOS targeted by phytoconstituents of TT. PPI network showed 32 nodes with degree of 11.8. Final compound-target-pathway network showed 78 nodes with 8.59 degree. Compounds (five) and proteins (five) having highest degree were subjected to docking. We found that Diosgenin acetate, Protodioscin, and Protogracillin has better docking score with selected targets compared to reference. The current study identified protein targets having major role in PCOS and targeted by various phytoconstituents of TT by Ras Signalling pathway, PIK3-Akt signalling pathway and EGFR pathway.

Keywords: Polycystic Ovary Syndrome, Tribulus Terrestris, Network-pharmacology, Molecular Docking, PI3K/NF- κ B pathway.

ETPS_FP_PT - 31

Investigation of Neuroprotective Potential of Swertia Chirayita against Cerebral Ischemia/Reperfusion Injury in Sprague Dawley Rats, Focusing PI3K/AKT/NF- κ B Pathway and Regulating NLRP3 Inflammasome: Computational Approach

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Broad Classification of Poster: Pharmacology

Stroke is a neurological condition in which blood flow stops to brain and spinal cord. Stroke is classified into ischemic and haemorrhagic. Ischemic stroke is the leading cause of death and functional impairment. This study examines the neuroprotective potential of root extract of *Swertia chirayita* against cerebral ischemia/reperfusion injury by computational approach. The phytoconstituents was retrieved from IMMPAT and screened based on drug likeness score using molsoft. The selected ones were subjected to SuperPred for target prediction. Disease targets were identified using Gene cards. STRING database was used for protein-protein interaction. The interaction between the phytoconstituents, proteins, and pathways was interpreted using cytoscape 3.7.2. Selected targets were subjected to docking using Auto dock vina 1.5.7. We selected Ten phytoconstituents having positive score who targeted 384 proteins. Gene card showed 302 proteins having role in Cerebral Ischemia Reperfusion Injury. Venny showed 18 proteins of PCOS targeted by phytoconstituents of Swertia Chirayita. Compounds (nine) and proteins (four) having highest degree were subjected to docking. We found that swertanone, stigmasterol, and swertiapuniside has better docking score with selected targets compared to reference. The results provide evidence that root extract of *Swertia chirayita* may possess potent neuroprotective action against global cerebral ischemia/reperfusion-induced neuronal damage in rats by inhibiting PI3K/AKT/NF- κ B pathway and regulating NLRP3 inflammasome.

Keywords: *Stroke, Ischemic reperfusion injury, Swertia chirayita, oxidative stress, BBB dysfunction.*

ETPS_FP_PT - 32

Untargeted Metabolomics Approach to Identify Metabolites as Potential Biomarkers in Cerebrospinal Fluid for Lethal Traumatic Brain Injuries.

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This study pioneers the use of metabolite analysis as a novel approach to diagnose traumatic brain injury (TBI) post-mortem and distinguish it from natural death, advancing the emerging field of "neuroforensomics." While structural proteins in serum and cerebrospinal fluid (CSF) have traditionally been employed as biomarkers for acute trauma in forensic pathology, the potential of endogenous metabolites remains largely unexplored. Using high-resolution liquid chromatography-mass spectrometry (HR-LC/MS), metabolites in post-mortem CSF were analysed from 10 cases, including lethal acute TBI and natural death controls. Statistical and graphical evaluations, along with a calculated TBI/ND quotient, identified significant concentration differences in numerous metabolites between TBI cases and natural deaths.

The findings underscore the suitability of metabolite profiling in post-mortem CSF for identifying TBI, offering a biochemical assessment of neuropathological changes with a high degree of specificity. This innovative approach not only complements existing methods but also provides valuable surrogate markers for understanding the biochemical pathways underlying acute TBI. By bridging forensic pathology and metabolomics, the study highlights the potential of metabolite analysis to enhance post-mortem diagnostics, offering deeper insights into central nervous system (CNS) damage and contributing to a better understanding of the causes and circumstances of death following TBI.

Keywords: *Untargeted Metabolomics, Traumatic Brain Injury (TBI), Cerebrospinal Fluid (CSF), Post-mortem biomarkers, Neuroforensomics.*

ETPS_FP_PT - 33

**Pharmacognosy, Phytochemistry and Anti-Urolithic Evaluation of
Cyamopsis tetragonoloba and *Trichosanthes dioica***

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Objective: To study in detail the morphology, microscopy, phytochemical analysis and evaluate the antiurolithiatic potential of *Cyamopsis tetragonoloba* (seeds) and *Trichosanthes dioica* (fruits) against calcium oxalate calculi in experimental rats.

Methods: Macroscopy, preliminary phytochemical screening and other recommended parameters for standardizations were performed. Urolithiatic enhancement by using drinking water containing 0.75% v/v ethylene glycol (EG) and 1% w/v ammonium chloride (AC) was used to induce hyperoxaluria in Wistar rats. Thirty-six rats divided into six groups (each containing six animals) were treated with vehicle (Normal control), EG + AC (Urolithiatic control), Cystone (Standard), and 100, 300 and 500 mg/kg, EAECT and EAETD (Ethyle acetate extract or test sample). Administration of EG + AC produced significant hyperoxaluria and altered biochemical parameters of urine, serum and kidney tissue homogenates in lithiatic group. **Results:** Pharmacognostic evaluation included examination of macroscopical and microscopical characters, preliminary phytochemicals investigations have been carried out on the seed extract and fruits extract by using petroleum ether (de-fatting), ethyl acetate solvents to collect the EAECT and EAETD extract. Furthermore, phytochemical analysis, TLC and HPTLC fingerprint profile also by column chromatatography collected various fractions of isolated compounds to perform the spectroscopy.

Conclusions: Qualitative phytochemicals analysis reflects the presence of flavanoids, phenolic compounds, steroids, and terpenoid in the extract. Conclusively, the experimental findings showed that EAECT and EAETD exhibited significant antiurolithiatic potential against calcium oxalate calculi in experimental rats.

Keywords: *Cyamopsis tetragonoloba* , *Trichosanthes dioica* , Cystone , Urolithiatic , Calcium oxalate

ETPS_FP_PT - 34

Beyond the sequence: epigenetic clues: integrating DNA methylation, Epigenetic factors and Biometric systems

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Since the Conception of Genetics, it has served as one of the most reliable, and efficient, individual specific factors. Epigenetics too has been emerging as a groundbreaking tool. Beyond the traditional characteristics, it lays a roadmap to unique and individual- specific identifiers, sparking its potential to revolutionize the field of Biology, Pharmaceuticals and Forensic Science. By analyzing patterns of Epigenetic factors of the organisms we can not only track, detect, identify and evaluate the exposure of danger to its life, but also sketch out the appropriate time as well such as during Post Mortem Intervals, enabling precision in drug detection, toxicological evaluations, and contamination analysis. Furthermore, the integration of epigenetics into forensic nanotechnology and biotechnology would lead to the development of advanced tools and methods for addressing complex forensic challenges.

Although DNA profiling is the most accurate method of biometrics, having a dynamic nature, Epigenetic Profiling can serve as one of the most trusted evolving identifiers of integral aspects, since they look at the deeply under layered components of DNA. This can visualize development of Biometric Modalities that could be used to identify and detect even trace and degraded amounts of DNA. This paper discusses the potential applications of epigenetic biometrics in fields of Health, Medicine, Forensics etc.

Keywords: Epigenetic Profiling, Forensic Pharmacy, Drug Detection, Precision Medicine

ETPS_FP_PT - 35

Involvement of circulating tumour cells in metastatic cancer

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Metastatic cancer, often referred to as metastasis, is a complex process where cancer cells spread from the primary tumour site to distant organs or tissues, establishing secondary tumours. This phenomenon is a significant contributor to cancer morbidity and mortality, as it complicates treatment and worsens prognosis. The mechanisms underlying metastasis involve a series of biological processes, including local invasion, intravasation into the bloodstream or lymphatic system, survival in circulation, extravasation into distant tissues, and colonisation of new sites. One of the key components in understanding metastasis is the role of circulating tumour cells (CTCs), which are cancer cells that have detached from the primary tumour and entered the bloodstream. The presence and characteristics of CTCs can provide valuable insights into the metastatic process and the overall prognosis of cancer patients. The identification and characterisation of CTCs from cancer patients has been made possible by developments in the enrichment and analysis of rare cells from circulation. CTC analysis has yielded a substantial understanding of metastasis. The molecular processes of CTC production, intravasation, survival, interaction with components of the blood, extravasation, and colonisation of distant organs have started to be elucidated thanks to studies on their biology. Furthermore, CTC research has shown striking intra- and inter-patient variability and the dynamic nature of CTCs across time. Here, we review the current understanding of CTC biology and talk about its potential clinical implications.

Keywords: Metastatic Cancer, Circulating tumor cells, Tumour Dissemination, Tumor Microenvironment, Invasion and Intravasation.

Epigenetic Mechanisms in Alzheimer's Disease: Potential Therapeutic Strategies and Challenges

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Alzheimer's disease (AD), an irreversible and progressive neurological disease, is the most prevalent type of neurodegenerative dementia. Alzheimer's disease (AD) features two key pathological aggregates: senile plaques, formed by amyloid-beta ($A\beta$), which is cleaved off the amyloid precursor protein (APP) by beta-site APP cleaving enzyme (BACE) and γ -secretase and neurofibrillary tangles (NFTs), composed of hyperphosphorylated tau protein. Epigenetics is the study of heritable changes in gene function, such as DNA methylation and histone modification, that influence gene expression and are stable across cell divisions. These mechanisms are essential for normal development and play a role in diseases like Alzheimer's (AD). AD is a progressive neurodegenerative disorder characterized by memory loss, cognitive decline, and behavioural changes. Key pathological features include extracellular amyloid beta ($A\beta$) plaques, intracellular tau tangles, and neuro-inflammation, along with neuronal loss in the cortex and hippocampus and disruption of neurotransmitter systems. Therapeutics for Alzheimer's disease (AD) are significantly impacted by epigenetics, the study of heritable variations in gene expression that do not involve modifications to the underlying DNA sequence. DNA methylation inhibitors {azacitidine}, HDAC inhibitors {varinostat}, histone methyl transferase inhibitors {JSK-J4}, and non-coding RNA modulators examples of epigenetics modifications that are important in controlling genes linked to inflammation, neuronal health and amyloid beta ($A\beta$) and tau protein pathologies, all of which are essential for the development of AD. However, epigenetic modifications in AD are complex and spread across genes, making it a major challenge to achieve targeted, target-specific effects without unintended consequences.

Keywords: *Alzheimer's Disease (AD), Epigenetics, DNA Methylation and Histone Modification, Amyloid Beta ($A\beta$) and Tau Pathology, Therapeutic Strategies.*

ETPS_FP_PT - 37

**Human metapneumovirus: molecular target used by the virus to avoid
immune system**

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Human metapneumovirus is a respiratory virus, from Pneumoviridae family and Metapneumovirus genus. The clinical symptoms were similar to those caused by human respiratory syncytial virus infection, ranging from upper respiratory tract to severe bronchiolitis and pneumonia. Susceptible population to hMPV-infection includes newborns, children, elderly and immunocompromised individual. This hMPV induces poor innate immune response and interfere with several PRRs and cell signaling pathways triggered by INF-associated genes. Mechanism of hMPV was not like the ones reported in hRSV, as the latter has two non-structural proteins that are able to inhibit these pathways. The viral glycoproteins, such as G and SH could play immune-modulator roles during infection. Almost all children are infected by HMPV below the age of five; the repeated infections throughout life indicate transient immunity. Since, culturing the virus is relatively difficult, diagnosis is mostly based on a nucleic acid amplification test, such as reverse transcriptase- quantitative polymerase chain reaction. To date, no vaccine is available and treatment is supportive. Here we will discuss about the mechanism underlying the poor immunity elicited by hMPV.

Keywords: Human Metapneumovirus, immune system, glycoproteins, RT- qPCR, respiratory virus

Mangiferin attenuates maternal immune activation-induced autism spectrum disorder in mice: Inhibition of neuroinflammation and BDNF level

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Maternal immune activation (MIA) in pregnant mother causes autism spectrum disorder (ASD) in offspring by activating the immuno-inflammatory and oxido-nitrosative pathway through inhibition of serotonin and elevation of brain derived neurotrophic factor (BDNF) level. Mangiferin (MGF) possesses antioxidant, anti-inflammatory and neuroprotective activities. The study investigated the protective effect of MGF against poly(I:C)-induced behavioral changes and biochemical modulations in fetal and adult mouse brain. Female C57BL/6 mice (n=6-8) were pre-treated with MGF (20 & 40 mg/kg, p.o.) from E0.5 to E12.5 and injected poly(I:C) (20 mg/kg, i.p.) on E12.5 to induce MIA. After 4 h of poly(I:C) injection mice were sacrificed to measure cytokines (IL-6, IL-17 α), IDO, BDNF and TrkB level in fetal brain. Other pregnant mice were allowed to deliver pups, and these offspring were subjected to behavioral tests (EPM, marble burying, rotarod apparatus & 3 chambered test) at different time intervals to assess anxiety, muscle coordination and social interaction, and then sacrificed for biochemical analysis in adult offspring's brain parts (hippocampus, PFC). Findings demonstrated that poly(I:C) significantly ($P<0.05$) decreased both open arms entries and duration in EPM, increased marble burying, decreased motor coordination in rotarod and decreased time spent with novel mouse in 3 chambered test which was significantly ($P<0.05$) ameliorated by MGF pre-treatment. Cytokines, IDO, BDNF, and TrkB level in mice were increased significantly ($P<0.05$) after poly(I:C) injection which were attenuated by MGF pre-treatment. Findings suggested that MGF attenuated the poly(I:C)-induced behavioral and neurochemical alterations by impeding neuroinflammation, diminishing BDNF signaling mechanism and up-regulating serotonergic pathway.

Keywords: Autism Spectrum Disorder; BDNF; Inflammation; Mangiferin; MIA; Poly(I:C).

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Mangiferin attenuates maternal immune activation-induced autism spectrum disorder in mice: Inhibition of neuroinflammation and BDNF level

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Maternal immune activation (MIA) in pregnant mother causes autism spectrum disorder (ASD) in offspring by activating the immuno-inflammatory and oxido-nitrosative pathway through inhibition of serotonin and elevation of brain derived neurotrophic factor (BDNF) level. Mangiferin (MGF) possesses antioxidant, anti-inflammatory and neuroprotective activities. The study investigated the protective effect of MGF against poly(I:C)-induced behavioral changes and biochemical modulations in fetal and adult mouse brain. Female C57BL/6 mice (n=6-8) were pre-treated with MGF (20 & 40 mg/kg, p.o.) from E0.5 to E12.5 and injected poly(I:C) (20 mg/kg, i.p.) on E12.5 to induce MIA. After 4 h of poly(I:C) injection mice were sacrificed to measure cytokines (IL-6, IL-17 α), IDO, BDNF and TrkB level in fetal brain. Other pregnant mice were allowed to deliver pups, and these offspring were subjected to behavioral tests (EPM, marble burying, rotarod apparatus & 3 chambered test) at different time intervals to assess anxiety, muscle coordination and social interaction, and then sacrificed for biochemical analysis in adult offspring's brain parts (hippocampus, PFC). Findings demonstrated that poly(I:C) significantly ($P<0.05$) decreased both open arms entries and duration in EPM, increased marble burying, decreased motor coordination in rotarod and decreased time spent with novel mouse in 3 chambered test which was significantly ($P<0.05$) ameliorated by MGF pre-treatment. Cytokines, IDO, BDNF, and TrkB level in mice were increased significantly ($P<0.05$) after poly(I:C) injection which were attenuated by MGF pre-treatment. Findings suggested that MGF attenuated the poly(I:C)-induced behavioral and neurochemical alterations by impeding neuroinflammation, diminishing BDNF signaling mechanism and up-regulating serotonergic pathway.

Keywords: Autism Spectrum Disorder; BDNF; Inflammation; Mangiferin; MIA; Poly(I:C).

ETPS_FP_PT – 40

Assessment of Risk Factors and Pharmacoeconomic Evaluation of Diabetic Nephropathy in Tertiary Care Hospital

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Aim: To assess the risk factors and Pharmacoeconomics evaluation of diabetic nephropathy patients.

Methodology: The proposed study was a cross-sectional type of clinical research study design. The methodology involved patients counseling, collecting their demographical data, medical and medication history, details of current medications. Results was expressed in the form of mean and percentage.

Results: There were 203 patients who met the study criteria. Risk factor analysis revealed that the majority of patients had a prolonged duration of diabetes, with 177 individuals (87.19%). This was followed by hypertension, which was present in 148 patients (72.91%), and poor glycemic control, observed in 147 patients (72.41%). Average direct medical cost of patients with Stage 2 DKD were ₹3280, Stage 3A was ₹3626.84, Stage 3B was ₹4745.43, Stage 4 was ₹5313.16, and Stage 5 was ₹5436.22. Incremental direct medical costs increased by 10.57% for Stage 3A, 30.84% for Stage 3B, 11.96% for Stage 4, and 2.31% for Stage 5 DKD. Patient faced 477.43% more economic burden of direct medical costs as compared to non-medical cost. **Conclusion:** Prolonged diabetes duration is the primary risk factor, followed by hypertension and poor glycemic control. The economic burden of (DKD) increases as the condition progresses from Stage 3A to Stage 3B.

Keywords: *Diabetic nephropathy, Risk factors, Pharmacoeconomics burden*

ETPS_FP_PT – 41

Incidence, Risk Factors, and Impact of Cisplatin-Induced Hyponatremia on Quality of Life in Cancer Patients Undergoing Chemoradiation Therapy

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Objective: To investigate and quantify the occurrence, risk factors, and severity of cisplatin-induced hyponatremia and evaluate the quality of life (QoL) of cancer patients undergoing concurrent chemoradiation therapy.

Material and Methods: This prospective observational study was conducted at the oncology department of a tertiary care hospital. Thirty-six cancer patients undergoing concurrent chemoradiation with weekly cisplatin were enrolled. Hyponatremia was graded, and QoL was assessed using the EORTC QLQ-C30 and WHOQOL-BREF scales. Statistical analysis was performed using paired t-tests and ANOVA to determine significance.

Results: Among the participants, 29 (80.6%) developed mild to moderate hyponatremia, predominantly grade 1. Significant changes in QoL scores were observed across all domains, with the most substantial decline noted after the sixth cycle of treatment. Statistical tests revealed a significant impact of cisplatin on QoL (p-values: <0.003 for t-test and <0.008 for ANOVA). Hyponatremia was associated with specific risk factors, including electrolyte imbalances and renal dysfunction.

Conclusion: Patients receiving weekly cisplatin with radiation had very mild hyponatremia of grade-1, and risk factors such as nausea, vomiting, diarrhoea, age can lead to hyponatremia. Additionally, the patient's general quality of life decreased from the start of treatment to the completion of cycle 6 of cisplatin.

Keywords: *Cisplatin, Hyponatremia, QOL.*

Ayurvedic Traditional Medicine and Toxicity: A Critical Appraisal

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Ayurvedic Bhasma, a unique preparation of metallic and mineral-based formulations, has been an integral part of traditional Indian medicine for centuries. These medicines are processed through elaborate purification and calcination techniques (Shodhana and Marana) to ensure their therapeutic efficacy and safety. However, concerns about potential toxicity, primarily due to the presence of heavy metals like mercury, lead, and arsenic, have raised questions about their modern-day applicability.

This presentation examines the scientific basis of Bhasma preparation methods, highlighting their role in reducing toxicity and enhancing bioavailability. Additionally, it delves into the challenges posed by improper preparation, non-standardized manufacturing, and inadequate regulation, which contribute to reported cases of toxicity. Modern analytical techniques such as ICP-MS, XRD, and SEM have revealed insights into the nanoscale structure of Bhasma, supporting its therapeutic action but also emphasizing the need for rigorous quality control.

Balancing ancient wisdom with contemporary scientific scrutiny, this discussion underscores the importance of adherence to classical methods, regulatory oversight, and interdisciplinary research to ensure the safe integration of Ayurvedic Bhasma into modern healthcare. The session concludes with actionable recommendations for policymakers, researchers, and practitioners.

Keywords: Ayurvedic traditionam medivcine, Toxicity etc.

Track-III

ANALYTICAL TOOLS (AT)

ETPS_FP_AT - 01

A Review of Analytical Methods for Detection of Food Preservatives Residues in Food

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The accurate detection of food preservatives residues is essential for ensuring consumer safety and regulatory compliance. Preservatives play a vital role in extending shelf life and maintaining food quality but pose health risks if misused. This review focuses on various analytical methods employed for the detection and quantification of preservative residues. Chromatographic techniques such as High-Performance Liquid Chromatography (HPLC) and Gas Chromatography (GC), often paired with Mass Spectrometry (MS), offer exceptional sensitivity and precision, making them indispensable for complex food matrices. Spectroscopic methods, including Fourier Transform Infrared (FTIR) and Nuclear Magnetic Resonance (NMR) spectroscopy, provide rapid and non-destructive analysis but are occasionally limited in specificity.

Emerging technologies, like biosensors and hybrid analytical approaches, are promising for routine quality control, offering simplicity and enhanced efficiency. Innovations in sample preparation, such as solid-phase extraction, have improved method reliability while reducing matrix interferences. The integration of chemometric tools has further enhanced data interpretation, especially in spectroscopic analysis.

Despite advancements, challenges persist, including the standardization of detection methods and the development of eco-friendly, cost-effective technologies. Addressing these issues is crucial for the future of preservative detection in the food industry. This review emphasizes the importance of a tailored approach to analytical method selection based on factors such as the preservative type, food matrix complexity, and detection limits, thereby contributing to global food safety and quality assurance.

Keywords: Food Preservative Residue, Analytical Methods, Chromatographic Techniques.

ETPS_FP_AT - 02

Development and Validation of UHPLC-MS/MS Method for Simultaneous Quantification of Poly- And Perfluoroalkyl Substances (PFASs) In Different Water Samples.

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The research presented in poster will focus on the development and validation of an ultra-high-performance liquid chromatography coupled with tandem mass spectrometry (UHPLC-MS/MS) method for the simultaneous quantification of poly- and perfluoroalkyl substances (PFASs) in various water samples. PFASs are a group of synthetic chemicals known for their persistence in the environment and potential health risks, making their detection and quantification critical for public health and safety. The study begins with an extensive review of PFAS classification, environmental impact, exposure routes, and associated health effects. Following this, the methodology section details the preparation of reagents, sample extraction processes, and the optimization of chromatographic conditions essential for achieving high sensitivity and specificity in detecting PFASs. Validation parameters including linearity, precision, recovery, and limits of detection were rigorously assessed to ensure the reliability of the method.

Results indicate successful quantification of multiple PFAS compounds across different water matrices, highlighting the method's applicability in environmental monitoring. The findings contribute valuable insights into PFAS contamination levels in water sources, emphasizing the need for regulatory measures to mitigate exposure risks. This research not only advances analytical methodologies but also serves as a foundational study for future investigations into PFAS prevalence and its implications on health and environment. The work underscores the importance of continuous monitoring and regulation of these hazardous substances to protect public health.

Keywords: PFAS, Water Samples, UHPLC-MS/MS, Validation, Quantification

ETPS_FP_AT - 03

Quality assessment of Eleusine coracana using chemometric methodologies

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Eleusine coracana, commonly known as ragi, is a vital cereal crop recognized for its nutritional attributes and adaptability to diverse agro-climatic conditions. Ensuring the quality and purity of Eleusine coracana is paramount for consumer safety and market integrity. Conventional methods of quality assessment and adulteration detection predominantly depend on subjective evaluation and rudimentary chemical assays, which may lack precision and reliability. The present work endeavours to enhance quality control measures for Eleusine coracana by developing robust predictive models utilizing advanced chemometric methodologies. Current methodologies for quality and adulteration assessment in Eleusine coracana encompass traditional chemical analyses and physical inspection. Despite providing foundational insights, these methods exhibit significant limitations, including low sensitivity, labour intensiveness, and inconsistency in results. Additionally, they are often time-consuming and unable to comprehensively analyse intricate datasets, leading to potential inaccuracies in quality assessment.

The outcome of the work proposes the implementation of sophisticated chemometric techniques to construct predictive models capable of accurately identifying quality parameters and detecting adulteration in Eleusine coracana. Chemometric methodologies such as Principal Component Analysis (PCA), Partial Least Squares (PLS) regression, and other multivariate analysis techniques will be employed to scrutinize spectral data derived from various analytical instruments. These techniques offer notable advantages, including heightened sensitivity, rapid analysis, and the capacity to manage extensive datasets, thereby ensuring more reliable and consistent quality assessments. The development of these robust predictive models is anticipated to substantially improve the accuracy and efficiency of quality control for Eleusine coracana, ultimately benefiting both consumers and producers.

Keyword: Eleusine Coracana, Plant quality evaluation, Chemometrics, Multivariate Data Analysis, Principal Component Analysis, Ragi, Metabolomics.

ETPS_FP_AT - 04

Development of a Non-Invasive Glucose Biosensor for Salivary Analysis Using Paper Strips by engineering nanoparticle

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This research proposes a simple and non-invasive paper strip biosensor to detect salivary glucose level in comparison to standard blood glucose monitoring. Utilizing the method of co-immobilization of glucose oxidase (GOD) with pH-sensitive dyes on paper strips for the detection process, colorimetric changes with RGB profiling is utilized for detecting glucose levels. The biosensor is shown to have a detection range of 9–1350 mg/dL, with a response time of 45 seconds and an acceptable clinical correlation ($R^2 = 0.95$) between SGL and BGL in diabetic patients. Stability studies confirm that the enzyme is functional for at least 60 days, while interference studies reveal ways in which external effects from compounds such as lactic and ascorbic acids may be circumvented. The device is designed for fast, low-cost, and painless glucose monitoring. It meets the ASSURED criteria of WHO and is scalable for mass diabetes screening. Future work includes optimizing sensitivity to non-diabetic glucose levels, automating fabrication, integrating smartphone technology, and validating additional biomarkers. This biosensor is a promising tool for accessible diabetes management, especially in resource-limited settings, and opens the door for the development of multi-biomarker diagnostics using non-invasive methods.

Keywords: *Paper strip biosensor, Salivary glucose detection, Glucose oxidase (GOD), Colorimetric detection, Clinical correlation, Stability studies, Non-invasive glucose monitoring*

ETPS_FP_AT - 05

Evaluation of Expired Pharmaceutical Drug - Amitriptyline

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Pharmaceutical drugs, which contain Active Pharmaceutical Ingredients (APIs), are essential for diagnosing, treating, and preventing diseases. However, over time, these drugs undergo degradation, leading to a loss of potency and efficacy. The expiration date indicates the period during which a drug is expected to remain effective; post-expiration, degradation products may form, although this does not necessarily render the drug unsafe for use. Factors influencing drug stability include temperature, humidity, light exposure, oxidation, pH levels, and contamination during manufacturing and storage. This study focuses on Amitriptyline Hydrochloride, a widely used antidepressant, examining its degradation over time and the implications for environmental safety. Research indicates that expired drugs can persist in the environment, posing risks to aquatic life and human health. Methods for evaluating the quality of expired drugs include qualitative and quantitative analyses as per the Indian Pharmacopeia. Initial findings suggest that some expired drugs may retain significant potency; however, safe disposal remains a critical challenge. The lack of infrastructure for managing expired pharmaceuticals leads to financial losses and environmental damage. Future research should aim at enhancing drug stability and developing effective disposal methods to mitigate these issues while exploring potential reusability of APIs from expired medications.

Keyword: Expired Drug Analysis Drug Degradation, Amitriptyline Hydrochloride Stability Drug Disposal Challenges, API Reusability, Pharmaceutical Waste Management

ETPS_FP_AT - 06

Nanostructured Fabricated Electrochemical Sensors: Magic Bullet for Heavy Metals

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The development of electrochemical sensors for detecting various toxic substances has emerged as a new field of study for numerous research teams. Advancements in electrochemical sensors have emerged with the creation of novel detection techniques and have proven to be a breakthrough in analysis with the development of nanomaterial-based electrochemical sensors. Electrochemical sensors exhibit increased sensitivity, response time, selectivity, and spot detection of analytes in industrial chemicals, environmental pollutants, pesticides, heavy metals, microplastics, drugs, and biomolecules. Nanomaterial-based electrochemical sensors can also be used to determine the toxicity, which can prevent product counterfeiting. The highlights the available electrode materials, surface-modification procedures, and signal amplification approaches. Electrochemical sensors are applied in various medical diagnostics, environmental monitoring, and food safety, and are poised to be competition changers in current detection technologies with further advancement.

Keywords: Electrochemical sensor; nanostructured materials; detection of heavy metals; qualitative and quantitative study.

ETPS_FP_AT - 07

Potential analytical tools used in forensic sciences

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Analytical chemistry is used to provide the qualitative and quantitative identification of an unknown samples through various techniques. Forensic scientists utilize various chromatographic techniques to analyze compounds in criminal investigations, from explosives to drugs. Each compound has unique chemical properties, making it essential to choose the appropriate method for each case. Planar techniques, such as Thin Layer Chromatography, are used for identifying substances like ink on banknotes, dyes, and drugs. In TLC, analytes are drawn through a stationary phase by capillary action, moving at different rates, allowing for easy identification. These techniques are quick, inexpensive, and effective for simpler analysis. High Performance Liquid Chromatography is a widely used column-based technique in forensic science. Unlike other liquid chromatography methods, HPLC forces the mobile phase through the column under high pressure. This method is effective for detecting drugs and has been instrumental in investigating crimes related to terrorism, drug cartels, and organized crime. Gas Chromatography plays a crucial role in forensic toxicology, helping determine if a deceased person ingested drugs or alcohol before death, or if they were poisoned. GC is also used to analyze blood, fibers, and other samples. This technique is vital for understanding the cause of death and supporting criminal investigations. For more precise identification, mass spectrometry is often coupled with chromatography techniques, such as GC-MS and LC-MS. This combination allows for the identification of a wide range of compounds, including explosives and drugs, and is essential for thorough forensic analysis.

Keywords: Forensic sciences, Analytical Chemistry, Chromatography, HPLC, GC.

ETPS_FP_AT - 08

Analytical tools in forensic drug analysis

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Forensic drug analysis is a critical process that involves testing biological samples to determine the presence and quantity of drugs, which can help explain behavioral changes, illness, injury, or death. It is commonly used in criminal investigations, workplace drug testing, and toxicology assessments. The goal is to identify what drugs are present in a sample and evaluate their potential impact on an individual's health or behavior. Forensic drug testing follows a three-step process: collection, preservation, and analysis. In the collection phase, biological samples such as blood, urine, or hair are gathered. These samples must be preserved to prevent contamination or degradation before analysis. Analysis is typically performed using advanced forensic chemistry techniques. Common methods include ultraviolet-visible spectrophotometry, which analyzes how a substance reacts to light to determine its molecular structure, and mass spectrometry, which separates and identifies molecules such as narcotics, stimulants, or anesthetics. NMR spectroscopy is used to analyze controlled substances like fentanyl and cocaine, while Raman spectroscopy detects drug traces on surfaces, including fingerprints. Gas chromatography is often employed in toxicology to identify drugs or alcohol in deceased individuals. The results from these tests are essential for understanding the role of drugs in specific cases, whether in criminal convictions or health assessments. These techniques provide valuable data that can influence legal decisions or medical treatments, making forensic drug testing a vital tool in both law enforcement and healthcare settings.

Keywords: Forensic drug analysis, Ultraviolet-visible spectrophotometer, Mass spectrometry, Raman spectroscopy, Gas chromatograph.

ETPS_FP_AT - 09

Stomach simulator

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The stomach simulator device addresses the limitations of traditional disintegration and dissolution apparatus, which only simulate temperature conditions and certain aspects of body movements, thereby failing to accurately reflect drug release behaviour of the formulation in the gastrointestinal environment. We have developed a stomach simulator device that replicates actual stomach movements to investigate their effects on formulation disintegration and its release. Developed stomach simulator, mimics various movement patterns from rest to active state and observe their impact on formulation disintegration and its release. The implications of this research suggest more realistic simulation of stomach conditions can lead to better predictions of drug behavior in vivo, ultimately enhancing the design of dosage forms.

Keywords: drug release, stomach model, dissolution, disintegration, gastrointestinal environment, stomach movements.

ETPS_FP_AT - 10

A Critical Review: Analytical and Bioanalytical Techniques for the Quantification of the Hiv-1 Protease Inhibitor – Nelfinavir Mesylate

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Nelfinavir Mesylate is a protease inhibitor used as an antiretroviral drug that effectively reduces viral load and increases CD4 + T cells in individuals infected with HIV. The analytical methods utilized in quantifying Nelfinavir Mesylate either alone or in combination with other pharmaceuticals in its pure form, tablets, powder and capsules. The bioanalytical techniques for the determination of nelfinavir have also been included. Analytical methods such as UV spectroscopy, fluorimetry, HPLC, HPTLC, LC-MS/MS micellar electrokinetic chromatography, capillary electrophoresis FT-IR and DSC have been reported for qualitative and quantitative analysis of nelfinavir mesylate. It was concluded that HPLC is the most commonly used method for the estimation of Nelfinavir Mesylate. The present review indicated a need to develop green analytical methods for the determination of nelfinavir, as the available methods utilize more organic solvents.

Keywords: *Nelfinavir Mesylate, Analytical Methods, Bioanalytical methods, HPLC, HIV*

ETPS_FP_AT - 11

**Formulation And Evaluation of Febuxostat and Ibuprofen in Capsule Dosage Form,
Development and Validation of Analytical and Bioanalytical Methods for Same by Rp-
Hplc**

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This study aimed to develop and evaluate a combination capsule dosage form containing febuxostat and ibuprofen, alongside the development and validation of analytical and bioanalytical methods using RP-HPLC. Febuxostat, a xanthine oxidase inhibitor, and ibuprofen, a nonsteroidal anti-inflammatory drug, were co-formulated to target the dual therapeutic needs of hyperuricemia and inflammation in gout. The formulation process involved optimization of granulation techniques and excipient compatibility studies to ensure uniformity, stability, and dissolution properties. Analytical method development focused on achieving specificity, precision, and accuracy for quantifying febuxostat and ibuprofen in bulk and plasma samples. Bioanalytical validation confirmed the methods' reliability under varied conditions, adhering to regulatory standards. The RP-HPLC method employed a C18 column with a mobile phase optimized for separation and detection. The dissolution and in-vitro release profiles of the capsules demonstrated sustained and synergistic drug release. Furthermore, FTIR and DSC analyses supported the compatibility of active pharmaceutical ingredients with excipients. The capsule formulation achieved targeted therapeutic outcomes, and the validated methods were robust for clinical and pharmaceutical applications. These findings underscore the potential for the combined use of febuxostat and ibuprofen, ensuring enhanced patient compliance and therapeutic efficacy.

ETPS_FP_AT - 12

Analysis of Heavy Metals Contamination in Bovine Milk: Analyzing Risks Assessment and Mitigation Strategies

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The present study aimed to determine the concentration level of heavy metals such as Cadmium (Cd) and Lead (Pb), in cattle milk samples. The sample were collected from various location in the southern region of Gujarat, India. The analysis was conducted using instrumentation techniques to ensure accurate and reliable results. The study provides a comprehensive evaluation of the potential health risks assessment with dairy consumption contaminated by hazardous substances. The contamination of milk with heavy metals, often influenced by industrial activities near the study areas, poses a significant risk to human health. This study's results contribute to the development of targeted strategies for mitigating contamination risks and ensuring the safety of dairy consumption. The responsibility for remediation of hazardous material waste sites, site investigations for property transfer, environmental proceedings between an insured party and identification of the causes of personal injury in the context of a toxic exposure. The environmental forensic is based on law and practices of Environmental Protection Act.

Keywords: Toxicity of heavy metals, Health risk assessment, bovine milk

ETPS_FP_AT - 13

The analysis of cosmetic products by using nanoparticles: As a forensic tool

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The worldwide popularity of cosmetic product, there is an urgent need to understand to the toxicities and risks associated with exposure to chemicals found in various cosmetic product formulation. Some cosmetic products such as hair dyes, lipstick, Sindhoor, eyeliner is categorized as oxidative and nonoxidative in terms of their chemical composition and ingredient. The various chemicals in oxidative and nonoxidative cosmetic dyes, toxicities linked with hair dyeing and the carcinogenic risks assessment to cosmetic product. The nanotechnology is used in the various field of Forensic Science perspective. In this study we have used various cosmetic product for investigation of dyes by nanotechnology method. The investigation of chemical composition may be detected in cosmetic samples can be used for a forensic perspective.

Keywords: Cosmetic product, nanoparticles, health risk assessment.

ETPS_FP_AT - 14

Fluorescent Carbon Dots: Novel Approach in Bacterial Detection

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This research paper presents the synthesis of Carbon Dots (CDs) through a simple and cost-effective pyrolysis method, demonstrating their potential for bacterial detection. The study focuses on the antimicrobial activity of CD@Colistin conjugates against *Escherichia coli* and *Staphylococcus aureus*, confirmed through fluorescence microscopy and spectral analysis. The findings highlight the selective detection of Gram-negative bacteria, particularly *E. coli*, utilizing Colistin as a binding ligand, with CD@colistin-4 exhibiting a higher specificity for *E. coli* compared to *S. aureus*. The fluorescence intensity of *E. coli* was significantly greater than that of *S. aureus*, showing a direct correlation with increased Colistin concentration. This research underscores the advantages of CDs, including their superior fluorescence performance, economical synthesis, and non-toxic nature, paving the way for various applications. Notably, the study innovatively explores the dual functionality of CDs in both latent fingerprint detection on nonporous surfaces and enhanced antibacterial efficacy, marking a significant advancement in the field.

Keywords- *fluorescence microscopy, Colistin, fingerprint detection, antibacterial efficacy*

ETPS_FP_AT - 15

The analysis of drug (Paracetamol) monitoring from urine samples: As a forensic perspective

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In this study, Urine Drug Testing (UDT) performance for detection of drug (paracetamol) by urine samples, the urine samples were collected from difference patient for identification of Urine Drug Testing. Urine drug monitoring (UDM) is significant tool for constituent abuse and adherence to prescribed treatment. The suggested UDM occurrence varies based on individual risk assessment and clinical judgment. Urine test is frequently used in doping cases as well as in criminal justice system. After a drug is consumed it is proceeded and break down into metabolites, which are then excreted through various biological processes, including into urine. Level of parent drug or its metabolites in urine indicate the victim or suspect has consumed drug. Detection of drug from urine containing paracetamol drugs which are available with doctors' prescription on medical stores. Similar to any other investigative or monitoring test, the goal for UDM should be to guide treatment and improve patient care.

Keywords: Urine drug testing, Drug (Paracetamol), addiction forensic testing, Instrumentation

ETPS_FP_AT - 16

Heavy Metal contamination in Chocolates: A comprehensive review

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Heavy metal contamination in food products is emerging as a challenging concern globally, along with significant health and safety implications to human beings such as neurotoxicity, cardiac diseases, renal dysfunction, and development disorders. Among these food products, chocolates are consumed widely by people of all age groups and are prone to potential contamination with heavy metals such as Lead (Pb), arsenic (As), Mercury (Hg) and Cadmium (Cd). This review explores the source of contamination of heavy metals in chocolates, including the environmental factors, agriculture practices, and post harvesting techniques and handling of the cocoa beans. The types of heavy metals commonly detected in chocolates are categorized, and their toxicological impacts on health are studied. A critical evaluation of existing regulatory frameworks and safety standards are discussed. The paper also examines the potential strategies to reduce heavy metal contamination, including improved agriculture practices, safer processing methods etc. Furthermore, the study emphasizes critical research gaps, highlighting the importance of advanced detection methods and comprehensive risk assessment methods.

Keywords: Chocolates, Food toxicity, Heavy metals, Metal contamination

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**Qualitative analysis of milk adulteration & their impact on human health
and their forensic perspective**

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Dairy products are a significant component of the human diet that is rich in carbohydrates and proteins, all of which are important to human health. Milk adulteration has been a significant problem in most of the developing countries. Adulteration of milk has not only reduced its nutritional values but also led to a wide array of allergies & intolerance to certain proteins and several other diseases. In this study we have collected milk samples from various location. The analysis of some chemicals were identified as an adulterant in milk samples. The common contaminants found in milk are starch, urea, detergent and synthetic milk. To combat milk adulteration, legislators, regulatory bodies and consumers must collaborate to enforce quality control procedures, detection methods and increase public awareness of dangers of contaminated milk. Hence, the present research focuses on milk adulteration and its effects on human health.

Keywords: Milk, chemicals contamination and health risk assessments

ETPS_FP_AT - 18

**RP-HPLC Method development and validation for the determination of
remdesivir in formulation**

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The overall effect of the SARS-CoV-2 virus, instigating COVID-19, has highlighted the urgent need for effective treatments. Remdesivir, the only FDA-approved antiviral for severe COVID-19 in adults and children, requires precise analytical methods for its pharmaceutical formulation. Current HPLC techniques exist, but there is a critical demand for more efficient and accurate approaches. This study addresses this need by developing and validating a specific HPLC method for Remdesivir's quantitative analysis in IV dosage form. Utilizing a column of C18 with a 0.7 mL/min flow rate, the analysis was completed in 10 minutes with an isocratic mobile phase of 50:50 acetonitrile and methanol. Validation followed ICH Q2 (R1) guidelines, confirming the method's suitability, linearity, precision, accuracy, and robustness. The results indicate this HPLC method is straightforward, efficient, and highly sensitive, making it a valuable tool for ensuring Remdesivir's quality and efficacy.

Keywords: COVID-19; RP-HPLC; method development and Validation; Remdesivir; quantification.

Nano-Assisted Mass Spectrometry Applicant: Unveiling the Hidden Traces of Date Rape Drugs in Forensic Analysis

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The detection and quantification of substances commonly associated with drug-facilitated crimes is a critical focus area in analytical toxicology. This review highlights recent advancements in analytical methods for identifying date-rape drugs, including ketamine, benzodiazepines, and cocaine, which are frequently implicated in criminal activities. The abuse of these substances, due to their profound effects on human behaviour, poses significant challenges for forensic science. Emphasis is placed on innovative sampling strategies and analytical techniques, particularly liquid chromatography coupled with mass spectrometry, which are widely recognized for their sensitivity and specificity. This review also addresses the complexities of analyzing diverse sample matrices and discusses the practical applications of these methods in forensic investigations. By synthesizing recent research, this article provides a comprehensive overview of the current state of detection technologies and offers insights into future directions for improving the accuracy and reliability of drug detection in forensic contexts.

Keywords: *Forensic toxicology, liquid chromatography-mass spectrometry (LC-MS), drug detection, substance abuse, biological sample analysis, date-rape drugs, drug abuse detection.*

A Review on Application of Nano-sensor Enabled Near Infrared Spectroscopy in Medical Diagnosis

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Near-infrared (NIR) Nano-sensors have emerged as cutting-edge tools in medical diagnostics, offering non-invasive, real-time, and highly sensitive detection of biomarkers across various diseases. Leveraging the unique optical properties of NIR light, such as deep tissue penetration and minimal background interference, these sensors enable advancements in early detection and monitoring. In cancer diagnosis, NIR Nano-sensors facilitate tumor imaging and circulating tumor cell (CTC) detection with exceptional precision. For neurological disorders, they provide insights into brain activity and neurochemical changes, aiding in the early detection of conditions like Alzheimer's and Parkinson's. In cardiovascular disease, NIR sensors detect arterial plaques and monitor biomarkers such as troponin, essential for assessing myocardial infarction. Additionally, they play a crucial role in renal and liver function tests by detecting creatinine and bilirubin levels. This review highlights the design, applications, and potential of NIR Nano-sensors in revolutionizing diagnostics, emphasizing their transformative impact on personalized medicine and clinical practice.

Keywords: Nano-Sensor, Near Infrared, Cancer diagnosis, Neurological disorders, Cardiovascular diseases.

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Fabrication of gold nanosensor for on-spot detection of cannabis

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Cannabis or commonly known as Marijuana or pot, is a psychoactive drug which is obtained from the plant- *Cannabis sativa*. Δ -9 Tetrahydrocannabinol (Δ -9 THC) is primarily responsible for the plant's psychoactive properties. This plant has gained a lot of attention owing to its medicinal properties and researchers continue to make endeavors in utilizing the same. The plant has also been a prime source of recreation in various forms since time immemorial, due to which the plant continues to be abused and illicitly trafficked, which poses a threat to public health and national security at large. To tackle this traditional detection methods are employed, which include microscopic tests, colorimetric tests, and analytical techniques like UV-visible spectroscopy, GC-MS, HPLC, etc. However, these techniques and tests demand a laboratory set-up, and an expert for instrument handling, and are expensive and time-consuming. The increasing abuse of cannabis calls for the development of a rapid, cost-effective, and simple on-spot detection technique, which can be achieved by scaling down to the nanoscale. The remarkable properties of nanoparticles can be exploited to fabricate a simple, rapid, and specific on-spot detection kit. A simple DIY paper sensor was produced from Whatman filter paper, and the results were reproduced showing colorimetric detection of Cannabis. This study aims to fabricate large-scale sophisticated sensors based on this principle, to aid the justice system and public health sector in dealing with illicit drug consumption, Driving Under the Influence of Drugs (DUID), and illicit drug trafficking thus in turn contributing to national security.

Keywords: *Cannabis detection, gold nanoparticles, drug abuse, illicit trafficking, national security.*

ETPS_FP_AT - 22

Advancements in Electrochemical Sensors for Drug Detection Using Nanomaterials

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In recent years, the efficient and precise detection of drugs has become a global priority due to their increasing prevalence and associated health risks. Accurate and rapid monitoring of drugs is essential for public health, law enforcement, and forensic applications. With the rising rates of drug abuse, it has become crucial to develop sensitive, cost-effective technologies for drug detection. The identification of drug compounds plays a key role in forensic laboratories, anti-narcotic operations, and clinical diagnostics. Currently, common drugs of abuse such as opioids, amphetamines, cocaine, and synthetic cannabinoids remain significant targets for detection due to their widespread misuse. Improper use of these substances and their harmful effects contribute to severe social, health, and environmental consequences. Recently, methods for trace drug detection have attracted substantial attention in the scientific community to address these issues. Various techniques for analyzing drugs, such as gas chromatography-mass spectrometry (GC-MS), liquid chromatography-mass spectrometry (LC-MS), UV-visible spectroscopy, and Raman spectroscopy, have been explored. However, these instrumental methods often require expensive equipment, skilled operation, and are not portable for field use. Furthermore, current on-site drug testing methods, such as immunoassays, sometimes yield false-negative results. As a result, electrochemical sensors have gained significant attention due to their advantages, including portability, ease of use, and reliability. Developing electrochemical sensors with enhanced selectivity and sensitivity for drug detection remains a major challenge. This review aims to address these challenges by exploring the synthesis and application of nanomaterials in electrochemical sensors, particularly for the ultrasensitive detection of commonly abused drugs such as cocaine and opioids.

Keywords: Identification of drug, Analysis techniques, Instrumental methods, Electrochemical sensors, Nanomaterials, Detection of commonly abused drugs.

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Unraveling the Isotonitazene Enigma: Current Analytical Techniques in Forensic Toxicology

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Isotonitazene, a highly potent synthetic opioid, has become a major public health issue due to its potency and it can lead to fatal overdoses, even at low concentrations. A total of 23 people died from isotonitazene reported in 2019. Its rapid rise in popularity has presented unique challenges for forensic toxicology laboratories tasked with identifying and quantifying it in biological and non-biological samples due to its low dose, new variants and its analogs, lack of reference standard and matrix effects. As a result, forensic laboratories are continually working to develop and refine analytical techniques. Therefore, a referenced compilation of previously published analytical techniques on Isotonitazene for sample preparation, detection and quantification would be useful. PubMed, Web of Science, Google Scholar and Scopus databases were searched using keywords related to isotonitazene and other new psychoactive substances. English-language articles published between 2019 and 2024 were included, along with reports from international organizations like the United Nations Office on Drugs and Crime (UNODC), European Monitoring Centre for Drugs and Drug Addiction (EMCDDA) and World Health Organization (WHO). A total of 11 papers were reviewed in this study.

Results: Isotonitazene is characterized and described in terms of synthesis, physical and chemical properties, available forms, pharmacokinetics, pharmacodynamics, medical use, toxic effects, production, distribution and trafficking. This article also outlines sample preparation and analytical techniques for identifying and quantifying isotonitazene in both biological and non-biological samples. Lastly, treatment of synthetic opioids overdoses is discussed. This review offers forensic scientists, public health authorities, law enforcement and toxicologists the up to-date data on detecting and quantifying isotonitazene in various biological and non-biological matrices.

Keywords: NSO's, Isotonitazene, Nitazene, Analytical techniques and Forensic toxicology

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Forensic analysis of counterfeit pharmaceuticals

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Counterfeit medications endanger global health by jeopardizing patient safety and eroding the credibility of healthcare institutions. These forged medications may lack active components, have improper dosages, or include hazardous adulterants. Others imitate the appearance of genuine medications or use outdated medications repackaged as new. Forensic analysis is critical in discovering counterfeit drugs, confirming their legitimacy, and protecting public health. Advanced analytical procedures are required for evaluating suspected counterfeit medications. Chromatography, mass spectrometry, and spectroscopy are all methods that can be used to precisely identify active components, detect impurities, and analyse dangerous chemicals. These techniques allow for close examination of medicine composition, revealing even minor differences between genuine and counterfeit products. By using such equipment, forensic scientists assure the safety and efficacy of drugs, preserving trust in healthcare systems. The continually changing counterfeit landscape creates substantial issues. Regulatory inadequacies, complex worldwide supply chains, and the rise of unregulated internet drug markets all hinder detection and prevention efforts. To address these concerns, blockchain technology, artificial intelligence algorithms, and smart packaging are proving to be excellent methods for securing supply chains and validating drug validity. Global collaboration and developments in forensic procedures are critical in combatting counterfeit medications. Forensic science remains vital in protecting public health, maintaining patient safety, and strengthening trust in pharmaceutical products by leveraging cutting-edge technology and encouraging worldwide collaborations.

Keywords: Counterfeit Medications, Forensic Analysis, Analytical Techniques, Drug Authentication, Public Health Protection

ETPS_FP_AT - 26

Development of chromatographic techniques from MPLC to n-HPLC

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The advancement of chromatographic techniques from Medium-Pressure Liquid Chromatography (MPLC) to Nano-High-Performance Liquid Chromatography (n-HPLC) showcases significant progress in improving precision, efficiency, and sensitivity in analytical methods. MPLC, as an early preparative approach, used moderate pressure and larger particles, making it suitable for separating large sample quantities. High-Performance Liquid Chromatography (HPLC) then transformed the field by offering greater resolution and adaptability for a wide range of applications. Building on this, Ultra-High-Performance Liquid Chromatography (UHPLC) introduced smaller particle sizes and higher pressures, enabling faster analyses and higher resolution to meet the growing demand for speed and accuracy. Lastly, n-HPLC emerged as a specialized technique for analyzing nanoscale samples, making it invaluable in areas like proteomics and metabolomics, where precision and sensitivity are essential. This evolution highlights not only technological advancements but also the increasing role of chromatographic methods in pharmaceutical research, biotechnology, and complex bioanalysis.

Keywords: Chromatographic techniques, MPLC, HPLC, UHPLC, n-HPLC

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Advanced analytical techniques (AAT) used in detection of doping among athletes: An overview
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The detection and prevention of performance-enhancing drug usage in sports is critical for leveling the playing field and protecting athlete's health. The present review compiles the analytical methods that have been published for the detection of prohibited substances involved in sports over 10 years. Relevant papers meeting the search criteria that discussed analytical methods aiming to detect and or quantify doping substances published from last decade were considered. The review examines the progress of doping detection, from the early use of gas chromatography to the current integration of modern omics technologies and gene doping analysis. It discusses commonly abused substances, such as anabolic steroids, peptide and protein hormones, and methods to improve oxygen delivery, as well as the analytical techniques used to detect them. The future of doping detection will most likely witness a greater incorporation of forensic science ideas, improving the ability to detect novel doping agents. As doping techniques evolve, so too must the analytical methods employed by anti-doping organizations. The present work indicates that while traditional methods remain vital, and will be crucial for ensuring fair competition in sports

Keywords: doping, performance enhancing drugs, analytical tools, gene doping analysis

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Forensic Challenges and Advanced Analytics in Investigation Crimes Involving Long-Acting Injectable Drugs

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Long-acting injectable (LAI) medications, such as antipsychotics and contraceptives, are crucial for controlling chronic illnesses and ensuring therapeutic compliance. These injectable pharmaceuticals help patients manage their condition better and improve long term outcomes by preventing relapses and improving compliances. LAI antipsychotics further have a more reliable delivery system, maintaining steady drug plasma levels and eliminating the peak to trough concentration related side effects common with oral antipsychotics. However, its abuse presents substantial forensic challenges, particularly in cases involving coercion, unlawful administration, or tampering. This study explores the forensic examination of crimes utilizing LAI drugs, with a focus on developing tools for detecting and tracking their misuse. Advanced analytical methods, such as liquid chromatography-tandem mass spectrometry (LC-MS/MS), hair and tissue analysis, and isotopic profiling, are highlighted for their effectiveness in detecting leftover drug components and metabolites. A significant component of this review is the use of molecular fingerprinting techniques to distinguish between pharmacologically similar formulations from various manufacturers, providing information into sourcing and distribution patterns in criminal cases. Also, growing forensic problems include the use of LAI contraceptives in non-consensual administration and antipsychotics in chemically restraining victims. By combining sophisticated forensic toxicology with real-time prescription data tracking, this research provides a system for monitoring LAI drug usage, assisting law enforcement, and improving legal adjudication.

Keywords: Long-acting injectables (LAI), Forensic toxicology, Drug misuse detection, Molecular fingerprinting, Non-consensual administration

Track-III

NARCOTICS DRUGS AND PSYCHOTROPIC SUBSTANCES (NDPS)

ETPS_FP_NDPS - 01

Synthetic Tryptamines - A New Era of Legal Highs

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The market of research chemicals has seen a significant rise in the use of synthetic tryptamines due to their ability to bypass legal restrictions. These substances are often marketed with disclaimers such as “not for human consumption”, which increases their availability and popularity, raising concerns about their potential for abuse and the effects they may induce. The scientific community is interested in exploring both the therapeutic potential and the risk associated with synthetic tryptamines. As interest in tryptamines grows, there is a need to balance public health concerns with the development of similar molecules. Ongoing researches aim to understand the long term impacts and possible benefits of synthetic tryptamines, which could affect their social acceptance and legal standing. Legal uncertainty has significantly contributed to the consumer interest in synthetic tryptamines, with substances like traditional psychedelics (e.g., psilocybin mushrooms) and some synthetic tryptamines being fully legal or existing in legal grey areas, depending on the jurisdiction. Regulatory bodies are increasingly vigilant and are re-evaluating legal frameworks to address the challenges posed by these substances. Synthetic tryptamines, as a new class of “legal highs”, provide new avenues for individuals seeking altered states of consciousness. While synthetic tryptamines offer potential medicinal applications and exploration of consciousness, they must be approached with caution. Responsible use, coupled with robust scientific research will be the main factors that demarcate the role of synthetic tryptamines in an ever-emerging panorama of psychoactive substances.

Keywords: Tryptamine, Hallucinogens, Psychedelics, Legal Highs, New Psychoactive Substances

ETPS_FP_NDPS - 02

**Development and Validation of Advanced Microscale Methods for
Extraction of Heroin in Forensic Samples**

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Modified Solvent-based and Modified QuEChERS-based extraction methods for the analysis of Heroin from post-mortem blood samples, using Gas Chromatography–Mass Spectrometry (GC–MS) in the electron impact (EI) mode, have been optimized and validated. These methods have been paralleled with conventional solvent extraction procedures commonly used for drug extraction in forensic cases. The instrumental limits of detection (LOD), linearity in calibration and effect of matrix were assessed by preparation of standards in solvent and in the biological matrix extracts using eight extraction methods. Limits of detection were calculated experimentally based on repeatability using relative standard deviations (RSDs). Accuracy (as percent recovery), precision (as repeatable experiments) and limits of quantification (LOQ) have also been determined. The results obtained indicated that each method requires 2 mL biological sample for heroin extraction with minimal quantity of solvents being used (<10 mL). The final aliquot was mixed with methanol and subjected to GC–MS analysis, without any clean-up. Great linearity in the calibration curve was obtained over the range from 50 – 1000 ppm, with $R^2 \geq 0.99$. The recovery obtained was as high as 96 percent of drug being recovered, with $RSD \leq 8\%$. Each of the developed extraction method showed results with good repeatability. Moreover, these methods are quick, reliable, rapid and robust, with the finest performance.

Keywords: *Heroin, Modified Solvent Extraction, Modified QuEChERS extraction, Gas Chromatography–Mass Spectrometry*

ETPS_FP_NDPS - 03

Analysis of Bail Jurisprudence Under Narcotics Drugs and Psychotropic Substances Act, 1985: Recent Judicial Advancement by Apex Court

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UNODC World Drug Report, 2024 has found substantial rise in drug consumption and trafficking across globe (1). Keeping in mind the growing concern and impacts of drug in health, economy and national level the Narcotic Drugs and Psychotropic Substances Act, 1985 was enacted. In light of Directive principal of State Policy and India's ratification of UN Convention and Protocols Narcotic Control Bureau was created being apex Coordinating authority it among other arrests accused persons, produces before magistrates, Courts competent and are ably assisted by stakeholders. Standing Instruction No.1/88 of Narcotics Control Bureau prescribes detailed procedure for sampling in addition to provisions under NDPS Act, 1985

Methods: A thorough search of Supreme Court Judgements through SC-Judis, Hon'ble High Courts website was conducted to look leading judgement related to Bail to the accused persons under NDPA Act, 1985 along with standing instructions.

Results: The Judgement Narcotics Control Bureau Versus Kashif delivered in Criminal Appeal No.5544 Of 2024 has turned to be correct interpretation of law on Procedural irregularities in search or seizure and delay in complying with Section requirements, the stringent conditions laid down has wide implications on Bail Jurisprudence, the aim and objective of enactment of the Narcotic Drugs and Psychotropic Substances (NDPS) Act 1985 has been emphasised.

Conclusion: The Judgement Narcotics Control Bureau Versus Kashif will settle the legal principle and will result in sea change in understanding the law in its true literal interpretation.

Keywords: Bail, Narcotic Control, Standing Order, Mandatory Requirement, Interpretation

ETPS_FP_NDPS - 04

Exploring the Adverse Effects of Carbamazepine in Abuse Scenerios

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Carbamazepine is a commonly prescribed anticonvulsant medication used to treat epilepsy, bipolar disorder, and neuropathic pain. Over the last decade, research has helped us new insights into its pharmacokinetics, therapeutic efficacy, and safety profile. Carbamazepine's metabolism via the cytochrome P450 enzyme system (CYP3A4) and the synthesis of its active metabolite, carbamazepine-10,11-epoxide, are important to its efficacy and potential toxicity. Recent data emphasizes the significance of therapeutic medication monitoring to optimize dose and reduce adverse effects, including severe reactions such as Stevens-Johnson syndrome, particularly in people with the HLA-B*1502 allele. Studies also emphasize its interactions with other anticonvulsants such as valproic acid and phenytoin, which can affect medication levels and efficacy. This study compiles a decade's worth of data on carbamazepine's therapeutic applications, safety concerns, adverse effects, drug of abuse and emerging developments in personalized medicine to provide clinicians and researchers with comprehensive insights.

Keywords: *Carbamazepine, Therapeutic drug monitoring, Adverse effects, Drugs of abuse, Anticonvulsant drugs.*

ETPS_FP_NDPS - 05

Psychotropic applications of snake venom and gecko tail: a forensic and pharmacological perspective

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The exploration of unconventional psychoactive substances has unveiled intriguing possibilities within the realm of animal-derived compounds. This study delves into the psychotropic properties of snake venom and gecko tails, elucidating their historical and emerging roles in forensic toxicology and pharmacological research. Snake venom, containing potent α -neurotoxins, interacts with nicotinic acetylcholine receptors, suggesting mechanisms for opiate-independent analgesia and potential substitution therapy for opioid withdrawal [1]. Similarly, anecdotal reports highlight the euphoric effects of gecko tails, attributed to hypothesized bioactive compounds, though scientific validation remains pending [2], [3]. Historical practices, as observed in cultural rituals and recreational abuse, underscore the socio-psychological and legal implications of such substances [4], [5]. For instance, snake venom has been used in rave settings as a substitute for opioids, with effects mediated through dopaminergic pathways [6]. Meanwhile, gecko tail utilization, often mixed with traditional intoxicants like cannabis, reflects both mystical beliefs and a quest for heightened psychoactive experiences. These unconventional substances pose challenges for forensic analysis due to their complex bioactive profiles and lack of comprehensive legal classification [7]. Further pharmacological investigations are crucial to demystify the psychoactive constituents and their pathways of action. Ethical considerations and wildlife conservation issues must guide this research to balance therapeutic potentials against environmental and societal impacts.

Keywords: *Forensic Toxicology, Pharmacology, Psychotropic, Snake Venom, Gecko Tail.*

ETPS_FP_NDPS - 06

From Pharmaceuticals to Forensics: Enhancing Detection of Clonazepam in Crime Scene Beverages

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This study examines the alarming increase in the use of narcotic drugs and psychotropic substances, with a focus on benzodiazepine drugs (BDZs). These medications significantly affect the central nervous system (CNS) and are essential in treating conditions such as seizures, anxiety, and alcohol withdrawal symptoms. Among BDZs, clonazepam stands out for its clinical importance but has also gained dishonor as a date rape drug, underscoring the urgent need for reliable detection and analytical methods. The research aims to develop a forensic analysis method for clonazepam tablets (0.5 mg) in potentially spiked beverages found at crime scenes. The proposed methodology utilizes liquid-liquid extraction with diethyl ether and employs advanced analytical techniques such as Gas Chromatography-Mass Spectrometry (GC-MS) and High-Performance Liquid Chromatography (HPLC). These methods are designed to enhance the precision and sensitivity of clonazepam detection, providing critical support to forensic scientists and law enforcement tackling drug-related crimes. In an era where the misuse of narcotics and psychotropic substances poses significant challenges, this study offers a valuable contribution to forensic science. It addresses concerns surrounding BDZ abuse and provides a robust tool for detecting clonazepam in beverages, particularly in cases of drug-facilitated crimes. By equipping legal and investigative bodies with improved methods for analysis and prosecution, this research reinforces the need for stringent chemical safety and environmental practices, ultimately contributing to societal well-being and the fight against substance abuse.

Keywords: *Psychotropic Substances, Clonazepam, Forensic analysis, Liquid-liquid Extraction method, Analytical techniques.*

ETPS_FP_NDPS - 07

**Pharmacodynamics, pharmacokinetics and detection of date rape
drugs: forensic perspective**

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Date rape drugs (DRDs) refer to substances that can be used to assist in commission of sexual assault by impairing the victim's ability to resist or recall the event. The most common types are benzodiazepines, gamma-hydroxybutyrate (GHB), and flunitrazepam, have distinct pharmacodynamic and pharmacokinetic properties that play a critical role in their effectiveness and detection. Pharmacodynamically, DRDs typically exert central nervous system depressant effects, resulting in sedation, memory impairment, and reduced motor coordination, making it easier for perpetrators to control their victims. Understanding the pharmacokinetics of these drugs, such as absorption, distribution, metabolism, and excretion (ADME) is essential for determining their duration of action and window for detection. Methods for identifying date rape drugs involve advanced toxicological techniques such as gas chromatography-mass spectrometry (GC-MS), liquid chromatography-tandem mass spectrometry (LC-MS/MS), and immunoassay-based screenings. This presentation will explore the pharmacological mechanisms underlying date rape drugs, their pharmacokinetic profiles, and current detection methods, as well as discuss challenges in forensic identification and potential improvements in detection strategies.

Keywords: Date Rape Drugs, Pharmacokinetics, Pharmacodynamics, ADME, Forensic identification

Track-IV

AI IN PHARMACEUTICAL INDUSTRY

ETPS_FP_AIPI - 01

Optimizing Drug Development with AI: Advances, Challenges, and Future Prospects

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Artificial intelligence (AI) and machine learning (ML) are revolutionizing the pharmaceutical industry, offering transformative solutions to the challenges of drug discovery, development, and patient care. AI algorithms can analyze extensive biological data, such as genomics and proteomics, to identify disease-associated targets and predict interactions with potential drug candidates, thus enabling a more efficient and targeted approach to drug development. These technologies also optimize research and development (R&D) processes, reducing costs and minimizing the need for expensive animal testing by predicting pharmacokinetics, toxicity, and prioritizing lead compounds. AI's integration into personalized medicine further enhances treatment effectiveness by analyzing real-world patient data, improving outcomes, and promoting patient adherence. Moreover, AI aids in optimizing drug delivery systems, dosage form design, and pharmacokinetics/pharmacodynamics (PK/PD) studies, making the drug development process faster and more reliable. However, challenges such as data privacy, ethical concerns, and regulatory barriers remain. In response, the pharmaceutical industry is increasingly adopting AI to automate tasks, improve drug safety and quality control, enhance inventory management, and provide personalized treatment plans. While these advances promise faster drug discovery, reduced costs, and more accurate patient care, responsible AI integration is crucial to ensure ethical use and address workforce and societal impacts. The ongoing collaboration between AI-driven drug discovery firms and pharmaceutical giants highlights the ultimate potential of AI to optimize drug development and improve patient outcomes on a global scale.

Keywords: *Artificial Intelligence (AI), Machine Learning (ML), Drug Discovery, Personalized Medicine*

ETPS_FP_AIPI - 02

Intergrating Artificial Intelligence for Drug Discovery in the Context of Revolutionizing Drug Delivery

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Drug Discovery is a highly intricate & lengthy process that requires the identification of potential drug candidates that can effectively treat various disease. It is an expensive, time consuming process & has higher failure rates. Artificial Intelligence emerged as a transformative tool. AI has the potential to revolutionize the drug discovery process, offering improved efficiency, accuracy & speed. AI is a technology-based system involving various advanced tools & networks that can mimic human intelligence. AI utilizes system & software that can interpret & learn from input data to make independent decisions for accomplishing specific objectives. AI offers innovative solutions to complex challenges in pharmaceutical industry. AI assistance to pharma industries helps to improve overall life cycle of product, AI can be implemented in pharma ranging from Drug discovery to product management. Several AI methods are used in Drug discovery such as Machine learning, Deep learning, Natural language processing (NLP), Text mining, High throughput density functional theory, Generative adversarial networks (GANs), Transfer learning, Active learning. The AI technology is used in a variety of applications such as Target identification & validation, Virtual screening & drug design, prediction of drug properties & Repositioning of existing drugs. AI does not replace humans it reduces human workload as well as achieving targets in short period.

Keywords: Drug discovery, Artificial intelligence, Pharmaceutical AI, Machine learning, Deep learning.

ETPS_FP_AIPI – 03

AI designed Nanoparticles: A formulation of hope in treatment of Breast

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Breast Cancer means abnormal growth /multiplication of Breast cells ,is most frequently diagnosed cancer in women ;most commonly Ductal carcinoma .Various herbal remedies ,mineral and various drugs was used such as Transtuzumab (herceptin) ,radiation therapy ,chemotherapy is obstructed by Multi drug resistance (MDR) .Since 1940 chemotherapy is used to treat the Brest cancer. Due to this various side effects such as hair loss, risk of infection, impact on fertility & Emotional impact. Therefore Nanotechnology helped in the development of new drugs to reverse MDR. The integration of AI and nanotechnology has revolutionized the field of nanomedicine. The nanoparticles maybe Liposomes, Polymeric nanoparticles (Ag,Au) Liposomal doxorubicin has improved survival rates and reduce cardiotoxicity Transtuzumb an Anti PD-I monoclonal antibody that has shown results in clinical trials for triple negative breast cancer. Its benefits targeted delivery, lower toxicity and increase therapeutic efficiency. Devices such as Microneedles and Microchips etc. are used. AI optimized nanoparticles design by machine learning algorithm, genetic algorithm.AI can help personalised nanoparticle therapy for individual patient based on their unique characteristics and needs.

Keywords: Breast Cancer, Chemotherapy, Monoclonal Antibody, Targeted Delivery, Microneedle and Microchips.

ETPS_FP_AIPI – 04

AI Driven Pharmaceutical Revolution

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Artificial intelligence (AI) in pharmaceutical industry refers to the use of AI to improve various aspects of drug discovery, development, production and distribution. AI techniques have the potential to revolutionize the pharmaceutical industry by streamlining processes, accelerating research and improving patient outcomes by applying AI algorithms. As AI evolves, it enhances drug discovery, optimizes clinical trials and ultimately leading to faster, cheaper manufacturing processes and tackle existing healthcare challenges. AI driven tools are enabling researchers to analyse vast data sets including genomic sequences and molecular structures to identify potential drug target interactions and predict their efficacy and safety. AI technologies are setting their routes deeper into the pharmaceutical sector. It is poised to fundamentally amend the pharmaceutical landscape, offering unprecedented opportunities to resolve unaddressed medical needs. AI technology analyse MRIs, X-rays, CT-scans to detect conditions like cancer, fractures and neurological disease with high accuracy. The robotics system guided by AI perform precise, minimally invasive surgeries. AI tools improve post market surveillance by identifying potential adverse drug reactions. Despite, these advancements, challenges such as data privacy, regulatory hurdles, it's integration with existing system and ethical consideration remains. This abstract demonstrates the emerging role of AI in the pharmaceutical sector highlighting its current applications, benefits and the obstacles that must be overcome to fully realize it's potential in transforming healthcare outcomes.

Keywords: Artificial Intelligence, drug discovery, healthcare outcomes, pharmaceutical landscape

ETPS_FP_AIPI - 05

AI-Driven Tools in Innovative Pharmaceutical Research and Drug Development

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The integration of artificial intelligence (AI) tools is revolutionizing research and development (R&D) in the pharmaceutical industry, driving a transformative shift in drug discovery and development. AI tools such as Atom Net, Deep 6 AI, IBM Watson, and Alpha Fold are enhancing the speed, precision, and efficiency of drug discovery and development processes by applying machine learning (ML), natural language processing (NLP), and generative models. These AI tools accelerate the identification of potential drug candidates by analyzing vast chemical and biological data with incomparable accuracy. They improve target identification and optimization, enabling the discovery of more effective therapeutic compounds. Additionally, AI tools facilitate the optimization of clinical trial designs by simplifying patient selection, improving trial efficiency, and reducing the time required for trial completion. Moreover, AI tools contribute to reducing drug development timelines by up to 70%, cutting costs and alleviating risks associated with late-stage clinical failures. By enhancing predictive accuracy and patient stratification, these tools increase the likelihood of clinical trial success and accelerate regulatory approval. The adoption of AI tools in pharmaceutical R&D is revolutionizing the industry, advancing precision medicine, and enabling the development of more personalized therapies. As the pharmaceutical field evolves, AI-driven solutions will be essential in addressing the complex challenges of drug discovery, establishing the foundation for innovative, targeted treatments and improving global healthcare outcomes.

Keywords: Artificial intelligence, Potential drug, Machine learning, Generative models, Drug development

ETPS_FP_AIPI - 06

Exploring the implications of artificial intelligence in pharmaceutical industry: a review

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This review explores the application of ai in the pharmaceutical industry, aiming to assess its role in enhancing drug discovery, clinical trials, personalized medicine, and operational efficiency. it also investigates the challenges faced in implementing ai and suggests ways to overcome them for future progress

Objective

This review explores the application of ai in the pharmaceutical industry, aiming to assess its role in enhancing drug discovery, clinical trials, personalized medicine, and operational efficiency. it also investigates the challenges faced in implementing ai and suggests ways to overcome them for future progress

Methodology

The review is based on a comprehensive analysis of recent literature, case studies, and industry reports it examines ai technologies like machine learning, deep learning, and natural language processing used across pharmaceutical sectors the focus is on applications in drug target identification, preclinical testing, and post-market surveillance, along with discussions of regulatory and ethical considerations

Keywords: *AI in pharmaceutical industry, Implication of AI in pharma*

ETPS_FP_AIPI - 07

Artificial Intelligence (AI) in Pharmaceutical Industry

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The advancement of computing and technology has invaded all the dimensions of science. Artificial intelligence (AI) is one core branch of Computer Science, which has percolated to all the arenas of science and technology, from core engineering to medicines. Thus, AI has found its way for application in the field of medicinal chemistry and health care. The conventional methods of drug design have been replaced by computer-aided designs of drugs in recent times. AI is being used extensively to improve the design techniques and required time of the drugs. Additionally, the target proteins can be conveniently identified using AI, which enhances the success rate of the designed drug. The AI technology is used in each step of the drug designing procedure, which decreases the health hazards related to preclinical trials and also reduces the cost substantially.

Keywords: Artificial Intelligence in pharma, Importance and Applications of AI in pharma

ETPS_FP_AIPI - 08

The Quality of Artificial Intelligence Software Services in the Improvement of Pharmacy Practice

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Continually improving the quality of community pharmacy services is important for the development of modern patient care. Artificial intelligence (AI) focuses on creating intelligent models that help imagine knowledge, solve problems, and make decisions. Recently, AI has been playing an important role in various fields of pharmacy. This poster discusses an application of AI in community pharmacy. This includes discussing SWOT analysis, which will help us identify outcomes related to our project planning, and identifying real-world problems that could benefit from this application of AI. Some important limitations are also discussed.

Keywords: Artificial Intelligence; Pharmacy Practice; Community Pharmacy; Healthcare Services, Pharmaceutical services.

Track-IV

FORENSIC CHEMISTRY

ETPS_FP_FC - 01

Self-assembly on Intercalative DNA Binding Interaction of Double-chain Surfactant Cobalt (III) Complexes Containing Imidazo [4,5-f] [1,10] phenanthroline and Dipyrido [3,2-d:2'-3'-f] quinoxaline ligands: Experimental and Theoretical Study

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A new class of surfactant cobalt (III) complexes, $\text{cis}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$ (1) and $\text{cis}[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$ (2) (ip = imidazo[4,5-f][1,10]phenanthroline, dpq = dipyrido[3,2-d:2'-3'-f]quinoxaline), have been synthesized and characterized by various spectroscopic and physico-chemical techniques. The critical micelle concentration (CMC) values of these complexes in aqueous solution were obtained from conductance measurements. The specific conductivity data (at 303, 308, 313, 318 and 323K) served for the evaluation of the temperature-dependent CMC and the thermodynamics of micellization (ΔG_m^0 , ΔH_m^0 and ΔS_m^0). The trend in DNA-binding affinities and the spectral properties of a series of complexes, $\text{cis}[\text{Co}(\text{ip})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$ (1) and $\text{cis}[\text{Co}(\text{dpq})_2(\text{C}_{12}\text{H}_{25}\text{NH}_2)_2](\text{ClO}_4)_3$ (2), have been experimentally and theoretically investigated. The experimental results indicate that the size and shape of the intercalated ligand and hydrophobicity of the complexes have a marked effect on the binding affinity of complexes to CT DNA in intercalation mode, and the order of their intrinsic DNA-binding constants K_b is $K_b(1) < K_b(2)$. In addition, the influence of the extended aromatic ring and optical properties of the complexes can be reasonably explained by applying the DFT calculations. The energy gap between HOMO and LUMO indicates that these complexes are prone to interact with CT DNA. Further, molecular docking calculations have also been performed to understand the nature of binding of the complexes and the result confirms that the complexes interact with CT DNA through the alkyl chain. The cytotoxic activity of these complexes on human liver carcinoma cancer cells were determined adopting MTT assay and specific staining techniques, which revealed that the viability of the cells, thus treated was significantly decreased and the cells succumbed to apoptosis as seen in the changes in the nuclear morphology and cytoplasmic features.

Keywords: DNA Binding Interaction, Double-chain Surfactant, Complexes Containing Imidazo phenanthroline, Dipyrido quinoxaline ligands.

ETPS_FP_FC - 02

Review Forensic Chemist: An Important Role in Forged Documents and Banknotes

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Forensic science, which is also known as criminalistics is the application of scientific principles and methods to support and corroborate the evidences and form a chain of transaction which also raised reliance of enforcement agencies, and judicial system, forensic science is where science meets the law. The term forensics includes biology, DNA profiling, toxicology, entomology, psychology, accounting, analysis of forged banknotes and documents. Forensic chemistry deals with matching the results of analyzed evidence with the suspected people in order to solve crimes and determine the proof and form the link to the person or a thing. Forensic chemist conducts qualitative and quantitative analyses on chemicals found on people various objects and in solutions which are measured by chemist. In this review, it explains how the forensic chemistry is helpful in solving crime scene. Further it discusses about the Indian courts which need to adopt the rationalise system in the context of forensic science by including the term forensic science terminology specifically in the definition cause by “expert opinion” under Bhartiya Shiksha Abhiyan-2023. It represented the scope of forensic chemistry ranging from simple analysis of drugs, food, paint, fire debris residue of gunshots, soil samples and other instruments are spectrophotometers, gas chromatography, infrared spectroscopy. It also describes the application of analytical chemistry in the analysis of forged terms notes and documents.

Keywords: Forensic Science, Forensic Chemistry, Forensic Toxicology, Forensic Explosive, Drug Analysis

ETPS_FP_FC - 03

Synthesis and characterization of hydroxyquinoline derivatives

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Hydroxyquinoline is a versatile organic compound with a bicyclic structure composed of a phenol and a pyridine ring. Substitution of hydroxyl group and other substituents at various positions in its structure yields a wide range of derivatives, having unique properties and applications. The derivatives show considerable pharmacological potential, including anticancer, antimicrobial, antiviral, anti-inflammatory, and neuroprotective activities. Recent studies demonstrate that hydroxyquinoline nanoparticles have been used in cancer treatment, improving the limitations in conventional therapies. Chelating properties of the compound have been further applied in agricultural and industrial uses, such as fungicides and preservatives. The present study deals with the synthesis and characterization of hydroxyquinoline derivatives, with their chemical behaviour, tautomeric forms, and interaction with biological targets. Among the hydroxyquinoline derivatives, 8-hydroxyquinoline has exceptional medicinal applications and metal chelation ability. Similarly, other derivatives like 4-hydroxyquinoline and 2-hydroxyquinoline also show specific biological activity in terms of antioxidant activity and fluorescence character. In recent times, the use of advanced computational tools such as DFT calculations have been helpful to probe their structural and electronic properties for enhancing their application in drug discovery and many more. This research work provides insights into hydroxyquinoline and its derivatives, enabling potential new applications in medical science, agriculture, or material science. The chemistry behind these compounds is beneficial in creating effective medication against cancer, diabetes, or neurodegenerative disease as well as effective towards the progress of sustainable industrial future.

Keywords: *Hydroxyquinoline derivatives, Synthesis and Characterization, Pharmacological applications, Metal chelation, Nanoparticles, Drug discovery*

ETPS_FP_FC - 04

Synthesis, Characterization, *In-Silico* Studies and Biological Evaluation of Novel 3,4-dihydropyrimidine Derivatives as Potent Anti-Tubercular Agents

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Antibiotic resistance is an increasing threat to global public health. The development of new antibiotics and alternative treatments is essential to combat resistant strains and reduce the global health burden. Hence, we synthesized and evaluated antitubercular potential of dihydropyrimidine derivatives. A simplified Biginelli condensation method was used to synthesize novel 3,4-dihydropyrimidine derivatives (4a-4m) through a one-pot three-component reaction with various substituted benzaldehydes. Reaction completion was monitored via thin-layer chromatography. The structures of the compounds were confirmed by FT-IR, mass spectrometry, ¹H NMR, and ¹³C NMR spectroscopy, and melting points were determined by differential scanning calorimetry. ADMET screening was performed for all synthesized compounds. Network pharmacology and homology modeling were employed to identify potential anti-TB targets, and molecular docking was used to analyze drug-target interactions. Selected compounds were tested for their antibacterial and anti-tubercular activity against gram-positive and gram-negative bacteria. ADMET screening identified eight potential compounds: 4c, 4e, 4f, 4g, 4i, 4j, 4k, and 4m. Network pharmacology analysis highlighted NFkB1, MAPK1, CTSD, ROCK1, and KDM1A as probable protein targets, while literature emphasized DprE1 as a critical target for anti-tubercular activity. Molecular docking studies revealed promising binding affinities for compounds 4g (-7.67), 4d (-7.316), 4e (-7.062), and 4c (-7.042) against DprE1. These compounds also exhibited significant antibacterial activity against gram-positive and gram-negative bacteria compared to standard drugs. In-vitro antitubercular assays against the H37Rv strain demonstrated moderate to notable efficacy relative to the standard reference drug. The findings suggest that these compounds could serve as promising drug candidates. Further development may lead to their use as effective antituberculosis agents in future research.

Keywords: 3,4-dihydropyrimidine, Biginelli condensation; molecular docking; ADMET pharmacokinetic study; Network pharmacology; anti-tubercular activity

ETPS_FP_FC - 05

Advancements in forensic chemistry – a review

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Forensic chemistry has rapidly evolved over the past few decades with integration of innovative techniques and technologies that enhance the accuracy and efficiency of crime scene investigations. The present study provides an overview of significant advancements in this field, particularly focusing on three pivotal areas: analytical methods, instrumentation, and interdisciplinary collaboration. Recent developments in analytical techniques, such as mass spectrometry and gas chromatography, have improved the identification and quantification of complex chemical mixtures often encountered in forensic samples, including drugs, explosives, and toxic substances. Mass spectrometry, with its high sensitivity and specificity, has become an indispensable tool in uncovering trace evidence that can link suspects to crime scenes. Additionally, the incorporation of portable and field-deployable instruments allows forensic experts to conduct on-site analyses, thereby expediting the investigative process and minimizing contamination risks. Techniques such as infrared spectroscopy and Raman spectroscopy are now utilized in the field, enhancing the speed and accuracy of forensic assessments. Moreover, interdisciplinary collaboration has become increasingly vital in forensic chemistry, where chemists work alongside law enforcement and legal professionals to ensure that chemical evidence is effectively interpreted within the legal context. This partnership fosters the development of standardized protocols and methodologies, ensuring the reliability and acceptance of forensic findings in court. Overall, advancements in forensic chemistry not only bolster the capabilities of forensic investigators but also enhance the integrity of the criminal justice system, ensuring that justice is served through scientifically sound practices. The present review provides a glimpse of the advancement of forensic chemistry and how it has changed the face of investigation.

Keywords: Forensic chemistry, analytical techniques, interdisciplinary collaborations, portable and field deployed instruments.

Development of Novel 9*H*-carbazole-4*H*-chromene Hybrids as Dual Cholinesterase Inhibitors for the Treatment of Alzheimer's Disease

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Alzheimer's disease (AD) is an age-related neurological disorder characterized by progressive deterioration of the memory and neurocognitive functions. Cholinesterase enzymes affect concentration of acetylcholine in the brain, leading to dementia. Thus, herein, we have designed and synthesized series of 9*H*-carbazole-4*H*-chromenes **4(a-l)** through a one-pot three-component reaction of salicylaldehydes (**1**), hydroxycarbazole (**2**) and *N*-methyl-1-(methylthio)-2-nitroethenamine (**3**) using triethylamine as a catalyst in ethanol. The rapid one-pot reaction does not require chromatographic purification, proceeds under mild conditions, and exhibits good tolerance toward various functional groups with high synthetic yields. Synthesized compounds were screened for cytotoxicity and *in-vitro* acetylcholinesterase (AChE) and butyrylcholinesterase (BuChE) inhibitory activity. *In-vitro* results showed that the compounds **4a** and **4d** have promising anticholinesterase response against both cholinesterase enzymes (**4a**, AChE IC₅₀: 5.76 μM, BuChE IC₅₀: 48.98 μM; **4d**, AChE IC₅₀: 3.58 μM, BuChE IC₅₀: 42.73 μM). *In-vitro* results were validated by molecular docking and dynamic simulation at 100 ns. Molecular docking and molecular dynamics (MD) simulation study strongly supported structural features present in these analogs. Together, these analogs could be exploited to develop dual anti-cholinesterase candidates to treat AD in combination with other drugs.

Keywords: Alzheimer's disease, 9*H*-carbazole, 4*H*-chromene, Cholinesterase inhibitors

ETPS_FP_FC - 07

Synthesis of p-tert butyl calix (4) arene and its application of eliminating detrimental substances from waste water

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Environmental related problems have reached its peak due to the rapid release of noxious substances into the Mother Nature caused by the rash evolution of industries and economies. False agricultural practice, rapid release of toxic chemicals into the water bodies creating the existences of terrestrial and aquatic life awful on this planet. So the elimination of such hazardous substances from the water bodies should be a pivotal issues demanding attention. For that we are conducting this study by coming up with an operational sound technique with the help of a third generation supra molecular chemical compound calix (4) arene derivative. The ongoing analysis explores the sorption potency of the supramolecular chemical compound p tert butyl calix (4) arene and checking out the ability of this macromolecule by not immobilizing and by immobilizing on to the surface of modified resin, that are taken into considerations. In this current investigation, we are making use of the immobilized resin as well as the pure synthesized calixarene derivative as a sorbent for the removal of detrimental substances (azo dye, insecticide, and toxic metals) from the aqueous solution. Sorption process is mainly adopted for the elimination and sorption studies such as the effect of sorbent dosage, pH, concentration, contact time, shaking time will be investigating.

Keywords: *Noxious substances, Industries and economies, p tert butyl calix (4) arene, Immobilization, Modified resin, Sorption studies.*

ETPS_FP_FC - 08

Synthesis of Heterocyclic Molecule *via* Multicomponent Reaction Using Metal Based Composite

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A recent advancement in metal-catalyzed multicomponent reactions (MCRs) for synthesizing bioactive heterocyclic molecules, with significant efficiency, sustainability, and broad applicability is studied. Using iron in metal-catalyzed-MCRs demonstrated greener benefits such as reduced by-products with high atom economy, and economic feasibility. These reactions have found widespread use in synthesizing biologically active and pharmaceutical compounds, offering significant advantages in reaction time, cost, and environmental impact. The catalyst demonstrated high efficiency and reusability up to five cycles in an aqueous ethanol medium to synthesize [2,3-*c*] pyrazole-type molecules. These findings emphasized the catalyst's versatility and potential in diverse organic transformations, highlighting its importance in advancing sustainable synthetic methodologies.

Keywords: Biologically Active, Heterocyclic, Iron, Multicomponent Reactions, Pyrazole.

ETPS_FP_FC - 09

Synthesis and Characterization of Quinoline

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Quinoline derivatives are heterocyclic compounds that play an important role in medicinal chemistry. The development of amino-substituted quinoline derivatives garnered significant attention due to their wide range of pharmacological properties and various biological activities such as antimalarial, antimicrobial, anticancer and anti-inflammatory activity. In this study, We describe a new method for the synthesis of amino-substituted quinoline derivatives. In this process, mono-bromophenol reacts with carboxylic acids. Benzyl bromide is substituted in the presence of potassium hydroxide (KOH) and dimethyl sulfoxide (DMSO) after the reaction. The intermediate is fused with various quinolines and obtained using the microwave irradiation method. The synthesized derivatives were characterised using analytical techniques. UV, IR, NMR and mass spectrometry.

Keywords: *Quinoline derivatives, amino-substitution, synthesis, biological activity, SAR study.*

In-silico identification of phytocompound-based tollip interactor: a approach to combat paraquat-induced toxicity

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Paraquat (PQ), is a highly toxic herbicide that is lethal and causes fatal multi-organ toxicity in humans, as there are no effective treatments available. Despite extensive studies on new therapeutic targets and lead compounds, the existing approaches for treating PQ-induced toxicity remain inadequate and challenging, highlighting the urgent need for curative therapeutic approaches of great significance. This study uses the computational approach to identify the potential phytoconstituent-based antioxidant exhibiting the potential binding affinity with the Toll interacting protein (TOLLIP). Initially, using molecular docking, mechanics-generalized born surface area (MM/GBSA) binding energy calculation, ADME-Tox (Absorption, Distribution, metabolism, Excretion, and Toxicity), a total of 89 phytoconstituents were evaluated for binding affinity to the TOLLIP. The five compounds Arbutin, Coumaric acid, Ethyl gallate, Ferulic acid, and Vanillic acid with significant binding affinity and pharmacokinetic properties, were further subjected to molecular dynamic simulation, trajectory analysis (RMSD, RMSF, Radius of gyration), binding free energy, PCA, DCCM, and per residue energy decomposition analysis. Our extensive computational analysis pinpointed the Ethyl gallate-TOLLIP complex as a promising candidate with exceptional structural stability, minimal fluctuation, and the highest negative binding free energy. Therefore, Ethyl gallate may act as a potent therapeutic agent for mitigating paraquat-induced toxicity by targeting TOLLIP.

Keywords: Paraquat poisoning, Toll interacting protein, in-silico, Phytocompound.

ETPS_FP_FC - 11

**A Review on Benzothiazole and it's Biological
Activies**

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In recent years, there has been a lot of interest in the development of novel benzothiazole moiety with a wide range of biological activities. This class of derivatives is now produced as target structures by multiple scientists, who have also designed their biological activity. A significant collection of highly specific and reliable benzothiazole moiety analogues with a wide range of biological activities have been mainly defined by recent research. Many various drugs are made using the benzothiazole nucleus. Benzothiazole derivatives have recently shown several intriguing alterations in their biological activities. These substances strong pharmacological potential makes them unique in the field of medicinal chemistry. The main purpose of this study is to provide a review of the most recent trends in the synthesis of heterocyclic compounds hybrid benzothiazole moiety and biological applications. The derivatives of benzothiazole moiety having multiple types of medicinal applications.

Keywords: Benzothiazole, Biological activities, Heterocyclic compounds hybrid benzothiazole derivatives

**A Green Chemistry Approach for Aldol condensation Followed
Decarboxylation in Aqueous ethanolic medium of Banana Peel Extract for
Constructing Coumarin Chalcone**

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A green chemistry approach was developed for synthesizing coumarin chalcones via aldol condensation followed by decarboxylation, using banana peel extract as a natural catalyst in an aqueous ethanolic medium. This sustainable method utilizes renewable, non-toxic, and inexpensive plant-based waste, offering an environmentally friendly and cost-effective protocol with minimal hazardous by-products. Coumarin chalcones, featuring two aromatic rings connected by an α , β -unsaturated carbonyl system, serve as precursor to flavonoids and exhibit significant biological activities, including anti-inflammatory and antibacterial effects, making them valuable for pharmaceutical application.

Keywords: Green Chemistry, Aldol Condensation, Decarboxylation, Banana Peel Extract, Coumarin Chalcone

ETPS_FP_FC - 13

**Recent development in fluorescent materials from heavy metal ions
analysis from the perspective of forensic chemistry**

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Forensic Chemistry is an emerging branch in today's world when one can use physical evidence from the crime scene it aims at identifying characterized materials, chemicals to aid in legal investigation with an emerging need there's fluorescent materials which has revolutionized for providing precise and reliable tools for solving cases fluorescent materials are used in toxicological analysis like lead, arsenic can be toxic and can be seen in poisoning, gunshot residue like barium, antimony fluorescent markers enhance the visibility of the residue under wavelength there are several methods like quantum dots where semiconductor nanoparticle that fluoresce in presence of the specific heavy metal, offering high sensitivity and tunable emission properties, fluorescent sensors like rhodamine, laser induced fluorescence are used in forensic world there are several advantages like its non-destructive, high sensitivity-capable for detecting trace elements, rapid analysis. For an example in case of heavy metal poisoning -detection of arsenic in poisoning cases using fluorescent chemosensors

Keywords: *Toxicological analysis, quantum dots, highly sensitivity, non-destructive, fluorescent sensors*

ETPS_FP_FC - 14

Analysis of Health Risks Assessment and Intoxication Effects of Solvent Cement Inhalation Through the Cloth Exposure as A Forensic Case Study.

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This study aims to explore the severe health risks and potentially fatal consequences associated with the inhalation of solvent cement vapors through a cloth, a method often used in pipe fixing applications. By examining both acute and chronic intoxication effects, the research will highlight the toxicological impact on human health. The study will delve into the physiological and neurological damage caused by inhalant abuse, with a focus on cases resulting in mortality. This investigation seeks to raise awareness and inform safety protocols to prevent such hazardous practices. Forensic analysis reveals that prolonged inhalation can lead to severe health complications, including respiratory failure, neurological damage, and even death. As a forensic tool, understanding the lethal health risks and intoxication effects of solvent cement inhalation can aid in investigating and reconstructing cases involving constituent abuse and related fatalities.

Keywords: Solvent cement, physiological and neurological damage to human health, chemical constituents.

ETPS_FP_FC - 15

Chromatographic Approaches for Cannabinoid Profiling in Biological Matrices

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Cannabidiol (CBD) and Δ^9 -tetrahydrocannabinol (THC) represent the principal bioactive constituents of Cannabis sativa, attracting considerable scholarly interest due to their therapeutic efficacy in the treatment of various medical conditions, including neurodegenerative diseases, malignancies, nociception, inflammation, and autoimmune disorders. While the medical applications of THC, CBD, and other cannabinoids have been extensively explored, their detection is similarly pertinent within the forensic domain to identify unauthorized cannabis consumption. The identification of these compounds in biological matrices is imperative for both forensic investigations and clinical applications, necessitating the advancement of chromatographic techniques for precise analytical outcomes. Nevertheless, owing to the intricate nature of biological matrices, the direct analysis of cannabinoids proves to be impractical, thereby necessitating a preparatory procedure to extract and concentrate the target analytes selectively. This extraction procedure is essential to mitigate interference from extraneous substances, thus facilitating accurate quantification, particularly given that cannabinoids frequently exist at trace concentrations. This presentation critically examines chromatographic methodologies that have been documented over the preceding two years, with a particular focus on advancements in sample preparation, biological matrices, and instrumentation. Furthermore, the utilization of these methodologies within both forensic and healthcare domains is analyzed, with an emphasis on the inherent challenges such as complexity, low cannabinoid concentration, cannabinoid stability and degradation, among others, alongside the corresponding solutions related to the analysis of cannabinoids and their metabolites in intricate biological matrices. This research is also pertinent to the fields of forensic toxicology, clinical trials, therapeutic drug monitoring, as well as pharmacokinetics and pharmacodynamics, among others.

Keywords: Cannabinoids, Chromatography, Sample Preparation, Forensic Analysis, Therapeutic Applications

ETPS_FP_FC - 16

Green synthesis of copper oxide nano needles using peltophorum pterocarpum leaf extract: application as a catalyst in click chemistry reactions, antimicrobial and antioxidant agents

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In current times, nano particles are leading the technology in various fields. Green chemistry principles are a key topic in nanoscience, a rapidly growing study field. The green synthesized nanoparticles have large applications in biomedical as drug carriers or imaging contrast agents in microscopy and the anisotropic nanoparticles are a good candidate in biomolecular detection. Copper oxide nanoparticles have gained significant attention due to their antibacterial and cytotoxic properties. Looking into the biological significance of Cu₂O nano particles and its application as a catalyst in click chemistry, we planned for the previously unknown green synthesis of Cu₂O nano needles utilizing *Peltophorum pterocarpum* leaf extract as a source of stabilizing and reducing agent. We are intrigued by the reporting of a stable, reliable, and long-lasting synthesis technique of Cu₂O nano needles, as well as its characterization, as an effective catalyst in click chemistry reactions such as coupling reactions (C-C, C-N, C-O and C-S bond formation), C-H bond activation reactions, cycloaddition reaction and antibacterial, antifungal and antioxidant evaluation.

Keywords: *Copper oxide Nano needles, Click Chemistry Reactions, Cycloaddition Reaction, Biological Active*

Track-IV

ENVIRONMENTAL FORENSICS

ETPS_FP_EF - 01

Impact of Air Pollution on Pregnancy and Birth Outcomes: A Smoggy Lullaby

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Air pollution is a leading environmental risk factor, contributing significantly to respiratory illnesses, cardiovascular diseases, and other chronic conditions; ultimately increasing the global burden of ailments. While the harmful effect of air pollutants on the respiratory and cardiovascular systems is well-known, concerns over its impact on pregnancy outcomes are rising. Pregnant women and their developing fetuses are particularly more susceptible to the harmful effects of air pollutants, which can penetrate the placental barrier and lead to a wide range of negative consequences such as preeclampsia, gestational diabetes, gestational hypertension, premature rupture of membrane, and placenta Previa, and these consequences concurrently lead to adversarial natal outcomes like congenital abnormalities, low birth weight, development delays, preterm birth, etc. This review elucidates the link between maternal exposure to air pollutants and the subsequent occurrence of adverse pregnancy and birth outcomes. It also delves into the utility of various biomarkers such as inflammatory markers, oxidative stress markers, biochemical markers, etc. used to analyze the presence of air pollutants and their impact on pregnancy and birth outcomes. Furthermore, through assimilating these insights this review emphasizes the crucial need for targeted interventions and policies to mitigate the air pollution's deadly effect on sensitive and vulnerable groups.

Keywords: Air pollution; Placenta; Biomarkers; Pregnancy outcomes; Birth Outcomes

ETPS_FP_EF - 02

Adsorptive Removal of the Model Dye Malachite Green by Thermal Fenton Treated Jute Fibre

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Textile production involves complex manufacturing processes that generate water pollution through multiple mechanisms. The discharge of treated wastewater with residual dyes and harmful chemicals creates a significant impact on the aquatic and aesthetic environment. Efficient removal of textile dye pollutants from wastewater is a critical challenge. Adsorption is an efficient and economical process for removing dyes, pigments, and other contaminants from wastewater. This study investigates the potential of Thermal Fenton-treated jute fibre as an eco-friendly and low-cost adsorbent for removing a cationic dye, Malachite Green dye, from a synthetic solution. Thermal Fenton activation is used as a novel process by creating carboxylic groups on the jute fibre to increase adsorption capacity. Jute fibre was treated with alkali for lignin removal followed by Thermal Fenton treatment, and characterization was done using UV-visible spectroscopy, ATR-FTIR and Zeta-sizer. Batch adsorption experiments were conducted to evaluate the effects of adsorbent dose, initial dye concentration, pH, and time on removal efficiency. The results revealed over 90% removal efficiency under optimal conditions, indicating that the Thermal Fenton Jute fibre is a highly efficient, low-cost, quick adsorbent. These findings demonstrate the viability of using Thermal Fenton Jute fibre as a potentially sustainable approach for removing residual dye from textile wastewater.

Keywords: *Jute fibre, adsorption, malachite green dye, textile wastewater, sustainable treatment.*

ETPS_FP_EF - 03

Development of Electro spun Membrane for Removal of Micropollutant from Water/ Wastewater: Review of recent Advancement

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The presence of micropollutants in the environment has become a major issue worldwide. Many micropollutants from diverse sources infiltrate into essential aquatic resources, including drinking water, surface water, and groundwater, at concentration varying from a few nanograms per liter to several milligrams per liter. Micropollutants are contaminants made up of a variety of anthropogenic and natural substances such as medications, personal care items, steroid hormones, industrial chemicals, pesticides, and many more. In this field of nanotechnology, nanofibrous structures offer specific features such as mechanical strength and a high surface area, which makes them suitable for various applications including removal of micropollutants. Electrospinning is a membrane production technology that creates highly porous nanofibrous structures from a range of polymers. Electro-spun nanofibrous membranes have been employed in water purification applications. Furthermore, the approach is commonly applied for manufacturing membranes for membrane distillation and nanofiltration procedures, for the removal of pollutants. Researchers are very interested in the research and development of electro-spun nanofibrous membranes since its huge versatility. This comprehensive review examines the properties, advantages, and future prospects of electro-spun membranes for the removal of micropollutants from water and wastewater.

Keywords: removal of micropollutants, electro spun, electrospinning, wastewater treatment.

ETPS_FP_EF - 04

Mushroom production on green waste substrate for environmental sustainability

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Boulevard arboriculture, parkland silviculture and ornamental horticulture, green waste generation rate exceeds its natural putrefaction. Hence, recalcitrant lignocellulosic green waste accumulates, thereby, marring parkland aesthetics, intensifying fire hazard and promoting parkland vermination which paves way to zoonosis. The current tempo of urban green waste management strategies renders the notion of sustainability questionable. Most of urban lignocellulosic green waste is being landfilled or disposed through open burning which intensifies air pollution. Such unorthodox waste management technique equates to underutilization of resources and undermines environmental sustainability. Conscious of the flaws and intricacies characterising lignocellulosic green waste management discourse, this research embraces mycology expertise for lignocellulosic green waste valorisation, degradation and management. *Pleurotus florida* species was cultivated on 5 different green waste substrates, with each substrate having 3 replicas. Mycelium colonization rate was recorded highest on *Plumeria obtusa* (21days) followed by lawn trimmings, *Duranta erecta*, mixed green waste, wheat straw, and *Plumeria obtusa*. Mushroom productivity was highest on mixed substrate which had 75% biological efficiency, followed by *Duranta erecta*, *Plumeria obtuse*, wheat straw and lawn trimmings. Mushroom productivity on green waste substrates was higher than that of wheat straw the convectional substrate being used by farmers. Therefore, green waste must be valorised through mushroom production, rather than being disposed through open burning and landfilling. Such a self-sufficient green waste management strategy brings about the most sought bio-circular-green economy. Which is a model of sustainable development, integrating the concept of bioeconomy, circular economy, and green economy.

Keywords: *Mushroom production, green-waste, environmental sustainability.*

ETPS_FP_EF - 05

Environmental Audit as A Tool for Resource Management in An Institution

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The increasing human need has given rise to the over exploitation of natural resources, pattern of mindless consumption and disposal mechanism of the used product has followed to the depletion and contamination of the ecological resources. Here, the role of Environmental Management System (EMS) is introduced, which provides a structural framework to monitor the production and service sector to manage their environmental compliance and impacts. Environmental audit is the tools of the EMS which is a systematic and documentation process to analyze the process or services throughout its life cycle, functioning and the disposal phase. Here, the main focus is to identify the basic process of the environmental audit of an institution in its functioning phases. The functioning phase has most of the resource usage and the waste generation. It is the phase which comes in between construction and the end life of an any institution where the import of the energy, water and natural resource take place. The production of solid waste, energy loss, waste water production and the hazardous waste production takes place. Environmental audit play's role in the detail evaluation of different phases, find the loop holes and give the mitigation solution to limit the losses. It is a continuous analyzing and improvement process. It is also the process to comply with the Environmental act 1986 and the guidance under it for the environmental audit.

Keywords: EMS, Environmental Audit, functioning phase, resource management

ETPS_FP_EF - 06

Nano-enabled advance oxidation processes for the degradation of dimethyl phthalate: a study on copper and silicon nanoparticles

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This study investigates the degradation of Dimethyl phthalate (DMP) in aqueous solutions using advanced oxidative processes (AOPs) involving UV radiation in conjunction with copper and silicon nanoparticles. DMP, a widely used phthalate ester in plasticizers and personal care products, is a recalcitrant organic pollutant with a persistent presence in the environment due to its prolonged half-life. Recognized as a subchronic toxicant and an endocrine-disrupting chemical (EDC), DMP poses significant risks to human health and aquatic ecosystems.

AOPs, renowned for their ability to generate highly reactive oxygen species (ROS) such as hydroxyl radicals, effectively facilitate the oxidative breakdown of recalcitrant pollutants. In this study, copper and silicon nanoparticles were synthesized and meticulously characterized using techniques like UV-Vis spectroscopy, Fourier Transform Infrared (FTIR) spectroscopy, and X-ray diffraction (XRD) to confirm their structural integrity and physicochemical properties. The experimental results unequivocally demonstrate that UV activation of these nanoparticles significantly enhances the degradation rate of DMP compared to the degradation observed under UV irradiation alone. The study delves into the mechanisms underlying the enhanced photocatalytic efficiency, attributing it to factors such as increased light absorption, efficient charge separation, and the synergistic interaction between the nanoparticles and the UV radiation.

These findings have significant implications for environmental remediation and water purification technologies. By effectively degrading DMP and other recalcitrant pollutants, this approach contributes to mitigating the harmful effects of these contaminants on aquatic life and human health, ultimately promoting a healthier and more sustainable environment. Further research can focus on optimizing nanoparticle synthesis and exploring the potential of these AOPs for the degradation of a wider range of emerging contaminants.

Keywords: Dimethyl phthalate (DMP), Advanced Oxidation Processes (AOPs), Copper nanoparticles, Silicon nanoparticles, Photocatalysis, Degradation

ETPS_FP_EF - 07

The Role of Forensic Ecotoxicology in Determining and Reducing the Impact of Hazardous Substances on Ecosystem.

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The worldwide problem of environmental pollution caused by hazardous contaminants is increasing day by day and has become a major issue of concern because of its adverse effects. Case studies of industrial spills, pesticide runoff, and other pollution events illustrate the practical applications of this field in tracing pollution sources and assessing ecological damage. The insights gained from forensic ecotoxicology are instrumental in shaping policies and remediation efforts aimed at protecting biodiversity and ecosystem health. By identifying the specific pollutants and their origins, this field not only helps in holding polluters accountable but also guides the development of effective mitigation strategies to reduce environmental harm. Microorganisms like actinomycetes, bacteria, algae, fungi as well as their enzymes play a vital role in the biodegradation of synthetic plastics. Current report highlights the everyday addition of pollutants into the environment, their side-effects and biodegradation by microorganisms.

Keywords: Forensic Ecotoxicology, Environmental hazards, Toxicological effects; Biodegradation, Health risk assessment.

ETPS_FP_EF - 08

Radicals Present in The Iron Ore And Percentage Estimation of Elements

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The presence of radicals and the precise estimation of elemental composition are pivotal for evaluating the quality and suitability of iron ore for industrial applications. Iron ores, being the primary raw material for steel production, contain various chemical constituents, including trace radicals, that significantly influence processing techniques and material properties. This study employs advanced analytical methods, such as X-ray fluorescence (XRF), to identify and quantify radicals present in iron ore samples. A systematic approach is also presented for determining the percentages of major elements, including iron, silica, alumina, and other impurities. The findings underscore the critical role of accurate elemental analysis in optimizing ore beneficiation, enhancing process efficiency, and predicting the ore's behavior during smelting and refining operations. These insights contribute to the advancement of ore characterization and its industrial utilization.

Keywords: Iron ore, Elemental analysis, X-ray fluorescence (XRF), Ore beneficiation, Industrial applications

Track-IV

FORENSIC BIOLOGY

ETPS_FP_FB - 01

Emerging techniques in PMI estimation

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Estimating the postmortem interval (PMI) is an important part of forensic investigations because it helps determine how long it has been since death. Traditional methods rely on body decomposition analysis, entomological data, and temperature-based algorithms. However, these methods have limitations because of environmental variability and individual differences. Emerging techniques take advantage of advances in molecular biology, spectroscopy, and artificial intelligence to improve accuracy and reliability. Metabolomic profiling, microbial community analysis, and advanced imaging techniques like hyperspectral imaging are all popular approaches. Estimating the postmortem interval (PMI) is an important part of forensic investigations because it helps determine how long it has been since death. Traditional methods rely on body decomposition analysis, entomological data, and temperature-based algorithms. However, these methods have limitations because of environmental variability and individual differences. Emerging techniques take advantage of advances in molecular biology, spectroscopy, and artificial intelligence to improve accuracy and reliability. Metabolomic profiling, microbial community analysis, and advanced imaging techniques like hyperspectral imaging are all popular approaches.

Keywords: *PMI estimation, proteomics, postmortem microbiome, machine learning, spectroscopy*

ETPS_FP_FB - 02

Epigenetic signatures as forensic biomarkers in drug overdose investigation

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Drug overdose cases represent a critical global challenge, with India exhibiting a rising trend in substance abuse-related mortality. Traditional forensic toxicology methods often fall short in reliably identifying drug involvement in overdose deaths, especially in post-mortem scenarios where biological degradation impairs evidence collection. This study explores the potential of epigenetic signatures such as DNA methylation, histone modifications, and non-coding RNA profiles as advanced forensic biomarkers to address these limitations within the Indian context.

Through a bibliographic analysis of existing literature, the research examines epigenetic alterations associated with substance exposure, highlighting specific patterns linked to alcohol and opioids. These findings suggest that epigenetic approaches can complement or even surpass traditional biochemical methods in precision and reliability. The study critically evaluates the feasibility of employing epigenetic tools in overdose investigations, focusing on challenges such as environmental degradation, metabolic pathways of drugs, and timeline reconstruction in post-mortem contexts.

Key barriers, including the lack of standardized methodologies, limited population-specific reference data for India, and ethical as well as logistical constraints, are also examined. By emphasizing context-specific adaptations and advancements, this research highlights the transformative potential of epigenetic biomarkers in forensic toxicology. The findings advocate for targeted research efforts, interdisciplinary collaborations, and policy reforms to establish epigenetic methodologies as robust tools for enhancing the accuracy of overdose investigations and supporting public health interventions in India.

Keywords: Epigenetic Biomarkers, Drug overdose, Toxicology, Alcohol, Opioids

ETPS_FP_FB - 03

An Applications of Optical sensors in Field of Forensic Sciences: A Review

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Forensic science depends on more accurate and efficient methods for the analysis of evidence. There has been the development of powerful tools in the area of optical sensors that can enable fast, ability to provide real-time results, minimal or no sample preparation, and often non-destructive analysis with high sensitivity of various kinds of forensic evidence. Many researchers have reported providing a comprehensive overview of the diverse applications of optical sensors in forensic sciences over the last ten years, it explores the underlying principles of various optical techniques and discusses their applications in on-spot enhancement and visualization of latent fingerprints, Illicit Drug detection, DNA analysis, rapid presumptive identification of biological fluids (blood, semen, saliva), Military Agent detection, field detection of Explosive, Post-blast residue analysis, counterterrorism, GSR detection, Security measures, Anti-counter detection, on-site identification of trace materials (fibers, glass, paint), etc. It has shown itself to be a reliable method for detecting crime because of its greater selectivity, sensitivity, and reliability, and it produces results effectively. The advantage of rapid evidence collection and preliminary analysis makes them invaluable tools that assist crime scene investigators and informed decision-making, ultimately contributing to more efficient and effective forensic investigations. This abstract underscore the growing importance of optical sensors in revolutionizing forensic science through rapid, on-site analysis and revolutionizing forensic investigations, aiding in faster and more accurate crime scene analysis and ultimately contributing to the pursuit of justice.

Keywords: *Forensic Science, Nanotechnology, Sensors, Crime Scene Investigation, detection*

ETPS_FP_FB - 04

Pharmacogenetics as a tool in forensic science

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Pharmacogenetics is the scientific study of how an individual's genetic makeup influences drug metabolism specifically; how genetics alter the drug response in a person's body. In forensic investigations drug-related death investigations, alleged medical malpractices or negligence, interpreting postmortem toxicological data, and other medicolegal cases often present complex challenges.

These challenges arise due to the individual's genetic variation which influencing their ability to drug- metabolizing enzymes, (such as cytochrome P450 enzyme) and other transport proteins. This variability modulates response to drug and complicate the determination of cause and manner of death.

Recent advancements in genetic technologies and next-generation sequencing have led to more precise pharmacogenetics findings and their application in forensic investigations. Integration of pharmacogenetics into forensic investigation science can help in resolving several critical issues. It provides insights into genetic predispositions that may explain why therapeutic doses of drugs can result in fatal outcomes in certain individuals. Additionally, it helps in understanding polydrug abuse cases, and can play a vital role in assessing the claims of impaired behaviour caused by medication side effects. This review investigates the integration of pharmacogenetics into forensic toxicology highlighting its applications to enhance individualized and accurate interpretations. Furthermore, discusses the limitations and future direction associated with the use of pharmacogenetics in forensic science.

Keywords: pharmacogenetics, cytochrome P450 enzyme, drug metabolism, dose, genetic Predisposition.

ETPS_FP_FB - 05

Leveraging AI for Bone Age Estimation: Opportunities and Challenges

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Bone Age Estimation (BAE) is done on the basis of skeletal maturity attained during the growth years and the degenerative changes observed in the skeleton. From forensic perspective BAE is utilised to determine criminal responsibility, establish identification, determining legal age and in cases of abuse. From medical perspective BAE is utilised to identify growth related disorders. The major limitation of traditional BAE is its inter and intra observer variability as well as the subjectivity associated with the method. Artificial intelligence (AI)-based tools have been utilised in the field of medicine and extensively in radiology. AI techniques rely on pattern recognition, object identification and segregation. Bone age assessment is the classical example where the concepts of AI such as object detection and classification can be used. These techniques can greatly benefit BAE by reducing intra observer and inter observer variability, increasing objectivity as well as by reducing the analytical time. This review poster describes various AI based algorithms developed for the purpose of radiologic BAE and the performances of the models. The poster also highlights the current opportunities and challenges faced in the performing AI-assisted BAE.

Keywords: *artificial intelligence, bone age estimation, machine learning, forensic*

ETPS_FP_FB - 06

A Review on Toxicity of chronic poisoning cases in western region of India

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Organophosphorus (OP) compounds are widely used in agriculture as pesticides, but their misuse and accidental or intentional exposure pose significant public health and forensic challenges. This review explores the forensic aspects of OP poisoning, emphasizing its prevalence, diagnosis, and implications in medico-legal investigations.

OP poisoning is characterized by acetylcholinesterase inhibition, leading to cholinergic symptoms such as salivation, respiratory distress, and neurological impairment. The forensic evaluation involves analyzing clinical findings, toxicological evidence, and circumstantial data to differentiate between accidental, suicidal, or homicidal intent. Autopsy findings often reveal pulmonary edema, frothy exudates, and characteristic histopathological changes. Toxicological analysis of biological samples, including blood, urine, and gastric lavage, is essential for identifying specific OP compounds.

Challenges in forensic investigations include delayed reporting, sample degradation, and the need for advanced analytical techniques. Public health measures, improved pesticide regulations, and awareness campaigns are critical for mitigating OP poisoning cases. From a forensic viewpoint, timely diagnosis and accurate interpretation of toxicological findings are pivotal in delivering justice and preventing future incidents.

Keywords: Organophosphorus poisoning, forensic toxicology, acetylcholinesterase inhibition, pesticide poisoning, medico-legal investigation, toxicological analysis, autopsy findings, public health.

ETPS_FP_FB - 07

Facial Reconstruction: Advances in Forensic Identification and Tissue Engineering

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Facial reconstruction is an essential forensic technique that aids in the identification of unknown individuals by recreating their facial appearance from skeletal remains. It plays a critical role in criminal investigations, disaster victim identification, and archaeological studies where other means of identification, such as DNA or dental records, are unavailable. Recent advancements have significantly enhanced the accuracy and efficiency of this field. Digital technologies, such as 3D scanning, printing, and computerized reconstruction software, have replaced traditional claybased methods, allowing for more precise and faster outputs. Three dimensional (3D) printing of scaffolds for facial reconstruction represents a cutting-edge approach in tissue engineering and regenerative medicine. As per the literature, scaffold technique allows for the creation of highly customized, biocompatible scaffolds tailored to patient-specific facial defects, using imaging data from CT and MRI scans. Various 3D printing methods, including stereolithography (SLA) and fused deposition modelling (FDM), are employed to fabricate scaffolds using materials like biodegradable polymers, hydrogels, and ceramics.

Keywords: *Digital technology, Computerized reconstruction, biocompatible scaffold, tissue engeneering, fabricate.*

ETPS_FP_FB - 08

Forensic entomology: Insect evidence in criminal investigations.

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Entomology is a broad field that includes general studies of insect biology and behavior, while forensic and medicolegal entomology specifically focus on the role of insects in criminal justice and legal proceedings. These subfields use the principles of general entomology to address specific questions related to death investigations, human health, and crime-solving. The importance of forensic entomology in criminal investigations cannot be overstated. It aids in determining the time of death, linking victims to crime scenes or weapons, and identifying the culprit. Its significance extends to cases of child abuse, narcotics use, and even kidnapping, where insect evidence can provide crucial insights. Additionally, forensic entomology helps uncover organized crime activities and plays a key role in ensuring justice by assisting in the identification of perpetrators and the appropriate punishment, making it an essential tool in modern forensic science. A fascinating field that unlocks the secrets of death through the behavior of insects. As a body begins to decompose, a unique procession of insects arrives in distinct stages, each species playing its part in the natural process. By studying the developmental stages of these insects—such as the growth of larvae—experts can unravel the time of death with remarkable precision. advanced tools like Scanning Electron Microscopy (SEM), High-Performance Liquid Chromatography (HPLC), and DNA analysis enhance investigative accuracy. SEM allows detailed examination of insect specimens for species identification, while HPLC helps detect toxins or drugs in insect larvae and the body, potentially linking a suspect to the scene. DNA analysis confirms insect species and traces genetic connections between the insects, victim, and crime. Together with traditional methods, these techniques form a powerful toolkit, providing reliable evidence and strengthening links between the crime scene, victim, and perpetrator.

Keywords: *medico-legal, culprit-weapon-victim linkage, Metamorphosis, toxological clues, antropod fauna, sources of Errors*

ETPS_FP_FB - 09

Forensic analysis of drug-facilitated sexual assault cases

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Drug-Facilitated Sexual Assault (DFSA) occurs when offender introduces psychoactive substances to a victim, rendering them unconscious or unable to resist, thereby increasing their vulnerability to sexual assault. This review explores the forensic investigation of DFSA cases, focusing on commonly implicated substances like benzodiazepines, gamma-hydroxybutyrate (GHB), alcohol, and other sedatives. Due to the rapid metabolism and elimination of these drugs, timely collection of biological specimens such as blood, urine, and hair is crucial. Advanced toxicological methods, including gas chromatography-mass spectrometry (GC-MS) and liquid chromatography-tandem mass spectrometry (LC-MS/MS), are evaluated for their effectiveness in detecting low drug concentrations with high precision. This review also addresses challenges related to sample preservation, degradation, and the interpretation of toxicological results, with a focus on distinguishing between voluntary substance use and drug-facilitation. Ethical and legal issues are also central in DFSA cases. Victims may be hesitant to report. Furthermore, the importance of a multidisciplinary approach is emphasized, involving collaboration among forensic toxicologists, law enforcement, and legal professionals to ensure effective investigations and the delivery of justice. By reviewing existing practices, addressing limitations, and exploring emerging technologies, this paper advocates for the implementation of standardized forensic protocols and advanced analytical techniques to enhance justice for Drug-Facilitated Sexual Assault victims.

Keywords: Drug-facilitated sexual assault, psychoactive substances, analytical methods, multidisciplinary approach, victim advocacy and justice

ETPS_FP_FB - 10

Recent Advances of Vibrational Spectroscopy and Chemometrics for Forensic Biological Analysis

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Any materials found at the crime scene are considered as the crucial evidence for the investigation in the forensic science as they might contain information regarding the biological data or the crime information. Vibrational spectroscopy has proved to be the efficient technique for forensic biology analysis due to its various advantages such as non - destructivity, rapid measurement and quantitative evaluation. I hereby review the recent developments in this technique as well as focus on the chemometric techniques which can be proven as the reliable technique for giving advanced analytical output from the complex data from forensic biological materials. With the present advancements the future prospects have also been taken in the subject

Keywords: Vibrational spectroscopy, chemometric techniques, analytical output, forensic biology

ETPS_FP_FB – 12

**Bomb Pulse Radiocarbon Dating: A Method Used to Determine the Timeline of
Decomposition Oof Human Body**

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This review poster explores the principle as well as limitations to the bomb pulse radiocarbon dating which has emerged as a revolutionary technique in forensic science for determining the postmortem interval (PMI) of human remains, aiding forensic scientist to determine the timeline of decomposition. This method leverages the spike in atmospheric radiocarbon (¹⁴C) levels caused by nuclear bomb testing during the mid-20th century. The pulse of radiocarbon, known as the “bomb pulse,” has had a significant impact on the carbon isotopic composition of the Earth’s atmosphere, and it can be used as a chronological marker in forensic sciences. The increase in ¹⁴C was then incorporated into plants and animals through the carbon cycle, which means that living organisms started to contain higher levels of ¹⁴C than normally. As we are aware, radiocarbon decays over time and has the half-life of 5,730 years. The bomb pulse caused a sharp, short-term spike, creating a distinct “fingerprint” of radiocarbon in samples from this period. Accelerator Mass Spectrometry plays a critical role in this process, offering unparalleled sensitivity and precision in measuring ¹⁴C levels within specific tissues, such as teeth, bones, and hair. However, certain limitations must also be considered. The influence of dietary sources on ¹⁴C levels and the gradual normalization of atmospheric radiocarbon post-1963 reduces precision in more recent decades. Despite these challenges, bomb pulse radiocarbon dating remains a robust as well as an innovative tool for forensic investigation, aiding law enforcement and advancing the understanding of decomposition processes in human bodies.

Keywords: Radiocarbon, Bomb Pulse Radiocarbon Dating, Half Life, Spectroscopy, Decomposition

ETPS_FP_FB - 13

Blood Patterns: Analysis, Examination and The Error Rates

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Bloodstains found at a crime scene are significant evidence in forensic investigations which provide information about the victim and perpetrator movements, the nature of the crime and offers insights into the events surrounding a crime. Various types of bloodstains, such as spatter, pools, and transfer stains, can indicate factors such as the velocity of the blood's release, the position of individuals, and the direction of blood flow. The study of these patterns plays a pivotal role in understanding the dynamics of the crime. Recent studies have revealed significant **error rates** in bloodstain pattern analysis (BPA). Errors in BPA occur for several reasons, often stemming from both human and technical factors including discrepancies in terminology, classification, and the subjective nature of analysis. Such inaccuracies have serious implications, particularly in legal contexts where BPA is used as evidence in court. This review poster emphasizes and focuses on providing a comprehensive examination on the current trends in BPA, the need for improved standards in training, terminology, and methodologies to reduce error rates and to enhance the reliability of BPA in forensic investigations. Further research and standardization are essential to minimize discrepancies and ensure that blood pattern analysis (BPA) conclusions can be trusted as a critical component in criminal casework.

Keywords: Bloodstain Pattern Analysis (BPA), Forensic Investigations, Error Rates in BPA, Standardization and Methodologies, Criminal Casework Reliability

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Diatoms: Unraveling the Mysteries of Drowning

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Diatoms are phytoplankton, a group of eukaryotic algae found mainly in aquatic habitats. This poster contains a brief description about forensic death analysis in cases where death occurred due to drowning, by examining the diatoms found in dead bodies of the deceased. This poster also deals with case studies of the same. The branch of Forensic Science that deals with the study of diatoms is Forensic Diatomology, which involves the microscopic examination of diatoms and identification of diatoms based on the girdle view.

Diatoms may serve as corroborative as well as conclusive evidence. The diatom test in forensic science is done by correlating and comparing the types and classes of diatoms found in the organs of the deceased and that found in the water sample collected from where the body was recovered. During drowning the diatoms may enter the respiratory system and get circulated to various organs. This evidence can further be strengthened by comparing the diatoms from various organs and the water source which helps in determining whether the drowning was ante-mortem or post-mortem.

This review poster discusses several drowning cases with an emphasis on the role of diatom test in establishing the cause and location of death.

Keywords: Drowning, Forensic Diatomology, Corroborative, Ante-Mortem And Post-Mortem

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Role of Salivary Microbiome in Forensic Investigation

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Saliva is a biological fluid produced and released by the salivary glands located in the mouth, it consists of roughly 99% water, along with electrolytes like sodium and calcium, enzymes such as amylase and lipase, mucins (glycoproteins), and immune components like immunoglobulins and WBCs, cells from buccal mucosa useful for DNA profiling, and ABO antigens for identifying secretors. Beyond its biological functions, saliva plays a significant role in forensic science.

As saliva serves as vital piece of biological evidence, it can be found on the crime scene on bite marks, non-porous objects, or food remnants. Detecting saliva involves methods like alternate light sources (ALS) with filters or goggles. Presumptive tests for saliva include looking for amylase activity through starch-iodine or Phadebas tests and screening methods like SALIgAE. To confirm its presence, advanced techniques like microbial DNA or RNA profiling and spectroscopy are used.

Forensic experts use saliva to determine an individual's sex, blood group, and even habits like smoking or drug use by analyzing its unique microbiome—a collection of microorganisms, mostly bacteria, such as *Streptococcus*, *Neisseria* and *Actinomyces*. The salivary microbiome is influenced by factors like age, diet, lifestyle, and even geographic background, making it a powerful tool for personal identification. By combining its biological richness with new technologies, saliva can be utilized as a window into a person's identity, habits, and health, making it a critical resource in solving crimes.

Keywords: Saliva, Salivary microbiome, biological evidence, Phadebas test, SALIgAE test, RNA profiling

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Integration of Artificial Intelligence in Forensic Odontology

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Forensic odontology is a specialized branch of dentistry that plays a very important role in investigations of cases involving dental evidence. This field helps identify individuals through stored dental records, bite mark analysis, age and gender estimation to some extent. It becomes particularly crucial in cases like crime scene investigations, mass disasters like landfall, flood, etc, or when dealing with unknown dead bodies.

Artificial Intelligence (AI) is changing the scenario in forensic odontology. AI refers to computer systems designed to imitate human intelligence, using techniques like machine learning, deep learning, and neural networks to process large amounts of data, recognize repeated patterns, and make decisions.

AI is revolutionizing how dental evidence is analysed for identification. Advanced technologies, like machine learning algorithms and digital imaging tools like Cone Beam Computed Tomography, allow for detailed examination of dental structures. These tools are very efficient for analysing bite marks, and reconstructing faces. AI also makes the comparison of dental records faster, reducing the chances of human error. In situations like mass disasters or cases involving decomposed remains, AI provides trust worthy identification methods. However, the use of AI in this field isn't flawless. Ethical concerns such as data privacy, biases in algorithms, and the need for clear regulations must be addressed. To fully realize AI's potential in forensic odontology, ongoing innovation, collaboration across disciplines, and a commitment to ethical standards are necessary. This growing relationship between AI and digital imaging is opening up new possibilities in forensic investigations, promising faster, more accurate outcomes.

Keywords: Forensic odontology, Artificial Intelligence, Cone Beam Computed Tomography, Deep neural networking

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Hair as An Evidence Can Be Used For DNA Analysis

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Biological evidence refers to any organic material from a living organism that can be used in establishing a connection between individuals, objects, or locations in a forensic investigation. Common examples include DNA, blood, saliva, hair, skin cells, bones, and other bodily fluids. Its importance in forensic science lies in its ability to provide highly specific and conclusive information.

Since an average human sheds 50-100 hairs each day it's one of the most common biological pieces of evidence that is found in the Scene of crime (both primary and secondary), on both clothes and near the victims. Starting from detection of human or animal origin to DNA extraction, much information can be gathered from a tiny strand of hair. when compared with other biological evidence, hair has a much lesser rate of decomposition which means it can be stored for a longer period of time compared to other samples. In cases of drug or poison detection the hair strand contains the metabolites for about 2-3 months, it gets passed into the hair keratin where the deposition is much stable. Some challenges that involve the estimation time of when was the drug was last consumed varies as hair has different growth cycles. Also, it could be difficult to detect the traces of drugs if the person has been taking it at an irregular basis. This review discusses the challenges faced in retrieving and examining the hair samples for detecting traces of drugs and poisons and suggests ways for overcoming those challenges.

Keywords: Hair analysis, Drug detection, Poison detection, Drug metabolites, Irregular drug consumption

ETPS_FP_FB - 18

Entomology and its Wonderstuck Benefits and Challenges in Forensic Science

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Entomology is the study of insects and how they are related with the environment and other organisms. Entomology contributes to several fields of science including animal health, criminology and forensic science. Study of insects developing on human corpse to detect the slip time from death is defined as Forensic entomology. China started using the technique of in the 13th century and later it grew globally in the recent centuries. Several cases require a forensic entomologist in investigating the elapsed time of death as the body shows development of maggots after 3 days or 72 hours. After 3 days of death, insect evidence is often the most accurate and the only method of investigation. Forensic entomologist studies insects and larvae found on the corpse or at the crime scene to help determine the time and lace of death. They analyze the species of insects, their age and developmental stage to estimate the time of death. The instars are studied to help investigate more efficiently as it deals with developmental stages to a fully grown insect. The instars occur between each molt until sexual maturity is reached, this can help identify the age of the corpse as well as the location. The challenges faced by forensic entomologist mostly deals with weather, environmental factors, improper collection of evidence, identification of insects, interference of wildlife, lack of taxonomists and many more. The present work deals with finding solutions for these challenges faced during the investigation and report preparation.

Key words: Entomology, Forensics, Insect, Maggots, Investigation

ETPS_FP_FB - 19

Untargeted Metabolomics Approach to Identify Metabolites as Potential Biomarkers in Cerebrospinal Fluid for Lethal Traumatic Brain Injuries

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This study pioneers the use of metabolite analysis as a novel approach to diagnose traumatic brain injury (TBI) post-mortem and distinguish it from natural death, advancing the emerging field of "neuroforensomics." While structural proteins in serum and cerebrospinal fluid (CSF) have traditionally been employed as biomarkers for acute trauma in forensic pathology, the potential of endogenous metabolites remains largely unexplored. Using high-resolution liquid chromatography-mass spectrometry (HR-LC/MS), metabolites in post-mortem CSF were analysed from 10 cases, including lethal acute TBI and natural death controls. Statistical and graphical evaluations, along with a calculated TBI/ND quotient, identified significant concentration differences in numerous metabolites between TBI cases and natural deaths.

The findings underscore the suitability of metabolite profiling in post-mortem CSF for identifying TBI, offering a biochemical assessment of neuropathological changes with a high degree of specificity. This innovative approach not only complements existing methods but also provides valuable surrogate markers for understanding the biochemical pathways underlying acute TBI. By bridging forensic pathology and metabolomics, the study highlights the potential of metabolite analysis to enhance post-mortem diagnostics, offering deeper insights into central nervous system (CNS) damage and contributing to a better understanding of the causes and circumstances of death following TBI.

Keywords: *Untargeted Metabolomics, Traumatic Brain Injury (TBI), Cerebrospinal Fluid (CSF), Post-mortem biomarkers, Neuroforensomics*

ETPS_FP_FB - 20

Role and Significance of Trace Evidences in Road Traffic Accidents Investigation

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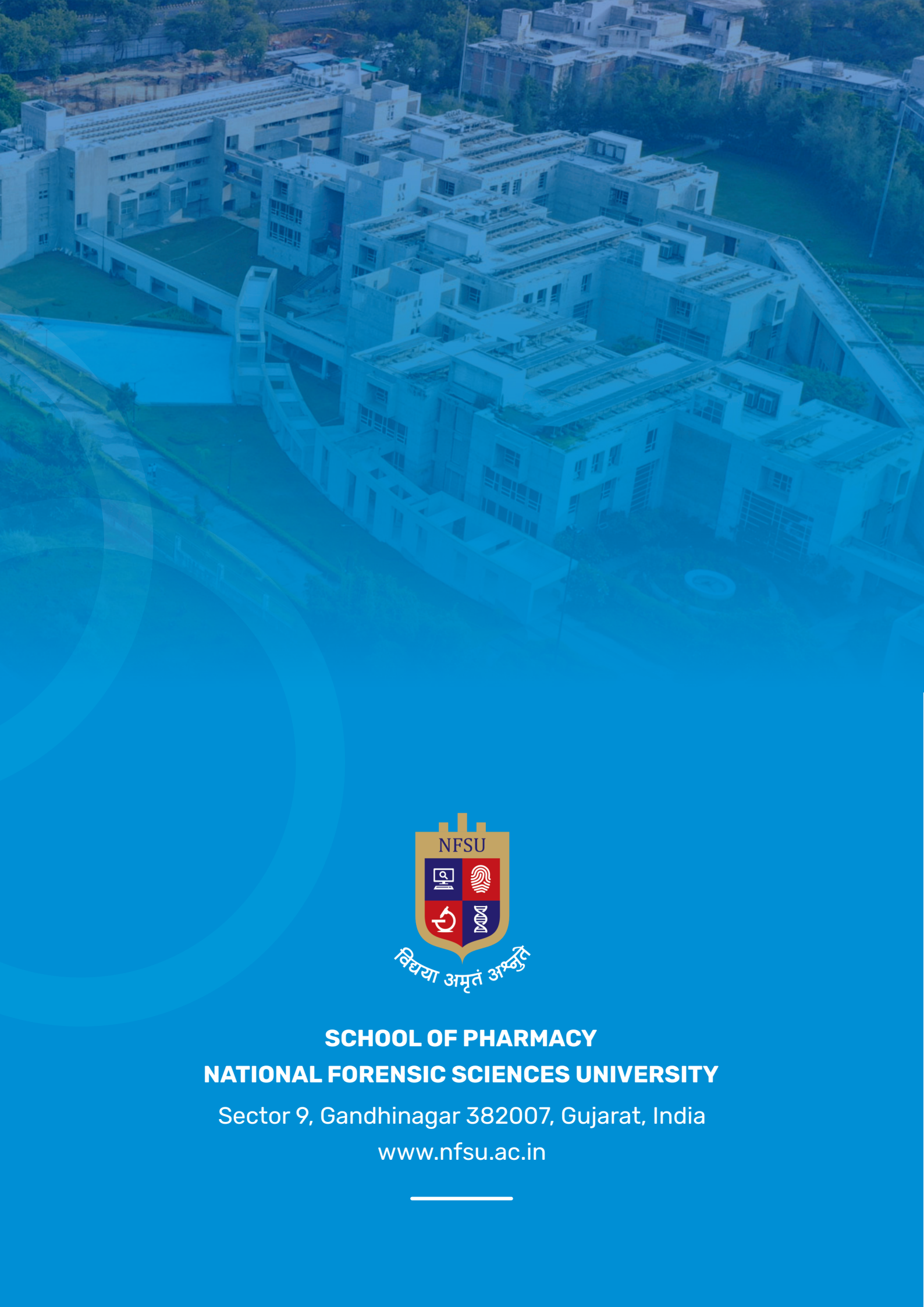
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The road traffic accidents are the big issue through the world, mainly in under developing countries. Day by day the road accidents cause number of fatalities and injuries of various age groups. According to ministry of roadways and transport, a total of 4,61,312 accidents were reported in 2022 in India. Haryana comes in 14th in the severity of road accidents. A total of 10429 accident cases were recorded in Haryana, despite which 4593 fatalities were observed. According to the MoRTH report of 2022, 8519 people in Haryana were injured in road accidents on national highways. When two or more than two vehicles, pedestrian or any fixed object hit then accident takes place. If two objects strike with each other they left some evidence that are known as trace evidence. To identify the cause as well as value of trace evidence in RTA, 100 accident cases were analyzed in two districts of Haryana. A survey and questionnaire were created to identify the primary cause and importance of trace evidence involved road traffic accident in both districts. Primary and secondary data were collected from the accident site and police stations. The finding of this research shows that the biological, chemical, patterned, physical, miscellaneous evidence etc. plays vital role in investigation of road traffic accident investigation. The environmental factors, human interfere; road conditions can destroy the value of evidence so that IO should photographs, videography, collection and packaging of evidence as soon as possible. Evidence is collected by investigating officers that solves the cause of accident. The proper evidence collection can solve the accident case very easily and actual cause of accident can be identified. For the safety from accidents, government should take strong actions.

Keywords: Physical evidence, Road Traffic accident, Forensic expert



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