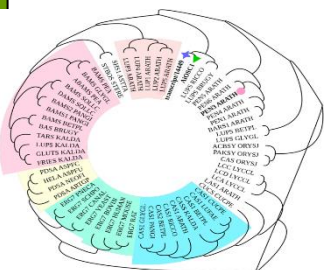
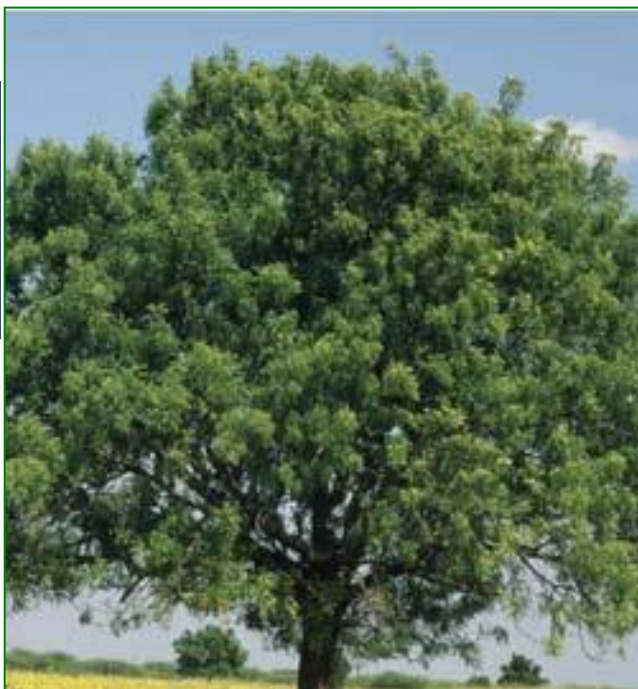




Neem Research Newsletter Volume 3, Issue 4, 2023



WORLD NEEM ORGANISATION (WNO)



From
The Editor's Desk.....

This month's research reports on neem are primarily in the field of agriculture. Scientists have demonstrated that applying azadirachtin to soil improves fall army worm control and its toxicity to corn plants. Neem oil was found to optimise the in vitro culture of an ancient pear tree cultivar. Several studies have emphasized the use of nanoparticles for higher efficacy and the potential of nanotechnology-based solutions for sustainable agriculture and food security. Green synthesized silver nanoparticles has been suggested as a promising approach for enhancing the growth and yield of tomato plants and protecting them against early blight disease. The pathogenic activities of *Azadirachta indica* aqueous formulated green synthesized copper oxide nanoparticles against phytopathogens were examined. Nimbolide was found to exhibit potent anticancer activity through DNA damage in human lung cancer cells. The nimbin analog N2 was shown to alleviate high testosterone induced oxidative stress in CHO cells and alters the expression of Tox3 and Dennd1a signal transduction pathway involved in the polycystic ovary syndrome zebrafish. Experimental studies indicate that biosynthesized nanoselenium from *Azadirachta indica* leaf extracts is a promising anticoccidial and antioxidant effector and could be used for the treatment of coccidiosis. The combination of the antidiabetic drug metformin and the neem limonoid gedunin was shown to induce cell death in lung cancer cells.

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Core Founding Member, WNO
Chief Scientific Coordinator &
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Neem in Agriculture

Control efficacy of azadirachtin on the fall armyworm, *Spodoptera frugiperda* (J. E. Smith) by soil drenching.

Acharya R, Sharma SR, Barman AK, Kim SM, Lee KY.

Arch Insect Biochem Physiol. 2023 Apr 27:e22020. doi: 10.1002/arch.22020. PMID: 37106481

The fall armyworm (FAW), *Spodoptera frugiperda*, is an important agricultural pest species native to the Western Hemisphere and has recently invaded to Africa and Asia. Owing to the development of pesticide resistance and environmental contamination, ecofriendly pesticides are desirable for FAW control. Azadirachtin is a plant-derived natural pesticide with low toxicity to humans and the natural environment. Azadirachtin is primarily applied by foliar spraying; however, this approach lowers the efficacy of controlling target insects owing to photodegradation and might give a harmful effect on nontarget beneficial insects. Thus, we investigated whether applying azadirachtin to soil improves FAW control and its toxicity to corn plants. Soil drainage of azadirachtin exhibited no phytotoxic effects on corn plants but significantly reduced the larval body weight and delayed the developmental period of each larval instar of FAW. Applying 10, 15, and 20 ppm azadirachtin to soil inhibited larval growth by 68%, 76%, and 91%, respectively. Furthermore, the survival rate of FAW gradually decreased when larvae were fed azadirachtin-treated corn leaves. Collectively, this is the first study suggesting the systemic efficacy of azadirachtin by soil drenching against FAW.

Optimization of the *In Vitro* Proliferation of an Ancient Pear Tree Cultivar ('Decana d'inverno') through the Use of Neem Oil.

Regni L, Facchin SL, da Silva DF, Proietti P, Silvestri C, Micheli M. *Plants (Basel).* 2023 Apr 10;12(8):1593. doi: 10.3390/plants12081593. PMID: 37111817

In vitro culture, ensuring rapid multiplication and production of plant material under aseptic conditions, represents an excellent tool for *ex-situ* conservation of tree species biodiversity and can be used for the conservation, among others, of endangered and rare crops. Among the *Pyrus communis* L. cultivars that have been abandoned over the years due to changed cultivation requirements, but which are still used today in breeding programs, there is the 'Decana d'inverno'. Pear is generally considered a recalcitrant species for *in vitro* propagation due to weak multiplication rate, hyperhydricity, and susceptibility to phenolic oxidation. Therefore, the use of natural substances like neem oil (although little explored) represents one of the options to improve the *in vitro* plant's tissue culture. In this context, the aim of the present work was to evaluate the effect of adding neem oil (0.1 and 0.5 mL L⁻¹) to the growth substrate in order to optimise the *in vitro* culture of the ancient pear tree cultivar 'Decana d'inverno'. The neem oil addition resulted in an increase in the number of shoots produced especially at both concentrations used. On the contrary, an increase in length of proliferated shoots was observed only with the addition of 0.1 mL L⁻¹. The neem oil addition did not affect the explants viability, fresh and dry weights. Therefore, the present study demonstrated for the first time the possibility of using neem oil to optimise the *in vitro* culture of an ancient pear tree cultivar.

Green Synthesized Silver Nanoparticles: A Novel Approach for the Enhanced Growth and Yield of Tomato against Early Blight Disease.

Ansari M, Ahmed S, Abbasi A, Hamad NA, Ali HM, Khan MT, Haq IU, Zaman QU. *Microorganisms*. 2023 Mar 29;11(4):886. doi: 10.3390/microorganisms11040886. PMID: 37110309

Tomato plants are among the most widely cultivated and economically important crops worldwide. Farmers' major challenge when growing tomatoes is early blight disease caused by *Alternaria solani*, which results in significant yield losses. Silver nanoparticles (AgNPs) have gained popularity recently due to their potential antifungal activity. The present study investigated the potential of green synthesized silver nanoparticles (AgNPs) for enhancing the growth and yield of tomato plants and their resistance against early blight disease. AgNPs were synthesized using leaf extract of the neem tree. Tomato plants treated with AgNPs showed a significant increase in plant height (30%), number of leaves, fresh weight (45%), and dry weight (40%) compared to the control plants. Moreover, the AgNP-treated plants exhibited a significant reduction in disease severity index (DSI) (73%) and disease incidence (DI) (69%) compared to the control plants. Tomato plants treated with 5 and 10 ppm AgNPs reached their maximum levels of photosynthetic pigments and increased the accumulation of certain secondary metabolites compared to the control group. AgNP treatment improved stress tolerance in tomato plants as indicated by higher activities of antioxidant enzymes such as PO (60%), PPO (65%), PAL (65.5%), SOD (65.3%), CAT (53.8%), and APX (73%). These results suggest that using green synthesized AgNPs is a promising approach for enhancing the growth and yield of tomato plants and protecting them against early blight disease. Overall, the findings demonstrate the potential of nanotechnology-based solutions for sustainable agriculture and food security.

The nematicidal potential of novel fungus, *Trichoderma asperellum* FbMi6 against *Meloidogyne incognita*

Saharan R, Patil JA, Yadav S, Kumar A, Goyal V.

Sci Rep. 2023 Apr 23;13(1):6603. doi: 10.1038/s41598-023-33669-z. PMID: 37088805

One of the most damaging pests in vegetable crops is the root-knot nematode (*Meloidogyne incognita*) worldwide. The continuous use of nematicide is costly and has unintended consequences for human and environmental health. To minimize nematicides, eco-friendly integrated nematode management is required. *Trichoderma*, an antagonistic fungus has been explored to control root-knot nematode. The fungal bio-control strain FbMi6 was identified as *Trichoderma asperellum* (accession no. MT529846.1). *T. asperellum* FbMi6 showed substantial nematicidal activity in the laboratory, with egg hatch suppression (96.6%) and juvenile mortality (90.3%) of *M. incognita*. *T. asperellum* FbMi6 was examined under pot and field conditions (after neem cake enrichment), both alone and in combination, and compared with controls. Application of *T. asperellum* FbMi6 enriched neem cake (1-ton ha⁻¹) increased (28.3%) the okra yield and decreased (57.1%) nematode population as compared with control. *T. asperellum* FbMi6 enriched neem cake had higher polyphenol content (resistance enhancer) in okra compared with inoculated check.

Association of growth-regulating insecticides and limonoid-based formulations: physicochemical compatibility and toxicity against *Spodoptera frugiperda* (Lepidoptera: Noctuidae).

Martins LN, Geisler FCDS, Amandio DTT, Rakes M, Pasini RA, Ribeiro LDP, Bernardi D. *J Econ Entomol.* 2023 Apr 14:toad070. doi: 10.1093/jee/toad070. PMID: 37058438

The objective of this study was to evaluate the physicochemical compatibility of mixtures of synthetic and botanical limonoid-based insecticides, as well as the toxicity of these associations, in the management of *Spodoptera frugiperda* (J.E. Smith) under laboratory and field conditions. For this, the associations of 4 commercial botanical insecticides based on neem registered in Brazil (Azamax, Agroneem, Azact CE, and Fitoneem) were tested with synthetic insecticides from the group of growth regulators (IGRs [triflumuron, lufenuron, methoxyfenozide and tebufenozide]). When mixed, all combinations caused a significant reduction in the pH of the mixture and a significant increase in electrical conductivity. However, all tested combinations showed similar stability behavior to the negative control (distilled water), which demonstrated their physicochemical compatibility. Furthermore, in laboratory and field bioassays, mixtures of IGRs with limonoid-based formulations provided satisfactory effects in the management of *S. frugiperda*. However, binary mixtures of insecticide Intrepid 240 SC with Azamax or Azact CE (at LC25 previously estimated) showed the highest toxicities on *S. frugiperda* larvae in laboratory bioassays and damage reduction caused by *S. frugiperda* in a 2-yr field experiments. Therefore, mixtures of IGRs with limonoid-based botanical insecticides are promising alternatives for the management of *S. frugiperda* and important component of integrated pest management and insect resistance management programs.

Environmental sustainable: Biogenic copper oxide nanoparticles as nano-pesticides for investigating bioactivities against phytopathogens.

Manzoor MA, Shah IH, Ali Sabir I, Ahmad A, Albasher G, Dar AA, Altaf MA, Shakoor A *Environ Res.* 2023 Apr 24:115941. doi: 10.1016/j.envres.2023.115941. PMID: 37100366

Endocrine-disrupting chemicals (EDCs) are of interest in human physiopathology and have been extensively studied for their effects on the endocrine system. Research also focuses on the environmental impact of EDCs, including pesticides and engineered nanoparticles, and their toxicity to organisms. Green nanofabrication has surfaced as an environmentally conscious and sustainable approach to manufacture antimicrobial agents that can effectively manage phytopathogens. In this study, we examined the current understanding of the pathogenic activities of *Azadirachta indica* aqueous formulated green synthesized copper oxide nanoparticles (CuONPs) against phytopathogens. The CuONPs were analyzed and studied using a range of analytical and microscopic techniques, such as UV-visible spectrophotometer, Transmission electron microscope (TEM), Scanning electron microscope (SEM), X-ray diffraction (XRD) and Fourier transformed infrared spectroscopy (FTIR). The XRD spectral results revealed that the particles had a high crystal size, with an average size ranging from 40 to 100 nm. TEM and SEM images were utilized to verify the size and shape of the CuONPs, revealing that they varied between 20 and 80 nm. The existence of potential functional molecules involved in the reduction of the nanoparticles was confirmed by FTIR spectra and UV analysis. Biogenically synthesized CuONPs revealed significantly enhanced antimicrobial activities at 100 mg/L concentration in vitro by the

biological method. The synthesized CuONPs at 500 µg/ml had a strong antioxidant activity which was examined through the free radicle scavenging method. Overall results of the green synthesized CuONPs have demonstrated significant synergetic effects in biological activities which can play a crucial impact in plant pathology against numerous phytopathogens.

Neem for Human Health

Comparative evaluation of fracture resistance among conventional versus herbal irrigants in root canal treated teeth: In vitro study.

Sinha DJ, Rani P, Vats S, Bedi K, Sharma N, Manjiri HN. *Aust Endod J.* 2023 Apr 27. doi: 10.1111/aej.12760. PMID: 37102259

To evaluate the efficacy of conventional irrigants and herbal extracts materials which helps to resist fracture of endodontically treated teeth. 75 maxillary human permanent incisor teeth instrumented using ProTaper rotary files till apical size(F4). Instrumented samples divided into 5 groups with n = 15 based on various irrigants used. Group I: normal saline, Group II: 5% sodium hypochlorite (NaOCl), Group III: 2% chlorohexidine, Group IV: 10% Azadirachta indica (neem extract) and Group V: 10% Ocimum sanctum (tulsi extract).After that, root canals were proceeded to be filled by using single gutta-percha cone and Sealapex sealer. Specimens were then prepared and loaded until root fracture occurred. Maximum mean flexural strength of dentin (fracture resistance) was obtained from group treated with 2% chlorohexidine and 10% neem extract. Least fracture resistance was observed with 5% NaOCl. Herbal irrigants can be used as an alternative to NaOCl as they exhibit high fracture resistance.

Traditional medicine trade and uses in the surveyed medicine markets of Western Kenya.

Chebii WK, Muthee JK, Kiemo JK.

Afr Health Sci. 2022 Dec;22(4):695-703. doi: 10.4314/ahs.v22i4.76.PMID: 37092072

Background: There exist vast traditional medicine and herbal remedies prescribed for diseases and socio-cultural ills that are sold in local medicine markets. **Objectives:** To assess the common traditional medicine traded in the local medicine markets and used for treating common diseases. **Methods:** The study was carried out in nine purposively selected medicine markets spread out in seven administrative counties of Western Kenya. Purposive sampling with elements of snow ball method was employed in the identification of willing respondents. In addition, face to face interviews were conducted with the aid of a pre-tested semi-structured questionnaire that sought to extract a targeted and expertise information from the respondents. **Results:** The survey recorded 45 commonly traded plant families composed of 78 genera and 87 medicinal plant species. Meliaceae, Apocynaceae and Fabaceae were leading plant families whereas *Trichilia emetica*, *Azadirachta indica*,

Dregea schimperi and *Aloe spp.* were commonly traded. **Conclusion:** Traditional medicine traded in the local medicine markets continue to play a significant role in the treatment of common diseases. Frequently traded medicinal plant species should be prioritized for conservation.

Evaluation of effects of essential oil vapors on the bacterial count in bioaerosols.

Shetty V, Varalakshmi KS, Prakash AJ, Lakshmi MV, Harsha M. *J Oral Maxillofac Pathol.* 2022 Oct-Dec;26(4):601. doi: 10.4103/jomfp.jomfp_279_21. Epub 2022 Dec 22. PMID: 37082083

Background: The aerosols generated during dental treatments contain bacteria and other microorganisms that penetrate the body through the respiratory system of dental surgeons and cause infectious diseases. Several studies have been done to reduce these hazards. The aim of the present study is to evaluate the effects of the plant extract essential oil (EO) vapors of Neem, Clove, Cinnamon bark, Thyme, Lemon Grass, and *Eucalyptus* on the bacterial count in bioaerosols near dental units. **Materials and methods:** Sampling was taken on nutrient blood agar plates by placing them open near dental units using passive air sampling method, before commencement of treatment for 1 h, during treatments for 2 h, and after introducing EO vapors for 2 h. The collected samples were taken for incubation at 37°C for 48 h. The colonies formed were counted in colony-forming units per cubic meter and taken for statistical analysis. **Results:** After comparing the obtained results, it was found that there was a significant reduction ($P < 0.05$) in the bacterial count for about 43% near the dental units after the introduction of the EO vapours. **Conclusion:** It is concluded that natural extracts like EOs can reduce bacterial contamination near dental units in the vapourized state, thereby reducing the health hazards in Dental Health Professionals.

Green synthesis of MgO nanoparticles and its antibacterial properties.

Rotti RB, Sunitha DV, Manjunath R, Roy A, Mayegowda SB, Gnanaprakash AP, Alghamdi S, Almeahmadi M, Abdulaziz O, Allahyani M, Aljuaid A, Alsaiari AA, Ashgar SS, Babalghith AO, Abd El-Lateef AE, Khidir EB. *Front Chem.* 2023 Mar 23;11:1143614. doi: 10.3389/fchem.2023.1143614. eCollection 2023. PMID: 37035117

Magnesium oxide nanostructured particles (NP) were prepared using a simple solution combustion technique using different leaf extracts such as *Mangifera indica* (Mango - Ma), *Azadirachta indica* (Neem-Ne), and *Carica papaya* (Papaya-Pa) as surfactants. The highly crystalline phase of MgO nanostructures was confirmed by PXRD and FTIR studies for 2 h 500°C calcined samples. To analyze the characteristics of obtained material-MaNp, NeNP, and PaNP for dosimetry applications, thermoluminescence (TL) studies were carried out for Co-60 gamma rays irradiated samples in the dose range 10-50 KGy; PaNP and NeNP exhibited well-defined glow curve when compared with MaNP samples. In addition, it was observed that the TL intensity decreases, with increase in gamma dose and the glow peak temperature is shifted towards the higher temperature with the increase in heating rate. The glow peak was segregated using glow curve deconvolution and thermal cleaning method. Kinetic parameters estimated using Chen's method, trap depth (E), and frequency factor (s) were found to be 0.699, 7.408, 0.4929, and 38.71, 11.008, and 10.71 for PaNP, NeNP, and MaNP respectively. The well-resolved glow curve, good linear behavior in the dose range of 10-50, KGy, and less fading were observed in PaNP as compared with MaNP and NeNP.

Further, the antibacterial activity was checked against human pathogens such as *Escherichia coli*, *Staphylococcus aureus*, and *Pseudomonas aeruginosa*. A visible zone of clearance was observed at 200 and 100 µg/mL by the PaNP and NeNP, indicating the death of colonies by the nanoparticles. Therefore, PaNP nanomaterial is a potential phosphor material for dosimetry and antibacterial application compared to NeNP and MaNP.

Green synthesis of multi-functional carbon dots from medicinal plant leaves for antimicrobial, antioxidant, and bioimaging applications.

Gedda G, Sankaranarayanan SA, Putta CL, Gudimella KK, Rengan AK, Girma WM. *Sci Rep.* 2023 Apr 19;13(1):6371. doi: 10.1038/s41598-023-33652-8. PMID: 37076562

In this research work, carbon dots (CDs) were synthesized from the renewable leaves of an indigenous medicinal plant by the one-pot sand bath method, *Azadirachta indica*. The synthesized CDs were characterized for its optical properties using UV-Vis, Fluorescence and Fourier transform infrared (FT-IR) spectrophotometry and for structural properties using dynamic light scattering (DLS), X-ray Diffraction (XRD) and high resolution Transmission electron microscopy (HR-TEM). The synthesized CDs exhibited concentration dependent biocompatibility when tested in mouse fibroblast L929 cell line. The EC₅₀ values of biomedical studies, free radical scavenging activity (13.87 µg mL⁻¹), and total antioxidant capacity (38 µg mL⁻¹) proved CDs were exceptionally good. These CDs showed an appreciable zone of inhibition when examined on four bacterial (two gram-positive and gram-negative) and two fungal strains at minimum concentrations. Cellular internalisation studies performed on human breast cancer cells (MCF 7- bioimaging) revealed the applicability of CDs in bioimaging, wherein the inherent fluorescence of CDs were utilised. Thus, the CDs developed are potential as bioimaging, antioxidants and antimicrobial agents.

Effect of biosynthesized nanoselenium using *Azadirachta indica* (Meliaceae) leaf extracts against *Eimeria papillata* infection.

Abdel-Gaber R, Hawsah MA, Al-Shaebi EM, Al-Otaibi T, Thagfan FA, Al-Quraishy S, Dkhil MA.

Microsc Res Tech. 2023 Apr 21. doi: 10.1002/jemt.24331. PMID: 37083178

Coccidiosis is a protozoan parasitic disease affecting different animal species. Resistance has been reported for all available anticoccidial drugs. Recently, green synthesis of nanoparticles is considered a new therapeutic tool against this parasitic disease. The present work aimed to study the effect of biosynthesized nanoselenium from *Azadirachta indica* leaf extracts (BNS) against *Eimeria papillata*-induced infection in mice. The phytochemical analysis of leaf extracts contained 33 phytochemical components. The BNS was spherical with ~68.12 nm in diameter and an absorption peak at 308 nm via UV-spectra. The data showed that mice infected with *E. papillata* revealed the highest oocyst output on the 5th-day post-infection (p.i.). Infection also induced injury and inflammation of the mice jejunum. Treatment with BNS resulted in a 97.21% suppression for the oocyst output. The treated groups with BNS showed enhancement in feed intake as compared to the infected group. Histological examinations showed a significant reduction in the intracellular developmental *Eimeria* stages in the jejunal tissues of infected-treated mice of about 24.86 ± 2.38 stages/10 villous crypt units. Moreover, there was a significant change in the

morphometry for *Eimeria* stages after the treatment with BNS. Infection induced a disturbance in the level of carbohydrates and protein contents in the infected mice which enhanced after treatment with BNS. In addition, BNS counteracted the *E. papillata*-induced loss of the total antioxidant capacity. Collectively, BNS is considered a promising anticoccidial and antioxidant effector and could be used for the treatment of coccidiosis.

Nimbolide Exhibits Potent Anticancer Activity Through ROS-Mediated ER Stress and DNA Damage in Human Non-small Cell Lung Cancer Cells.

Chen X, Zhang H, Pan Y, Zhu N, Zhou L, Chen G, Wang J. *Appl Biochem Biotechnol.* 2023 Apr 27. doi: 10.1007/s12010-023-04507-9. PMID: 37103738

The non-small cell lung cancer (NSCLC) accounts for about 85% of all lung cancers. It is usually diagnosed at an advanced stage with poor prognosis. Nimbolide (NB), a terpenoid limonoid isolated from the flowers and leaves of neem tree, possesses anticancer properties in various cancer cell lines. However, the underlying mechanism of its anticancer effect on human NSCLC cells remains unclear. In the present study, we investigated the effect of NB on A549 human NSCLC cells. We found that NB treatment inhibits A549 cells colony formation in a dose-dependent manner. Mechanistically, NB treatment increases cellular reactive oxygen species (ROS) level, leading to endoplasmic reticulum (ER) stress, DNA damage, and eventually induction of apoptosis in NSCLC cells. Furthermore, all these effects of NB were blocked by pretreatment with antioxidant glutathione (GSH), the specific ROS inhibitor. We further knockdown CHOP protein by siRNA markedly reduced NB-induced apoptosis in A549 cells. Taken together, our findings reveal that NB is an inducer of ER stress and ROS; these findings may contribute to increasing the therapeutic efficiency of NSCLC.

Nimbin analog N2 alleviates high testosterone induced oxidative stress in CHO cells and alters the expression of Tox3 and Dennd1a signal transduction pathway involved in the PCOS zebrafish.

Sudhakaran G, Rajesh R, Murugan R, Velayutham M, Guru A, Boopathi S, Muthupandian S, Gopinath P, Arockiaraj J. *Phytother Res.* 2023 Apr;37(4):1449-1461. doi: 10.1002/ptr.7685. Epub 2022 Nov 30. PMID: 36450691

Polycystic ovarian syndrome (PCOS) is a hormonal disorder that causes enlargement of ovaries and follicular maturation arrest, which lacks efficient treatment. N2, a semi-natural triterpenoid from the neem family, was already reported to have antioxidant and antiinflammatory properties in our previous report. This study investigated the anti-androgenic property of N2 on testosterone-induced oxidative stress in Chinese Hamster Ovarian cells (CHO) and PCOS zebrafish model. The testosterone exposure disrupted the antioxidant enzymes and ROS level and enhanced the apoptosis in both CHO cells and PCOS zebrafish. However, N2 significantly protected the CHO cells from ROS and apoptosis. N2 improved the Gonado somatic index (GSI) and upregulated the expression of the SOD enzyme in zebrafish ovaries. Moreover, the testosterone-induced follicular maturation arrest was normalized by N2 treatment in histopathology studies. In addition, the

gene expression studies of Tox3 and Dennd1a in zebrafish demonstrated that N2 could impair PCOS condition. Furthermore, to confirm the N2 activity, the in-silico studies were performed against PCOS susceptible genes Tox3 and Dennd1a using molecular docking and molecular dynamic simulations. The results suggested that N2 alleviated the oxidative stress and apoptosis in-vitro and in-vivo and altered the expression of PCOS key genes.

Targeted Inhibition of Hsp90 in Combination with Metformin Modulates Programmed Cell Death Pathways in A549 Lung Cancer Cells.

Hasan A, Khamjan N, Lohani M, Mir SS.
Appl Biochem Biotechnol. 2023 Mar 31. doi: 10.1007/s12010-023-04424-x.
PMID: 37000353

The pathophysiology of lung cancer is dependent on the dysregulation in the apoptotic and autophagic pathways. The intricate link between apoptosis and autophagy through shared signaling pathways complicates our understanding of how lung cancer pathophysiology is regulated. As drug resistance is the primary reason behind treatment failure, it is crucial to understand how cancer cells may respond to different therapies and integrate crosstalk between apoptosis and autophagy in response to them, leading to cell death or survival. Thus, in this study, we have tried to evaluate the crosstalk between autophagy and apoptosis in A549 lung cancer cell line that could be modulated by employing a combination therapy of metformin (6 mM), an anti-diabetic drug, with gedunin (12 μ M), an Hsp90 inhibitor, to provide insights into the development of new cancer therapeutics. Our results demonstrated that metformin and gedunin were cytotoxic to A549 lung cancer cells. Combination of metformin and gedunin generated ROS and promoted MMP loss and DNA damage. The combination further increased the expression of AMPK α 1 and promoted the nuclear localization of AMPK α 1/ α 2. The expression of Hsp90 was downregulated, further decreasing the expression of its clients, EGFR, PIK3CA, AKT1, and AKT3. Inhibition of the EGFR/PI3K/AKT pathway upregulated TP53 and inhibited autophagy. The combination was promoting nuclear localization of p53; however, some cytoplasmic signals were also detected. Further increase in the expression of caspase 9 and caspase 3 was observed. Thus, we concluded that the combination of metformin and gedunin upregulates apoptosis by inhibiting the EGFR/PI3K/AKT pathway and autophagy in A549 lung cancer cells.

Neem for Sustainable Environment

Characterization, catalytic, and recyclability studies of nano-sized spherical palladium particles synthesized using aqueous poly-extract (turmeric, neem, and tulasi).

Velidandi A, Sarvepalli M, Gandam PK, Prashanth Pabbathi NP, Baadhe RR.
Environ Res. 2023 Apr 3:115821. doi: 10.1016/j.envres.2023.115821. PMID: 37019298

Green synthesis of noble metal nanoparticles (NPs) has gained immense significance compared to other metal ions owing to their unique properties. Among them, palladium 'Pd' has been in the spotlight for its stable and superior catalytic activity. This work focuses on the synthesis of Pd NPs using the combined aqueous extract (poly-extract) of turmeric (rhizome), neem (leaves), and tulasi (leaves). The bio-synthesized Pd NPs were characterized to study its physicochemical and morphological features using several analytical techniques. Role of Pd NPs as nano-catalysts in the degradation of dyes (1 mg/2 mL stock solution) was evaluated in the presence of a strong reducing agent (sodium borohydride; SBH). In the presence of Pd NPs and SBH, maximum reduction of methylene blue (MB), methyl orange (MO), and rhodamine-B (Rh-B) dyes was observed under 20 min (96.55 ± 2.11%), 36 min (96.96 ± 2.24%), and 27 min (98.12 ± 1.33%), with degradation rate of 0.1789 ± 0.0273 min⁻¹, 0.0926 ± 0.0102 min⁻¹, and 0.1557 ± 0.0200 min⁻¹, respectively. In combination of dyes (MB + MO + Rh-B), maximum degradation was observed under 50 min (95.49 ± 2.56%) with degradation rate of 0.0694 ± 0.0087 min⁻¹. It was observed that degradation was following pseudo-first order reaction kinetics. Furthermore, Pd NPs showed good recyclability up to cycle 5 (72.88 ± 2.32%), cycle 9 (69.11 ± 2.19%) and cycle 6 (66.21 ± 2.72%) for MB, MO and Rh-B dyes, respectively. Whereas, up to cycle 4 (74.67 ± 0.66%) during combination of dyes. As Pd NPs showed good recyclability, they can be used for several cycles thus influencing the overall economics of the process.