Pharmacy Education (2024) 24(7) 304 - 312
https://doi.org/10.46542/pe.2024.247.304312

CONFERENCE ABSTRACTS

FIP CAPE TOWN 2024

82nd FIP World Congress of Pharmacy and Pharmaceutical Sciences in Cape Town, South Africa, 1 to 4 September 2024

New generation and pharmaceutical scientists

Synthesis and characterisation of Vitamin D3 nanoparticles for inducing cathelicidin expression and release in macrophages

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Introduction: Tuberculosis (TB), an infectious disease primarily caused by mycobacteria tuberculosis (mtb), represents a persistent burden of disease globally. Reportedly, 7.5 million people were newly diagnosed with TB in 2022, the highest incidence since 1995, a trend likely influenced by the COVID-19 global pandemic. Standard pharmacotherapeutic intervention for TB consists of a six-month multidrug antibiotic regimen. However, disruptive adverse effects and the development of resistant and multidrug-resistant TB strains present significant limitations to TB pharmacotherapy. Research into novel TB therapeutic interventions promises a rejuvenation of TB therapy. Recent studies indicate that vitamin D3 (VD3) is an essential component of the host-mediated pathogen eradication of mtb, directly, through the induction of the broad spectrum cathelicidin antimicrobial peptide (CAMP) and indirectly through the activation of intracellular autophagic eradication of mtb. However, the pharmacokinetic limitations of VD3 complicate traditional formulation strategies. Nanoparticles are a novel drug delivery system of synthetic submicron structures with a broad spectrum of formulation applications. Nanoparticle formulation can protect a drug compound from enzymatic degradation and alter the bioavailability, biocompatibility, and target specificity of a drug to improve the pharmacokinetic profile of the compound significantly.

Method: Poly-ε-caprolactone nanoparticles were synthesised using a single emulsion evaporation process with an aqueous surfactant and high shear mixing to prepare an oil-in-water emulsion. Dynamic Light Scattering (DLS) was used to characterise the synthesised nanoparticles based on size, polydispersity index (PDI) and zeta potential (ZP). DLS was employed to evaluate the relative stability of nanoparticles in cell culture media. Scanning electron microscopy was utilised to determine the morphology and size of the nanoparticles. Synthesised nanoparticles were characterised in methanol using ultraviolet spectrophotometry. The in-vitro application was carried out in cell culture using differentiated THP-1 monocytes for the determination of potential nanoparticle cytotoxicity and stimulation. Human LL-37-specific ELISA was used to quantify LL-37 in stimulated cells.

Results: The average sizes of the loaded nanoparticles following lyophilisation and freeze-drying were 289.97 nm (cholecalciferol), 539,2nm (calcifediol), 400.9 nm (calcitriol) and 311.2 nm for the non-loaded samples. There was no statistically significant difference observed in size, PDI, and ZP following the lyophilisation and freeze-drying of synthesised nanoparticles, which suggested the relative stability of nanoparticles. Likewise, there was no statistically significant change in characterisation parameters following suspension and incubation in cell culture media for up to 24 hours. Microscopy imaging revealed all loaded and non-loaded nanoparticles to be spherical in shape. Direct quantification through UV-spec indicates a 12.2% loading capacity for cholecalciferol-loaded samples, 6.35% for calcifediol and 22.6% for calcitriol. No significant cytotoxicity was observed following cytotoxicity studies.

Conclusion: All three VD3 metabolites were successfully loaded into stable nanoparticles that were able to maintain stability through freeze-drying and in-vitro application in cell culture studies. Since this is still an ongoing study, the synthesised nanoparticles may be used for the third phase of the study. Thanks to the broad range of possible nanoparticle formulations, future studies may focus on the viable loading of VD3 in different types of nanoparticles.

A survey and evaluation of Selected South African medicinal plants with phytochemicals of inhibitory and hemolytic properties in the management of SARS-COV-2

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Introduction: The COVID-19 pandemic has underscored the urgent need for effective therapeutic interventions against SARS-COV-2. Traditional medicinal plants have long been recognised for their potential to provide novel treatments, with South Africa boasting a rich biodiversity of flora with diverse pharmacological properties. In response to this global health crisis, this study embarked on a comprehensive survey and evaluation of selected South African medicinal plants to identify potential candidates for managing SARS-COV-2. The focus centred on exploring extracts rich in Saponin, Alkaloids, and Flavonoids, known for their inhibitory and hemolytic properties against viral pathogens.

Method: An ethnobotanical survey was conducted in Limpopo to identify medicinal plants with documented antiviral properties and phytochemical constituents capable of inhibiting SARS-COV-2 replication and exhibiting hemolytic activity. The two selected plants were subjected to rigorous phytochemical analysis, mainly Saponins, alkaloids, and Flavonoids, to identify active compounds. TLC was done with known standards, and inhibitory and thrombolytic assays were then performed to assess their inhibitory effects on SARS-COV-2 and their hemolytic properties.

Results: Extracts rich in Saponin, Alkaloids, and Flavonoids were obtained and subjected to rigorous analysis. Saponin extracts exhibited a dose-dependent inhibition of viral replication, with characteristic bands identified via TLC analysis. Alkaloid-rich extracts displayed diverse profiles and significant antiviral activity, supported by HPLC and TLC analyses. Flavonoid extracts showed variability in content across species, with potent antiviral effects observed in vitro. Quality and quantitative studies ensured the safety and efficacy of the extracts, paving the way for further research into their therapeutic potential. These findings highlight the promise of South African medicinal plants as sources of natural compounds for combating SARS-COV-2, warranting future investigations into their mechanisms of action and clinical application.

Conclusion: The study underscores the potential of South African medicinal plants in the management of SARS-COV-2. Extracts rich in saponin, alkaloids, and flavonoids demonstrated significant antiviral effects and were validated through rigorous qualitative and quantitative analyses. These findings highlight the diverse pharmacological activities of indigenous plants and their promise as natural sources of anti-COVID-19 agents. Further research into their mechanisms of action and safety profiles is essential for clinical translation. Harnessing the therapeutic potential of these plants offers a sustainable and culturally relevant approach to addressing global health challenges posed by emerging infectious diseases.

A digital integrated report prototype of the national medicines policy

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This paper describes a digital prototype conceptual design of an integrated reporting tool for the national medicines policy. It is intended to address poor data quality from previous templates and optimise and integrate the policy-generated data using artificial intelligence and robotics to support decision-making and learning, enabling the long-term sustainability of the pharmaceutical policy life cycle. This digital integrated reporting tool envisages capturing the policy-making process, enabling policy assessments, gauging policy options and taking advantage of opportunities that will set policy direction and priorities. This digital system is developed from empirical qualitative methods such as collaborative modelling approaches. This integrated system modelling uses multi-stakeholder participation to provide a basic understanding of the integrated system to support evidence-based stakeholder dialogue from policy formulation to the next cycle. The prototype concepts and algorithm are discussed, and the system's architecture is presented, describing the main components. The developed system will then undergo testing and validation.

Effect of curcumin and rosuvastatin on lipid peroxidation in lung and heart tissues on a rat model of chronic kidney disease

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Introduction: Chronic kidney disease (CKD) is a condition in which kidneys lose their ability to eliminate metabolic waste products and excess fluid from the body. Along with diabetes and dementia, it is one of the fastest-growing causes of death. It is believed that oxidative stress, inflammation and increased activity of the renin-angiotensin system have the greatest influence on the development and progression of CKD. As a result of CKD, atherosclerosis and hyperlipidemia can occur, which are treated by statins. In addition to hypolipemic effects, statins are considered antioxidants and anti-inflammatory agents. Recently, herbal preparations have been used in the prevention, mitigation and treatment of many diseases. A lot of research is available on substances of plant origin with potential anti-inflammatory and antioxidant effects that could be used in the treatment of CKD as adjunctive therapy or combined therapy with statins.

Purpose: This research aimed to examine the effect of curcumin, rosuvastatin and the combination of curcumin and rosuvastatin on lipid peroxidation in the homogenate of heart and lung tissues of rats with adenine-induced CKD.

Method: The research was conducted on 36 male Wistar rats divided into six groups. Solvent, curcumin (100mg/kg), standard dose of rosuvastatin, reduced dose of rosuvastatin (25% of the standard dose) and a combination of reduced dose of rosuvastatin and curcumin were administered orally to individual control/therapeutic groups for 24 days. The concentration of malondialdehyde, as a biomarker of lipid peroxidation, was determined spectrophotometrically.

Results: Curcumin showed a tendency to decrease lipid peroxidation in both tissues. Rosuvastatin induced a dose-dependent increase in lipid peroxidation in both tissues. The combined use of curcumin and a reduced dose of rosuvastatin had the best protective effect; it reduced lipid peroxidation to the greatest extent.

Conclusion: The results indicate that the combined use of curcumin and reduced dose of rosuvastatin could improve the nephroprotective and other effects of curcumin and build on the limited effects of rosuvastatin, thus achieving a better effect in slowing the progression of CKD and the resulting cardiovascular complications.

Novel sodium alginate aerogels with monometallic MOF for antibiotic decontamination in water

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Introduction: This study tackles the urgent environmental and public health concerns of antibiotic-resistant bacteria (ARB) and antibiotic resistance genes (ARGs) resulting from ecosystem contamination by antibiotic residues. It proposes an innovative, cost-effective solution using a novel composite of Metal-Organic Frameworks (MOFs) and Sodium Alginate Aerogel. This approach aims to enhance environmental remediation, particularly by targeting antibiotic residues. The paper explores the characterisation of these materials, evaluating their potential to efficiently and sustainably reduce various antibiotics in wastewater. This research introduces a synergistic, eco-friendly method by combining the high porosity and versatile chemical functionalities of MOFs with the biocompatible and absorbent Sodium Alginate Aerogel. The study assesses the effectiveness of this novel composite in decontaminating wastewater, potentially establishing a new benchmark in eco-friendly remediation strategies against antibiotic pollution.

Method: The methodology involved several stages. Initially, a 2% Sodium Alginate solution was prepared by mixing the powder with deionised/distilled water and a non-ionic surfactant for pore control. Microcrystalline Cellulose (MCC) was dispersed in water and blended with this solution to enhance structural integrity. Concurrently, 10mg/ml Metal-Organic Framework (MOF) solutions were prepared and integrated into the aerogel matrix. Gelation occurred overnight in moulds using a calcium chloride solution for cross-linking. Freeze-drying followed. Aerogel characterisation involved Electron Microscopy (SEM) and Energy-Dispersive X-ray Analysis (EDX) for elemental analysis, Transmission Electron Microscopy (TEM) for nanoscale structural insights, particularly of Copper MOF, and Brunauer-Emmett-Teller (BET) Analysis for porosity and surface properties. X-ray Diffraction (XRD) aided in understanding the crystalline structure. The study concluded by assessing the aerogel's catalytic activity in reducing various antibiotics, using NaBH4 as the reducing agent and monitoring the reactions via UV-Vis spectra to evaluate catalytic efficiency under varied conditions.

Results: The study revealed that Sodium Alginate Aerogel loaded with Copper MOF varied in antibiotic degradation efficiency. It achieved high degradation rates for Ceftriaxone (99.93%) and Metronidazole (98.53%) but was less effective for Gentamicin (37.78%) and Vancomycin (6.63%). Degradation efficiency also varied with pH; for example, Amoxicillin showed a 99.62% degradation rate at pH 7.5, highlighting the influence of environmental factors. XRD and EDX analyses provided insights into the structural and compositional properties, revealing a crystalline Copper MOF structure and successful integration into the aerogel. SEM and TEM analyses demonstrated the Copper MOF's crystallinity and the aerogel's porous structure. The aerogel with Copper MOF showed a well-organised porous network, indicating successful MOF loading. TEM highlighted the aerogel's interconnected pores and well-defined Copper MOF lattice fringes, underlining the precision in MOF synthesis.

Conclusion: This study presents a groundbreaking solution to address antibiotic residue's environmental impact, which is crucial in modern medicine. Integrating a Monometallic Metal-Organic Framework with Sodium Alginate Aerogel offers a promising approach to combat contamination, aligning with sustainable development goals. These findings emphasise tailored processes in environmental remediation, laying the groundwork for future advancements.

An innovative strategy for clinical monitoring of deferasirox based on fluorescence quenching and recovery of surface-modified carbon dots

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Background: Patients withβ-thalassemia are usually treated with two major therapies, which are bone marrow transplantation and long-term blood transfusion. Bone marrow transplantation is often disfavoured due to transplant rejection, which can be life-threatening. Long-term blood transfusion thus becomes the more favourable choice for treatβ-thalassemia. However, a continuous blood transfusion will lead to hemochromatosis and peroxidative tissue damage resulting from the accumulation of iron ions in the blood. To tackle this, iron-chelating agents, such as deferasirox (DFX), were used to remove excessive irons from patients' bodies. Unfortunately, administration of DFX is still associated with some drug-related adverse events, including rash, diarrhoea, and even hepatic or renal toxicity. Many analytical techniques such as CE-UV, HPLC, and LC-MS have been innovated to avoid these. Still, their use has been limited due to complicated pretreatment processes, intensive labour, and high costs. Thus, a simple and cost-effective sensing platform based on dopamine-conjugated carbon dots (DA-CDs) for monitoring the plasma level of deferasirox has been designed.

Purpose: To develop a rapid strategy for precise determination of deferasirox in human plasma.

Method: The CDs were synthesised by reacting citric acid with urea and further reaction with N-Hydroxysuccinimide and 1-(3-Dimethylaminopropyl)-3-ethylcarbodimide). Afterwards, dopamine was added to obtain the final product DA-CDs. In basic environment (pH 11), DA-CDs were able to bind with copper ions, causing noticeable fluorescence quenching. In the presence of DFX, DFX formed a complex with copper ions, preventing the binding of copper ions with DA-CDs and causing the recovery of fluorescence intensity. Therefore, the concentration of DFX was determined by calculating fluorescence recovery.

Results: Under the optimised conditions, the limit of detection was found to be 600 ng/mL, with a linear response between 1 and 10 µg/mL, which was satisfactory for clinical application. This method was later proved feasible in real sample analysis with RSD values below 4.71%

Conclusion: A novel biosensor has been fabricated for the detection and quantification of DFX in plasma samples. This strategy not only offers us new insight into biosensing materials but also shows proof of the convergence of nanotechnology and clinical pharmacy. The results validated that this method can be useful for drug estimation by improving its efficiency, accessibility and affordability. It may open up a new generation of clinical care for pharmacists and other healthcare practitioners.

Shifting paradigms – Innovating for the future of healthcare: embracing emerging technologies

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This abstract explores the transformative phase of the pharmacy profession in today's rapidly evolving healthcare landscape. It highlights the significance of professional diversification within the pharmacy field and the role of emerging technologies in reshaping and consolidating the profession. The objective of this study is to provide an overview of the paradigm shifts occurring in professional diversification and examine how emerging technologies drive these changes. The main structure of the abstract consists of an Introduction, a Method, Results, and a Conclusion.

Introduction: The pharmacy profession is transforming, driven by shifting paradigms and propelled by emerging technologies. This abstract emphasises the importance of leveraging emerging technologies to maximise pharmacists' potential in meeting the demands of modern healthcare. It also mentions the need for consolidating and integrating emerging technologies to enhance pharmacists' role and impact in healthcare delivery.

Method: This presentation is based on a comprehensive review of literature, case studies, and expert opinions. Insights from pharmacists, healthcare providers, policymakers, and patients have been incorporated to present a comprehensive understanding of the subject matter.

Results: Advancements in technology and the growing demand for patient-centred care are redefining the traditional role of pharmacists. Emerging technologies offer opportunities to expand the scope of practice, improve patient outcomes, and contribute to the overall healthcare ecosystem. The abstract delves into professional diversification within the pharmacy profession, exploring the integration of technologies such as artificial intelligence, telepharmacy, robotics, and digital health platforms. It discusses the potential benefits of these technologies, including improved medication management, enhanced patient education, remote monitoring, and personalised therapy optimisation. The presentation also addresses challenges associated with technology adoption and provides strategies for overcoming barriers, including education, training, and regulatory support. Interprofessional collaboration is emphasised, showcasing successful models and their positive impact on patient outcomes.

Conclusion: The integration of emerging technologies is shaping shifting paradigms in the pharmacy profession. By embracing these technologies, pharmacists can consolidate efforts in community service, clinical pharmacy, professional diversification, and collaborative relationships. This consolidation allows pharmacists to leverage virtual care, enhance clinical practice, explore new career pathways, and drive healthcare innovation. Embracing emerging technologies positions pharmacists to meet the evolving needs of patients and the healthcare system, consolidating the pharmacy profession in an era of technological advancements.

Formulation and evaluation of garlic and shea butter-based natural shampoo.

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Introduction: Garlic (Allium sativum) is a species in the genus Allium, which includes onions, leeks, and shallots. Shea butter is a natural plant fat extracted from the nuts of the shea tree (Vitellaria paradoxa). Shampoos are widely used cosmetic products, often for daily cleaning of the hair and scalp. In some cases, shampoos target factors responsible for ensuring the hair looks healthy through specific excipients. Formulating and manufacturing a shampoo that can remove all dirt from hair is relatively simple. A shampoo needs to include excipients that cleanse the hair and scalp but also leave the hair moisturised. Shampoo products must also be medically safe for long-term use without damaging the scalp and hair. The study aimed to formulate and prepare an effective shampoo that included surfactants and others with distinct but equally important roles. The physicochemical properties of the products evaluated included pH, dirt dispersion, foaming ability and stability, percent solid content and physical appearance.

Methods: Formulation development and optimisation studies for the shampoo were undertaken using a Central Composite design (CCD) and an Artificial Neural Network (ANN). All samples were prepared in double distilled water equilibrated to 25°C in a water bath controlled with a thermostat. Measurements were taken within one day of sample preparation. The formulations were evaluated in colour, clarity, and odour. The pH of 10% aqueous solutions was monitored. The cylinder shake method was used to determine the foaming ability and stability of the different shampoos produced. The percent solid content was determined by heating 10g of each shampoo after recording the mass of shampoo prior to heating and comparing it to that obtained after heating. The cylinder shake method and Sudan Red dye were used to determine the dirt dispersion level of the different shampoos.

Results: The 17 formulations (N1-N17) were created using a CDD and an ANN. The pH of most shampoos was around 6, with formulation N1 having the highest pH of 7.33 and formulation N12 the lowest at 5.83. Formulation N9 exhibited the highest moisture content at 72.55%, resulting in the lowest percent solid content. The dirt dispersion level for all shampoos was light. The optimised shampoo formulation had a creamy colour, viscous texture, and a lemon grass scent. It had a pH of 6.67, moisture content of 74.05%, percent solid content of 21.35, and a foamability profile of 160ml, with dirt dispersion at light intensity.

Conclusion: According to national standards, the optimised shampoo is not suitable for commercial use due to the dirt dispersion level. Even though the intensity level was light,

there should be no dye present in the foam. The pH and percent solid content complies with national standards. The foamability profile and moisture content of the shampoo are within acceptable ranges.

Development of a non-small cell lung cancer spheroid xenograft model for preclinical precision medicine screening

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Background: Utilising a physiologically relevant lung cancer spheroid-derived xenograft (SDX) model to identify potential therapies can make a huge contribution to precision medicine. These models are created by implanting three-dimensional cultured cell spheroids into rodents. Preclinical models provide an important foundation for precision treatment research, and SDX models provide important information on cancer biology and therapy potential. Preclinical models aid biomarker discovery, metastasis, and treatment responses, paving the way for personalised therapies.

Purpose: This study aimed to develop a physiologically functional non-small cell lung cancer (NSCLC) SDX model and to assess cancer biomarkers and changes in metabolic pathways.

Methods: A549 spheroids (up to 1 mm in diameter) were formed and grown using a Celvivo ClinoStar™ and subcutaneously implanted into the right flank of ten athymic nude mice (1 spheroid per animal). They were allowed to develop tumours over 25 days. Tumour growth rates, serum cancer biomarkers and metabolomics were assessed compared to non-cancer mice. Carcinoembryonic antigen (CEA) and carbohydrate antigen 125 (CA-125) were quantified with ELISA kits. A miniaturised proton nuclear magnetic resonance (1H-NMR) spectroscopy method was used to detect changes in untargeted serum metabolites in the collected serum. The excised tumours were processed and histologically investigated.

Results: Compared to a non-cancer control, the implanted mini tumours expressed significant levels ($p < 0.05$) of CEA and CA-125. The relationship between elevated CEA, CA-125 concentrations and tumour growth highlights the potential of the model for tracking lung cancer progression. Similarly, significant changes ($p < 0.05$) in metabolites were observed. These metabolic alterations impact glutamine's role in energy and carbon metabolism, a characteristic also observed in patients with lung cancer. Moreover, the elevation in pyruvic acid because of lactate metabolism is associated with cancer angiogenesis—evidence seen in the histology results. Additionally, 3-hydroxyisobutyric acid is identified as a ketone body upregulated in non-small lung cancer patients, while creatine, when converted into phosphocreatine by cancer cells, functions as an energy reservoir. Inosine was detected only in the SDX animals, resembling the metabolite profiles found in patients with lung cancer. Histology showed vascularisation and dense cell packing, characteristics of solid adenocarcinomas.

Conclusion: The A549 SDX model is a physiologically relevant model for lung cancer research. It successfully mimicked cancer biomarkers and reflected the metabolism of cancer patients. These biochemical characteristics, together with the tumour evaluations, allow for a model that can effectively serve preclinical drug development for precision medicine design.

Young health professionals platform – Fostering interdisciplinary collaboration

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Background: The future of health systems hinges on overcoming multifaceted challenges that extend to healthcare professionals. To address these challenges, interdisciplinary collaboration is increasingly pivotal in shedding light on the needs surrounding healthcare professionals.

Purpose: The Young Health Professionals Platform (YHPP) is a national forum to discuss and foster interdisciplinary collaboration among young healthcare professionals. By joining efforts, the YHPP endeavours to advocate and support current and future healthcare professionals, actively contributing to the resilience of Portugal's healthcare system and the identification of solutions to health challenges at the national level.

Methods: The project was initiated in 2023 by bringing together associations and representatives of young members of professional organisations, namely, medical doctors, pharmacists, nutritionists, dentists and veterinary doctors. A

Memorandum of Understanding (MoU) was crafted and endorsed between these organisations in a forum dedicated to the theme "The new generation of healthcare professionals" at the Portuguese Parliament. The MoU outlined the vision, mission, principles and strategic areas of activity. Aligned with the Sustainable Development Goals, the One Health framework, and the WHO's Budapest 2023 Youth Declaration, this document serves as a guiding framework for the YHPP's initiatives.

Results: The YHPP's first endeavour was developing a Call to Action entitled "The Vision of Young Healthcare Professionals, " targeted at healthcare professionals, policymakers, and public stakeholders. This initiative seeks to redefine professional standards and navigate challenges and opportunities in a demanding landscape. The document was presented to candidates from each political party during the electoral campaign ahead of the national elections in March 2024 to inform the policy debate and foster dialogue and awareness among parliamentary representatives.

Conclusion: In conclusion, the YHPP envisions itself as a dynamic force actively dedicated to advancing the well-being of emerging healthcare professionals and fostering excellence in their professional training and intervention. By spearheading initiatives, advocating for interdisciplinary collaboration, the involvement of young professionals in the political decision-making process, and actively engaging with key stakeholders, the YHPP aspires to play a pivotal role in shaping a resilient and innovative political and healthcare ecosystem in Portugal.

Drug-induced mitochondrial dysfunction: Effect on insulin sensitivity in liver and skeletal muscle cells in vitro

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Introduction: Mitochondrial dysfunction has been associated with the development of insulin resistance, the hallmark of type 2 diabetes mellitus (T2DM). However, the relationship between mitochondrial impairment and insulin resistance is not fully elucidated due to insufficient evidence and lack of consensus to support the hypothesis. Insulin resistance and insulin deficiency are characterised by excessive production of reactive oxygen species and mitochondrial coupling. Compelling evidence states that improving the function of the mitochondria may provide a positive therapeutic tool for improving insulin sensitivity. There has been a rapid increase in reports of the toxic effects of therapeutic drugs and pollutants on the mitochondria in recent decades, interestingly correlating with an increase in T2DM prevalence. A variety of drug classes have been reported to potentially induce toxicity in the mitochondria, leading to skeletal muscle, liver, central nervous system, and kidney injury. With the increase in diabetes prevalence and mitochondrial toxicity, it is, therefore, imperative to understand how potential mitochondrial toxicological agents can compromise insulin sensitivity. Although the development of insulin resistance has been linked to mitochondrial dysfunction, this hypothesis remains to be fully elucidated. Hence, this in vitro study aimed to understand the correlation between drug-induced mitochondrial toxicity and the development of insulin resistance in skeletal muscle and liver cells. The potential mitotoxicants of interest in this study were efavirenz, tenofovir, rifampicin, clarithromycin, simvastatin and lamotrigine.

Method: In this study, skeletal muscle (C2C12) and liver (HepG2) cell lines were used. A cell viability study was conducted after 24 hours of exposure of C2C12 and HepG2 cells to potential mitotoxicants, efavirenz, tenofovir, rifampicin, clarithromycin, simvastatin and lamotrigine and at (25, 50, 100, 200 and 400 µM). Thereafter, differentiated C2C12 and HepG2 cell preparations were exposed to these potential mitotoxicants for 24 hours at (25, 50 and 100 µM), separately to evaluate glucose uptake. Glucose handling was evaluated by observing the changes in insulin-stimulated glucose uptake and assessing the changes in glucose transporter 4 (GLUT4) translocation and expression and protein kinase B (PKB) expression. The changes in mitochondrial function were evaluated by assessing mitochondrial membrane potential, cellular ATP production, generation of intracellular reactive oxygen species (ROS) in C2C12 and expression of tafazzin and quantification of medium malonaldehyde (MDA) in C2C12 and HepG2 cell lines.

Results: Insulin-stimulated glucose uptake was inhibited in C2C12 and HepG2 cells treated with potential mitotoxicants. Additionally, ATP production, alterations in mitochondrial membrane potential, excessive accumulation of intracellular ROS and lipid peroxides (MDA) were observed in the presence of potential mitotoxicants. Particularly, the authors observed suppression of proteins involved in the insulin signalling pathway and maintenance of mitochondrial function, namely GLUT4, PKB and tafazzin.

Transforming healthcare: The revolutionary influence of artificial intelligence

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Introduction: The healthcare industry has witnessed an exceptional revolution driven by the upgradation of artificial intelligence (AI) technology. This abstract focuses on the radical effect of AI on healthcare, exploring its transformative potential across various domains, including diagnosis, treatment, patient care, and healthcare management. AI has been shown to be a compelling mechanism for improving the precision and convincingness of diagnosis. Large amounts of medical data, including genetic data, electronic health records, and medical imaging, can be determined using machine learning algorithms to find patterns, determine defects, and estimate the course of diseases. These qualities have enhanced patient outcomes by developing early disease detection, providing more effective treatment, and contributing tailored therapy recommendations. Artificial Intelligence has completely altered the way healthcare is provided and examined. Utilising robotic-assisted surgeries empowers surgeons to execute intricate procedures with heightened precision and minimised invasiveness. AI-driven systems consistently monitor patients, identify early warning signs, and offer timely interventions, mitigating the likelihood of medical errors and enhancing patient safety. Virtual assistants with chatbots, coupled with natural language processing capabilities, streamline patient communications, simplifying real-time responses, appointment scheduling, and remote consultations.

Method: To effectively achieve the transformation outlined in "Transforming Healthcare: The Revolutionary Influence of Artificial Intelligence," a well-structured method can be employed like Needs Assessment: Stakeholder Engagement, Strategic Planning, Regulatory Compliance, Infrastructure Enhancement: Pilot Programs, scalable Implementation, Continuous Monitoring and Improvement, Measuring Impact: Feedback Loop Integration, Periodic Reviews and Updates.

Results: The results of revolutionising healthcare with AI can encompass a wide range of positive outcomes, advancements, and improvements across various aspects of the healthcare system. Here are some potential results:

Enhanced Diagnostics, Personalised Treatment Plans, Efficient Administrative Processes, Predictive Analytics for Disease Prevention, Remote Monitoring and Medicine, Drug Discovery and Development, Optimised Resource Allocation:

Reduced Healthcare Costs, Enhanced Patient Engagement, Ethical and Responsible AI Practices, Continuous Learning and Improvement, Collaboration between Healthcare and Technology Sectors, and Global Health Impact.

Conclusion: The trans-formative impact of artificial intelligence (AI) on healthcare represents a promising frontier that has the potential to revolutionise the industry in unprecedented ways. The integration of AI technologies has already shown substantial benefits, ranging from enhanced diagnostics and personalised treatment plans to streamlined administrative processes and improved patient outcomes.

As the authors move forward, collaboration between the healthcare and technology sectors becomes increasingly critical. This partnership not only fuels innovation but also facilitates the development of AI applications specifically tailored to meet the unique challenges and demands of the healthcare landscape.

In summary, artificial intelligence has the potential to greatly transform healthcare. Navigating this evolving landscape will require a thoughtful and collaborative approach to fully unlock AI's benefits for patients, healthcare professionals, and society as a whole.

Novel nanoarchitectured approach: Mesoporous silica loaded with metal-organic frameworks for antibiotic removal from wastewater

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Introduction: The escalating concern surrounding antibiotic contamination in natural water sources poses a significant environmental challenge, threatening aquatic ecosystems due to their persistence and detrimental effects. In response, innovative methods for wastewater antibiotic removal, such as integrating mesoporous silica nanoparticles (MSNs) with metal-organic frameworks (MOFs), have garnered attention. This approach capitalises on MSNs' high surface area, tunable pore size, MOFs' porosity and controllable surface chemistry to address antibiotic pollution effectively. This research investigates the collaborative impact of MSNs and MOFs in removing various antibiotics from aqueous wastewater, aiming to develop sustainable solutions for mitigating antibiotic contamination in aquatic ecosystems.

Method: Mesoporous Silica Nanoparticles (MSNs) synthesis involved dissolving Cetyltrimethylammonium Bromide (CTAB) in distilled water, adding Tetraethyl Ortho Silicate (TEOS) and ethanol, and adjusting pH with ammonia solution and Hydrochloric acid (HCl). Simultaneously, Bimetallic Copper-Cobalt Metal-Organic Frameworks (MOFs) synthesis required dissolving cobalt chloride (CoCl2), copper chloride (CuCl2), and terephthalic acid in Dimethylformamide (DMF), controlled reflux, cooling for crystalline maturation, vacuum filtration, and washing for impurity elimination. MSN synthesis comprised mixing CTAB and TEOS solutions, stirring

with ethanol, pH adjustment, overnight gel formation, purification, and annealing. Integrating Cu-Co MOFs with MSNs required dissolving bimetallic MOF in DMF, mixing with dried and activated MSNs, and allowing for adhesion. Characterisation involved Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), X-ray Diffraction (XRD), and Energy-Dispersive X-ray Analysis (EDX) to elucidate structural and compositional features. The study concluded by assessing the catalytic activity in reducing various antibiotics, using NaBH4 as the reducing agent and monitoring the reactions via UV-Vis spectra to evaluate catalytic efficiency under fixed conditions.

Results: The study demonstrated the efficacy of MSNs loaded with MOFs in degrading various antibiotics. Antibiotics such as Amoxicillin, Ciprofloxacin, Doxycycline, Gentamicin, Sulfamethoxazole, and Vancomycin underwent degradation tests, revealing variable degradation rates, with some achieving up to 99%. This high efficiency suggests enhanced adsorption and reactivity due to a broader range of active sites in the bimetallic MOF. SEM showed a well-organised nanostructure, enhancing material permeability, crucial for controlled release or selective adsorption. TEM provided detailed insights into morphology and structure, highlighting the uniform coating of MOF on silica nanoparticles, indicative of synthesis uniformity and homogeneous nanoparticle distribution. XRD and EDX confirmed the crystal and metallic composition of the materials.

Conclusion: This research presents a significant stride in addressing antibiotic contamination in natural water sources using MSNs loaded with MOFs, showcasing a promising strategy for environmental remediation. The effectiveness of this approach, validated by meticulous experimental design and advanced characterisation techniques like TEM, SEM, EDX and XRD, highlights the potential of MSNs loaded with MOFs in antibiotic degradation. This study not only demonstrates the catalytic efficiency but also contributes to evolving strategies in environmental remediation, aligning with several Sustainable Development Goals and underlining the importance of sustainable, effective solutions for current and future environmental challenges.

The oral acute toxicity and pharmacokinetic evaluation of a chloroquine hybrid molecule in rats

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Introduction: The authors' collaborator developed a chloroquine hybrid molecule. This compound has shown good anti-microbial activity and low cytotoxicity in normal cells in vitro. This molecule could inhibit a malaria parasite at various stages of its life cycle. Oral acute toxicity and a pharmacokinetic profile must first be determined before infectious studies are done. This study aimed to perform an oral acute toxicity and pharmacokinetic study on rats to determine a chloroquine hybrid molecule's toxicity and pharmacokinetic profile that will be used in a future infectious study with P. *berghei.*

Methods: This study was divided into three phases.

1) The oral acute toxicity study involved dosing (100 mg/kg) five Sprague Dawley rats and monitoring them over a period of 14 days to assess whether they displayed any signs of toxicity.

2) A pharmacokinetic study was then conducted to determine the compound's breakdown at different time points. Blood was collected by tail bleeding and spun down to obtain plasma for analysis by tandem mass spectrometry (LC-MS/MS).

3) In the LC-MS/MS analysis, a method was first developed to determine the precursor and fragment ions to be analysed. A column study was conducted to determine the most suitable column for the retention of the analyte, and a sample preparation study was conducted to investigate whether protein precipitation or liquid-liquid extraction is the better analyte recovery method.

Results: During the oral acute toxicity study, it was found that all the rats survived the dose of 100 mg/kg with no signs of weight loss or any other health condition. The LC-MS/MS method development found that a precursor ion of 490.063 m/z and a fragment ion of 262.000 m/z were the most intense analyte responses. A polar C-18 column was found to retain the analyte the best. In contrast, protein precipitation was found to give the best analyte recoveries and could, therefore, be used for the final sample analysis. The pharmacokinetic study determined the Cmax, t1/2 and Tmax of the compound of interest.

Conclusion: The compound evaluated in this study showed no visible toxic effects in rats. The information obtained from Cmax and Tmax showed that a future infectious study in vivo can be done within a short time frame at a maximum dose of 100 mg/kg or lower. An LC-MS/MS method was successfully developed and validated to determine the concentration of the novel chloroquine hybrid molecule in the plasma samples obtained from the pharmacokinetic study.