Neem Research Newsletter

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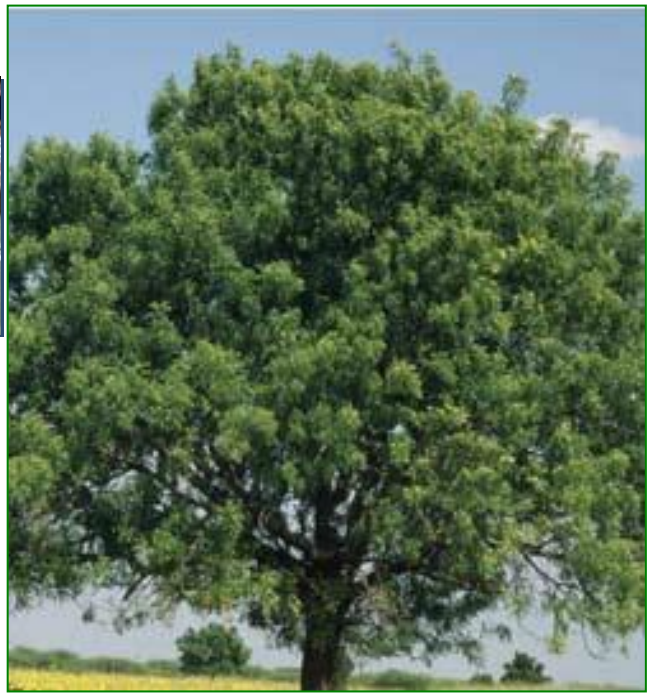
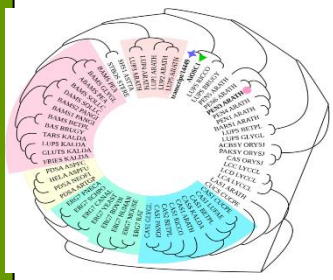
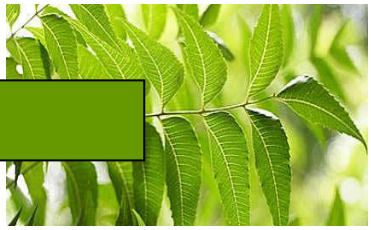




WORLD NEEM ORGANISATION (WNO)



From The Editor's Desk.....

Wishing all Neem enthusiasts a Happy Neem March. This issue highlights the potential of neem in various fronts. In Nigeria, intercropping of suitable vegetables in combination with the application of aqueous extracts of *Azadirachta indica* proved to be most successful in the among the IPM practices. Another study demonstrated for the first time, the positive role of neem oil in the proliferation of olive in vitro with low zeatin concentrations. Interestingly, machine learning was found to be a useful tool for predicting the properties of modified gedunin molecules that could aid in rational drug design and development. Neem extract incorporated electrospun polyvinyl alcohol nanofiber membrane was prepared to obtain a sustainable and hydrophilic facial mask highlighting the application of neem in cosmetic industry. Several studies have reinforced the antimicrobial potential of neem. Deacetyl epoxyazadiradione was found to exert renoprotective effects. Neem leaf extract was used for sustainable synthesis of Fe-Zn nanocomposites to remove crystal violet. Neem oil was found to be a highly effective lubricant in reducing cutting forces, tool wear and surface roughness during turning of AISI 316L stainless steel under minimum quantity lubrication.

S. Nagini

Core Founding Member, WNO
Chief Scientific Coordinator &
Regional Director, South India

A Review of Insect Pest Management in Vegetable Crop Production in Nigeria.

Ofuya TI, Okunlola AI, Mbata GN.

Insects. 2023 Jan 21;14(2):111. doi: 10.3390/insects14020111. PMID: 36835680

Insect pest infestations and damage can limit the production of vegetables in the farming systems in Nigeria. This review looks at integrated insect pest management as a possible panacea for resolving insect pest issues in vegetable crops. The main vegetable crops which include okra, tomatoes, chilli peppers, cucumbers, green amaranth, carrots and onions are highlighted. The major insect pests of the various vegetables which include foliage beetles, caterpillars, aphids, fruit flies, stink bugs, and grasshoppers are also mentioned. The various control measures that have been empirically verified for the mitigation of the impact of these insect pests, including the application of synthetic insecticides, modification of agronomic practices, use of resistant varieties, application of botanicals, biological and mechanical controls, are discussed. Studies which have been carried out attempting to integrate two or more of the control strategies for better insect pest control are also reviewed. Strategies that can be put in place for the integrated pest management of vegetable insect pests in Nigeria are considered. Among the IPM (Integrated Pest Management) practices instituted for the mitigation of pest infestations on vegetable crops in Nigeria, intercropping of suitable vegetables in combination with the application of aqueous extracts of *Azadirachta indica* and *Piper guineense* seeds under good farm hygiene and sanitation proved to be most successful.

Efficacy of Organic Fungicides for Downy Mildew in Field-Grown Sweet Basil.

McGrath MT.Plant Dis. 2023 Feb 1. doi: 10.1094/PDIS-10-22-2424-RE. PMID: 36724027

Downy mildew is a common, widespread disease affecting the leaves of sweet basil, which is the herb grown the most globally. No tolerance for disease symptoms, especially on basil leaves marketed for fresh consumption, necessitates management. Six replicated experiments were conducted between 2010 and 2016 with field-grown basil of a susceptible cultivar exposed to naturally-occurring wind-dispersed sporangiospores of Peronospora belbahrii to evaluate fungicides approved for use on organically-produced crops, as well as products in development for this use. Most fungicides tested are biopesticides. Products tested that currently are registered for use on basil in the U.S. and labeled for downy mildew were Actinovate (Streptomyces lydicus), Companion (Bacillus subtilis), Cueva (copper octanoate), Double Nickel (Bacillus amyloliquefaciens), Forticept EP #1 (thyme oil), Milagrum Plus (Bacillus subtilis), Organocide (sesame oil), Oso (polyoxin D zinc salt), OxiDate (hydrogen dioxide), Procidic (citric acid), Regalia (Reynoutria sachalinensis extract), Stargus (Bacillus amyloliquefaciens), and Trilogy (neem oil). Seven other products were tested. A conventional fungicide, Revus (mandipropamid), was included in most experiments serving as a positive control for comparison. Applications were made weekly to foliage with a backpack sprayer starting before symptoms were seen in the plots, except in 2013 when disease onset was early and in 2015 when a twice weekly application schedule was used. Organic treatments tested in 2013 started with a soil drench application around the base of plants two days after they were transplanted. Fungicide efficacy was assessed based on incidence of symptomatic leaves rather than disease severity which is stringent

but realistic because there is no tolerance for disease on fresh-market herbs. None were effective based on weekly severity assessments or AUDPC values, which confirms results obtained by other researchers that downy mildew cannot be effectively managed with organic fungicides applied to susceptible cultivars of basil.

Neem Oil to Reduce Zeatin Use and Optimize the Rooting Phase in *Olea europaea* L. Micropropagation.

Regni L, Facchin SL, da Silva DF, De Cesaris M, Famiani F, Proietti P, Micheli M. Plants (Basel). 2023 Jan 28;12(3):576. doi: 10.3390/plants12030576. PMID: 36771660

Micropropagation is an in vitro propagation technique, established in the nursery field sector for numerous species, which offers several advantages compared to traditional agamic propagation techniques. In the case of the olive tree, however, despite the advances made through research, it is still little used, due to the recalcitrance to in vitro proliferation and/or rooting of many olive cultivars and the high cost of zeatin, the only cytokinin that makes it possible to achieve a satisfactory proliferation rate in this species. In this context, numerous attempts have been made to identify alternative cytokinin compounds able to improve the proliferation rate of olive tree explants and thus reduce the unitary production cost. In particular, there is a growing interest in the use of natural substances (called in some cases "complex mixtures"), which, when added to the in vitro cultivation substrates, seem to be able to improve proliferation rates. In the present study, neem oil was added to the propagation substrates (partially/totally replacing zeatin) and in the rooting phase for the olive cultivar Moraiolo. In particular, in the proliferation phase, the effect of neem oil (0.1 mL L^{-1}) in substrates containing different zeatin concentrations (0, 1, 2, and 4 mg L^{-1}) was evaluated. For the rooting phase, agarized substrate and soil were used with shoots derived from a standard proliferation substrate (4 mg L^{-1} zeatin) and from the substrate that gave the best results in the proliferation phase (2 mg L^{-1} zeatin and 0.1 mL L^{-1} neem oil). In the proliferation phase, the addition of neem oil in the substrates with low zeatin concentration (1 and 2 mg L^{-1}) induced an increase in the number of adventitious shoots and shoots length. On the contrary, the addition of neem oil in the rooting substrates did not positively influence the rooting phase, but positive results especially in terms of root number and length were observed in explants derived from a neem oil-enriched proliferation substrate compared to the control substrate. Therefore, the present study demonstrated for the first time the positive role of neem oil in the proliferation of olive in vitro with low zeatin concentrations.

Efficacy evaluation of some fumigants against Fusarium oxysporum and enhancement of tomato growth as elicitor-induced defense responses.

El-Aswad AF, Aly MI, Alsahaty SA, Basyony ABA. Sci Rep. 2023 Feb 11;13(1):2479. doi: 10.1038/s41598-023-29033-w. PMID: 36774421

Fusarium wilt, the most serious soil-borne pathogen, is a serious problem for tomato production worldwide. The presented study evaluated the antifungal activity against Fusarium oxysporum f. sp. lycopersici in vitro and in vivo for nine fumigants. In addition, the research examined the possibility of enhancing the growth of tomato plants in order to increase resistance against this disease by using four chemical inducers. The results indicated that at 20 mg/L, the radial growth of the pathogen was inhibited 100% by formaldehyde and > 80% by phosphine. Among the essential oils investigated, neem oil was

the most effective, however, it only achieved 40.54% at 500 mg/L. The values of EC_{50} for all fumigants, except dimethyl disulfide (DMDS) and carbon disulfide (CS2), were lower than those for thiophanate-methyl. Phosphine was the highest efficient. The elicitors can be arranged based on their effectiveness, gibberellic acid (GA3) > sorbic acid > cytokinin (6-benzylaminopurine) > indole-3-butyric acid. The change in root length, fresh weight, and dry weight was greater with soil drench than with foliar application. The fumigant generators formaldehyde, phosphine and 1,4-dichlorobenzene and bio-fumigants citrus and neem oils as well as elicitors gibberellic and sorbic acid could be one of the promising alternatives to methyl bromide against Fusarium oxysporum as an important component of integrated management of Fusarium wilt.

Evaluating options to increase the efficacy of biocontrol agents for the management of Pantoea spp. under field conditions.

Koirala S, Myers B, Shin GY, Gitaitis R, Kvitko B, Dutta B.Plant Dis. 2023 Feb 12. doi: 10.1094/PDIS-11-22-2710-RE. Online ahead of print.PMID: 36774574

Center rot of onion is caused by plant pathogenic Pantoea species which can lead to significant yield losses in the field and during storage. Conventional growers use foliar protectants such as a mixture of copper bactericides and an ethylene-bis-dithiocarbamate (EBDC) fungicide to manage the disease; however, organic growers have limited management options besides copper-protectants. Biocontrol agents (BCAs) provide an alternative; however, their efficacy could be compromised due in part to their inability to colonize the foliage. We hypothesized that pre-treatment with peroxide (OxiDate 2.0: a.i. hydrogen peroxide and peroxyacetic acid) enhances the colonizing ability of the subsequently applied BCAs leading to effective center rot management. Field trials were conducted in 2020 and 2021 to assess the efficacy of peroxide, BCAs (Serenade ASO: Bacillus subtilis and BlightBan: Pseudomonas fluorescens) and an insecticide program (tank mix of spinosad and neem oil) to manage center rot. We observed no significant difference in foliar AUDPC between the peroxide pre-treated P. fluorescens plots and only-P. fluorescens treated plots in 2020 and 2021. Peroxide pre-treatment before B. subtilis significantly reduced the foliar AUDPC as compared to stand-alone B. subtilis treatment in 2020; however, no such difference was observed in 2021. Similarly, peroxide pre-treatment before either of the BCAs did not seem to reduce the incidence of bulb rot as compared to the stand-alone BCAs treatment in any of the trials. Additionally, our foliar microbiome study showed comparatively higher P. fluorescens retention on peroxide pre-treated onion foliage; however, at the end of the growing season, P. fluorescens was drastically reduced and was virtually non-existent (<0.002% of the total reads). Overall, the pre-treatment with peroxide had a limited effect in improving the foliar colonizing ability of BCAs and consequently a limited effect in managing center rot.

Bio-Intensive Tactics for the Management of Invasive Fall Armyworm for Organic Maize Production.

Keerthi MC, Suroshe SS, Doddachowdappa S, Shivakumara KT, Mahesha HS, Rana VS, Gupta A, Murukesan A, Casini R, Elansary HO, Shakil NA.
Plants (Basel). 2023 Feb 3;12(3):685. doi: 10.3390/plants12030685.PMID: 36771769

Spodoptera frugiperda (J.E. Smith) (Lepidoptera: Noctuidae) is an invasive pest native to the American continent. The present study focused on bio-intensive tactics like

intercropping, using natural enemies, botanical insecticides and biopesticides for managing *S. frugiperda* for the organic production of maize in Indian conditions. A total of eight different parasitoids attacking the different stages of *S. frugiperda viz.,* eggs and larvae were found in the study area. The total parasitism rate due to all the parasitoids ranged from 28.37 to 42.44%. The egg-larval parasitoid, *Chelonus formosanus* Sonan (Hymenoptera: Braconidae) was the dominant parasitoid (12.55%), followed by *Chelonus* nr. *blackburni* (Hymenoptera: Braconidae) (10.98%) and *Coccygydium* sp. (4.85%). About 36.58 percent of the egg masses collected was parasitized by egg parasitoids, among which *Telenomus remus* (Nixon) (Hymenoptera: Scelionidae) was the dominant parasitoid. The botanicals insecticides such as citronella and annona extract were most effective, resulting in 100% mortality of FAW larvae (168 h after treatment). The essential oil of garlic (100%) was found highly effective in inhibiting egg hatching, followed by geraniol (90.76%). The maize intercropped with lady's finger (okra) recorded significantly the lowest pest infestation and recorded higher grain yield (6.17 q/ha) than other intercropping systems and control (5.10 q/ha). The overall bioefficacy of commercial biopesticides against the larvae of *S. frugiperda* was in the following order azadirachtin > *Metarhizium anisopliae* (Metch.) Sorokin (Hypocreales: Clavicipitaceae) > *Beauveria bassiana* (Balsamo) Vuillemin (Hypocreales: Clavicipitaceae) at 168 h after treatment.

The Impact of Systematic Insecticides Against Emerald Ash Borer on Phenology of Urban Ash Trees.

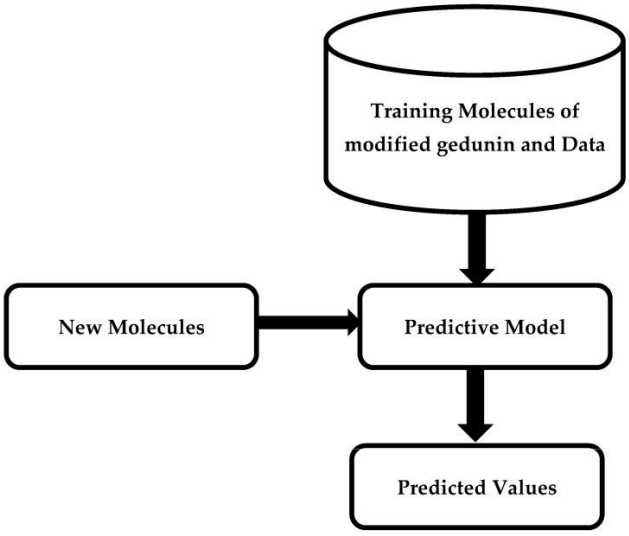
Mwangola DM, Kees AM, Grosman DM, Aukema BH.
J Econ Entomol. 2023 Feb 3: toad015. doi: 10.1093/jee/toad015. PMID: 36734017

The continued threat of emerald ash borer (Agrilus planipennis; EAB) to North American ash trees (Fraxinus spp.) has necessitated the use of systemic insecticide treatments as a primary control strategy against EAB in urban centers. Altered tree phenology due to systemic insecticides could mediate nontarget effects on other insect species, such as seed weevils or leaf-feeders, but whether such injections alter phenological events has not been studied. This study assessed the effects of systemic injections of emamectin benzoate or azadirachtin relative to untreated controls on the spring and fall phenology of mature green ash trees in Saint Paul, MN, USA from fall 2017 to spring 2019. EAB was first detected in this area in 2009. Trees showed minor, visible signs of EAB infestation at study initiation, but not mortality. We examined six phenological events: bud swelling, budburst, flowering, leaf out, leaf color change, and leaf abscission using a visual survey protocol. The timing of phenological events was similar across the different treatments for all but two of events; budburst and flowering. Budburst and flowering occurred 7 d and 5 d earlier, respectively, in treated trees than untreated trees. Given symptoms observed, we posit that delays in these events in untreated trees were due to infestations of EAB and the treatments of emamectin benzoate or azadiractin simply preserved the original phenology. The results from this study suggest that systemic insecticides may mitigate changes in ash tree phenology such as delayed leaf out that may be early symptoms of emerald ash borer.

Neem Limonoids- Prediction of Molecular Properties by Machine Learning Tools

Molecular Property Prediction of Modified **Gedunin** Using Machine Learning.
Aly M, Alotaibi AS.Molecules. 2023 Jan 23;28(3):1125. doi: 10.3390/molecules28031125.PMID: 36770791

Images of molecules are often utilized in education and synthetic exploration to predict molecular characteristics. Deep learning (DL) has also had an influence on drug research, such as the interpretation of cellular images as well as the development of innovative methods for the synthesis of organic molecules. Although research in these areas has been significant, a comprehensive review of DL applications in drug development would be beyond the scope of a single Account. In this study, we will concentrate on a single major area where DL has influenced molecular design: the prediction of molecular properties of modified gedunin using machine learning (ML). AI and ML technologies are critical in drug research and development. In these other words, deep learning (DL) algorithms and artificial neural networks (ANN) have changed the field. In short, advances in AI and ML present a good potential for rational drug design and exploration, which will ultimately benefit humanity. In this paper, long short-term memory (LSTM) was used to convert a modified gedunin SMILE into a molecular image. The 2D molecular representations and their immediately visible highlights should then provide adequate data to predict the subordinate characteristics of atom design. We aim to find the properties of modified gedunin using K-means clustering; RNN-like ML tools. To support this postulation, neural network (NN) clustering based on the AI picture is used and evaluated in this study. The novel chemical developed via profound learning has long been predicted on characteristics. As a result, LSTM with RNNs allow us to predict the properties of molecules of modified gedunin. The total accuracy of the suggested model is 98.68%. The accuracy of the molecular property prediction of modified gedunin research is promising enough to evaluate extrapolation and generalization. The model suggested in this research requires just seconds or minutes to calculate, making it faster as well as more effective than existing techniques. In short, ML can be a useful tool for predicting the properties of modified gedunin molecules.



Neem in Cosmetic Industry

Development of Sustainable Hydrophilic ***Azadirachta indica*** Loaded PVA Nanomembranes for Cosmetic Facemask Applications.

Tahir R, Albargi HB, Ahmad A, Qadir MB, Khaliq Z, Nazir A, Khalid T, Batool M, Arshad SN, Jalalah M, Alsareii SA, Harraz FA.Membranes (Basel). 2023 Jan 26;13(2):156. doi: 10.3390/membranes13020156.PMID: 36837659

Nanofiber-based facial masks have attracted the attention of modern cosmetic applications due to their controlled drug release, biocompatibility, and better efficiency. In this work, *Azadirachta indica* extract *(AI)* incorporated electrospun polyvinyl alcohol (PVA) nanofiber membrane was prepared to obtain a sustainable and hydrophilic facial mask. The electrospun *AI* incorporated PVA nanofiber membranes were characterized by scanning electron microscope, Ultraviolet-visible spectroscopy (UV-Vis) drug release, water absorption analysis, 2,2-diphenyl-1-picrylhydrazyl (DPPH) scavenging, and antibacterial activity (qualitative and quantitative) at different PVA and *AI* concentrations. The optimized nanofiber of 376 ± 75 nm diameter was obtained at 8 wt/wt% PVA concentration and 100% *AI* extract. The *AI* nanoparticles of size range 50~250 nm in the extract were examined through a zeta sizer. The water absorption rate of ~660% and 17.24° water contact angle shows good hydrophilic nature and water absorbency of the nanofiber membrane. The UV-Vis also analyzed fast drug release of >70% in 5 min. The prepared membrane also exhibits 99.9% antibacterial activity against *Staphylococcus aureus* and has 79% antioxidant activity. Moreover, the membrane also had good mechanical properties (tensile strength 1.67 N, elongation 48%) and breathability (air permeability 15.24 mm/s). *AI*-incorporated nanofiber membrane can effectively be used for facial mask application.

Neem for Human Health

Antimicrobial study of cast post and its surface modification with nanoparticle.

Pavithra AS, Maiti S, Rajeshkumar S, Jessy P.J Adv Pharm Technol Res. 2022 Dec;13(Suppl 2):S416-S420. doi: 10.4103/japtr.japtr_329_22. Epub 2022 Dec 30.PMID: 36798573

A cast post is a one-piece unit that is custom fabricated for the tooth at the dental laboratory. Traditional extracts such as neem and green tea have good antimicrobial and antioxidant activity against pathogens. The empty canal space may provide a suitable environment for promoting bacterial growth. The main aim of the study is to find the antimicrobial activity of the cast post coated with the nanoparticle. Prepared cast post was coated with prepared green tea and neem-mediated zinc oxide (ZnO) nanoparticles. Culture is done in agar media where control is noncoated post and another is nanoparticle coated post was implanted in the agar media. The zone of inhibition was noted and statistical analysis was done. The maximum zone of inhibition found on *Candida albicans* (19.333 2.081) followed by *Enterococcus faecalis* (14.000 3.605), and *Streptococcus mutans* (12.666 2.516). Green tea and neem-mediated ZnO nanoparticle showed good antimicrobial activity against the tester microorganism. Cast post coated with nanoparticles has been proved to be important as it is helpful in the prevention of origin and spread of infection around the canal and through the apical foramen.

Characterization and antimicrobial activity of cerium oxide nanoparticles synthesized using **neem** and ginger.

Devi NS, Ganapathy DM, Rajeshkumar S, Maiti S.J Adv Pharm Technol Res. 2022 Dec;13(Suppl 2):S491-S495. doi: 10.4103/japtr.japtr_196_22. Epub 2022 Dec 30.PMID: 36798577

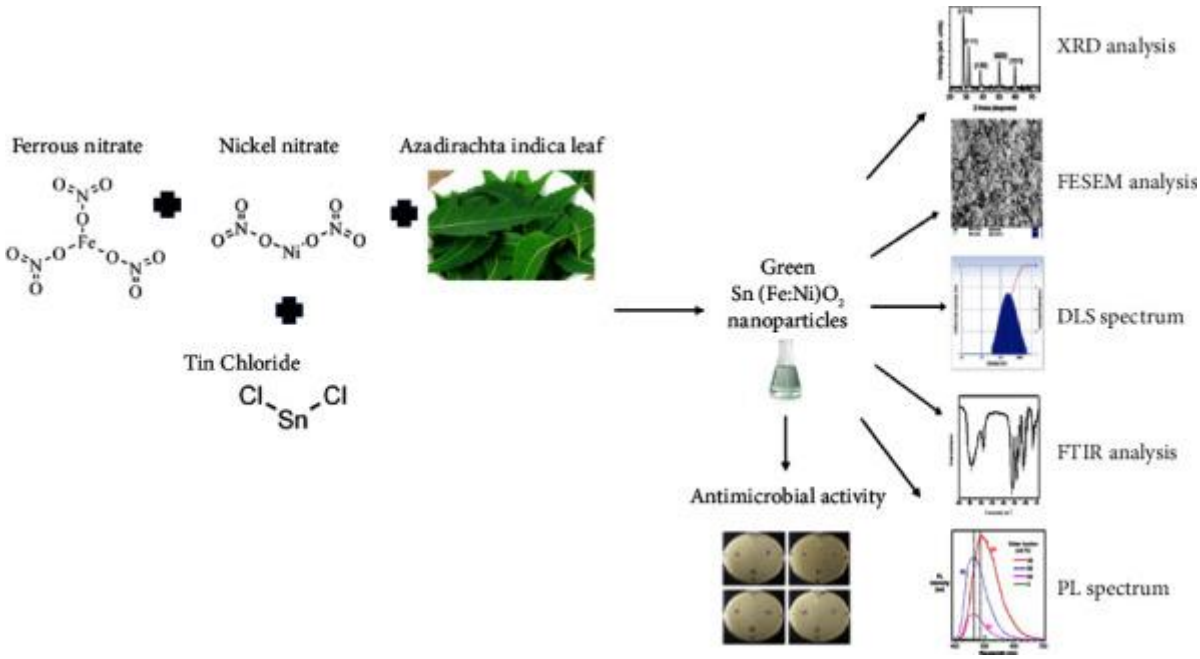
The aim of this study is to analyze and characterize the antimicrobial effect of cerium oxide nanoparticles (NP) synthesized using neem and ginger. Finely grounded neem and ginger powder were taken and mixed with distilled water. This mixture was then heated and filtered. Ammonium cerium nitrate dissolved in distilled water. Both the mixtures were mixed and stirred magnetically. A double-beam ultraviolet-visible spectrophotometer was used to monitor color changes. The extract was centrifuged at 8000 rpm for 15 min. The final pellet was powdered using a hot air oven at 70°C for 24 h. Visualization was done by transmission electron microscopy and spherical morphology was noted, with an average diameter of 5 nm, in aggregated form. The sample containing 100 mg of cerium oxide shows the most significant effect on the zone of inhibition of 11 mm of *Staphylococcus aureus*. The results obtained in the current study confirmed that CeO-NP possessed antioxidant and cytotoxic properties.

Assessment of Structural, Optical, and Antibacterial Properties of Green Sn(Fe : Ni)O_2 Nanoparticles Synthesized Using ***Azadirachta indica*** Leaf Extract.

Aloufi AS.

Bioinorg Chem Appl. 2023 Feb 7;2023:5494592. doi: 10.1155/2023/5494592. eCollection 2023.PMID: 36798449

Metal oxide nanoparticles have attained notable recognition due to their interesting physicochemical properties. Although these nanoparticles can be synthesized using a variety of approaches, the biological method involving plant extracts is preferred since it provides a simple, uncomplicated, ecologically friendly, efficient, rapid, and economical way for synthesis. In this study, the *Azadirachta indica* leaf extract was used as a reducing agent, and a green process was used to synthesize tin(ferrous: nickel)dioxide (Sn(Fe : Ni)O_2) nanoparticles. The synthesized nanoparticles were subjected to characterization by using X-ray diffraction (XRD), energy-dispersive X-ray (EDX) spectroscopy analysis, field emission scanning electron microscopy (FESEM), Fourier transform infrared (FTIR) spectroscopy, dynamic light scattering (DLS), and photoluminescence (PL) measurement. Furthermore, Sn(Fe : Ni)O_2 nanoparticles were analyzed for their antimicrobial activity against Gram-positive and Gram-negative organisms including *Staphylococcus aureus, Streptococcus pneumoniae, Bacillus subtilis, Klebsiella pneumoniae, Escherichia coli*, and *Pseudomonas aeruginosa* bacterial strains. XRD patterns revealed that Sn(Fe : Ni)O_2 nanoparticles exhibited a tetragonal structure. The hydrodynamic diameter of the nanoparticles was 143 nm, as confirmed by the DLS spectrum. The FESEM image showed the spherical form of the synthesized nanoparticles. Chemical composites and mapping analyses were performed through the EDAX spectrum. The Sn-O-Sn and Sn-O stretching bands were 615 cm^{-1} and 550 cm^{-1} in the FTIR spectrum, respectively. Various surface defects of the synthesized Sn(Fe : Ni)O_2 nanoparticles were identified by photoluminescence spectra. Compared to traditional antibiotics like amoxicillin, the inhibition zone revealed that Sn(Fe : Ni)O_2 nanoparticles displayed remarkable antibacterial activity against all tested organisms, indicating the valuable potential of nanoparticles in the healthcare industry.



The Effect of Hydroalcoholic Extracts of Medicinal Plants on Fungi Isolated From Toilet and Nursery Surfaces in a Daycare Center: An In Vitro Study.

Batista Mendes EC, Kozusny-Andreani DI, Rodrigo Ramos R, Pinto Neto JM, Estevam Simonato L, Lozano AW, da Silva WR, Vicente Pereira LL, Garcia Regino DDS, Geraldo de Moraes CMZ. Cureus. 2023 Jan 20;15(1):e34013. doi: 10.7759/cureus.34013. PMID: 36811061

Background Brazil has the most extensive plant genetic biodiversity in the world. Knowledge regarding the therapeutic properties of medicinal plants obtained through popular medicine has been accrued over centuries. Such empirical knowledge often symbolizes the only therapeutic resource for various ethnic communities and groups. This study aimed to evaluate the efficacy of hydroalcoholic extracts of medicinal plants in controlling isolated fungi found in bathrooms and nurseries of a daycare center in the northwestern region of São Paulo state. **Methodology** This is an in vitro study carried out in the microbiology laboratory. The analyzed fungi were *Aspergillus niger*, *Fusarium* spp., *Trichophyton mentagrophytes*, *Microsporum gypseum*, and *Candida albicans*. These fungi were exposed to the hydroalcoholic extracts of rosemary, citronella, rue, neem, and lemon. **Results** Rue extract was more effective against *Candida albicans* at a concentration of 12.5%. Citronella was effective against *Aspergillus niger* and *Trichophyton mentagrophytes* at a concentration of 6.25%. Lemon was effective against *Fusarium* spp. at a concentration of 6.25%. **Conclusions** The hydroalcoholic extracts showed antifungal activity. The in vitro evaluation of medicinal plants showed that the extracts of rue, citronella, and lemon showed a fungicide effect.

Antimicrobial Activity of Some Medicinal Herbs to the Treatment of Cutaneous and Mucocutaneous Infections: Preliminary Research.

Noites A, Borges I, Araújo B, da Silva JCGE, de Oliveira NM, Machado J, Pinto E.Microorganisms. 2023 Jan 20;11(2):272. doi: 10.3390/microorganisms11020272.PMID: 36838237

(1) Background: Superficial, including cutaneous and mucocutaneous infections are a current public health problem with universal distribution. One of the main concerns, in the present/future, is fungal/bacterial infections by resistant microorganisms. This study aimed to verify if decoctions of coptidis (*Coptis chinensis*, Ranunculaceae family), neem (*Azadirachta indica*, Meliaceae family), and their essential oils (EOs), as well as the EO of manuka (*Leptospermum scoparium*, Myrtaceae family) have antimicrobial activity against prevalent species of microorganisms responsible for superficial infections. (2) Methods: The antimicrobial activity was determined by the minimum inhibitory concentration (MIC), using broth microdilution method, and minimum lethal concentration (MLC) was determined from subculture of MIC plates. (3) Results: *C. chinensis* EO and decoction demonstrated some antifungal action against the yeasts and dermatophytes tested. Greatest bactericidal effect against *Propionibacterium acnes* and some action against *Staphylococcus aureus* was observed. For *A. indica* only EO proved activity against dermatophytes and *P. acnes*. *L. scoparium* EO showed the broadest antimicrobial spectrum with activity against bacteria, yeasts, and dermatophytes showing greater activity against *P. acnes* and *S. aureus*. (4) Conclusions: *C. chinensis* (EO/decoction), EOs of *L. scoparium* and *A. indica* proved in vitro efficacy against fungal, bacterial, or mixed agents of superficial infections, either by sensitive or resistant strains.

Phytochemical Screening, Anti-bacterial, Anti-fungal, Anti-biofilm and Anti-oxidant Activity of **Azadirachta Indica** A Juss Flowers.

Mohanasundaram P, Saral M.Chem Biodivers. 2023 Feb 22:e202201049. doi: 10.1002/cbdv.202201049. Online ahead of print.PMID: 36810960

The present study involves investigation of Pharmacognostic properties, phytochemicals, anti-oxidant, anti-biofilm, and anti-microbial activities of Azadirachta Indica A Juss Flower extracts. The Pharmacognostic characteristics were evaluated with respect to moisture content, total ash content, acid, and water-soluble ash content, swelling index, foaming index, and metal content. The macro and micronutrient content of the crude drug was estimated by AAS and Flame photometric methods and it gives the quantitative estimation of minerals, where calcium is present in abundance (88.64 mg/L). Soxhlet extraction was carried out in the increasing order of polarity of the solvent viz Petroleum Ether (PE), Acetone (AC), and Hydroalcohol (20%) (HA). The antioxidant activity of the extracts was evaluated by DPPH, FRAP, and Phosopomolybdenum assay. This reveals that HA extract shows good scavenging activity than PE and AC extracts which is well correlated with the bioactive compounds, especially phenols which are present as a major component in the extract. The anti-microbial activity was investigated via Agar well diffusion method for all the extracts. Among all the extracts HA extract shows good antibacterial activity with MIC of 25 µg/mL and AC extract shows good anti-fungal activity with MIC of 25 µg/mL. The antibiofilm assay confirms that the HA extract shows good biofilm inhibition about 94% among other extracts on human pathogens. The results confirm that the HA extract of A. Indica flowers will be an excellent source of natural anti-oxidant and also antimicrobial agents. This paves the way for its potential uses in herbal product formulation.

Antibacterial efficacy of indigenous Pakistani honey against extensively drug-resistant clinical isolates of Salmonella enterica serovar Typhi: an alternative option to combat antimicrobial resistance.

Ejaz H, Sultan M, Qamar MU, Junaid K, Rasool N, Alanazi A, Alruways MW, Mazhari BBZ, Alruwaili Y, Bukhari SNA, Younas S.

BMC Complement Med Ther. 2023 Feb 8;23(1):42. doi: 10.1186/s12906-023-03870-8.PMID: 36755237

Background: Extensively drug-resistant (XDR) Salmonella enterica serovar Typhi (S. Typhi) poses a grave threat to public health due to increased mortality and morbidity caused by typhoid fever. Honey is a promising antibacterial agent, and we aimed to determine the antibacterial activity of honey against XDR S. Typhi. **Methods:** We isolated 20 clinical isolates of XDR S. Typhi from pediatric septicemic patients and determined the minimum inhibitory concentrations (MICs) of different antibiotics against the pathogens using the VITEK 2 Compact system. Antimicrobial-resistant genes carried by the isolates were identified using PCR. The antibacterial efficacy of five Pakistani honeys was examined using agar well diffusion assay, and their MICs and minimum bactericidal concentrations (MBCs) were determined with the broth microdilution method. **Results:** All 20 isolates were confirmed as S. Typhi. The antibiogram phenotype was confirmed as XDR S. Typhi with resistance to ampicillin (≥ 32 µg/mL), ciprofloxacin (≥ 4 µg/mL), and ceftriaxone (≥ 4 µg/mL) and sensitivity to azithromycin (≤ 16 µg/mL) and carbapenems (≤ 1 µg/mL). Molecular

conformation revealed the presence of bla_{TM-1}, Sul1, qnrS, gyrA, gyrB, and $bla_{CTX-M-15}$ genes in all isolates. Among the five honeys, beri honey had the highest zone of inhibition of 7-15 mm and neem honey had a zone of inhibition of 7-12 mm. The MIC and MBC of beri honey against 3/20 (15%) XDR S. Typhi isolates were 3.125 and 6.25%, respectively, while the MIC and MBC of neem were 3.125 and 6.25%, respectively, against 3/20 (15%) isolates and 6.25 and 12.5%, respectively, against 7/20 (35%) isolates. **Conclusion:** Indigenous honeys have an effective role in combating XDR S. Typhi. They are potential candidates for clinical trials as alternative therapeutic options against XDR S. Typhi isolates.

Comparison study of Beninese and Chinese herbal medicines in treating COVID-19.
Houeze EA, Wang Y, Zhou Q, Zhang H, Wang X.
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Ethnopharmacological relevance: The worldwide use of natural remedies is an alternative therapeutic solution to strengthen immunity, fight, and prevent this disease. The rapid spread of the coronavirus disease worldwide has promoted the search for therapeutic solutions following different approaches. China and Benin have seen the use of natural remedies such as Chinese herbal medicine and local endemic plants as alternative solutions in treating COVID-19. **Aim of the study:** The present study was designed to identify the prevalence of medicinal plant use in four municipalities of Benin most affected by COVID-19 and compare them with traditional Chinese medicine and finally verify the efficacy of the main components of the six plants most frequently used, via in vitro experiments. **Materials and methods:** This study targeting market herbalists and traditional healers was conducted in the form of an ethnomedicinal survey in four representative communities (Cotonou, Abomey-Calavi, Zè, and Ouidah) of southern Benin. The chemical compositions of the six most commonly used herbs were investigated using network pharmacology. Network-based global prediction of disease genes and drug, target, function, and pathway enrichment analysis of the top six herbs was conducted using databases including IPA and visualised using Cytoscape software. The natural botanical drugs involved three medicines and three formulas used in the treatment of COVID-19 in China from the published literature were compared with the top six botanical drugs used in Benin to identify similarities between them and guide the clinical medication in both countries. Finally, the efficacy of the common ingredients in six plants was verified by measuring the viability of BEAS-2B cells and the release of inflammatory factors after administration of different ingredients. Binding abilities of six components to COVID-19 related targets were verified by molecular docking. **Results:** According to the medication survey investigation, the six most used herbs were Citrus aurantiifolia (13.18%), Momordica charantia (7.75%), Ocimum gratissimum (7.36%), Crateva adansonii (6.59%), Azadirachta indica (5.81%), and Zanthoxylum zanthoxyloides (5.42%). The most represented botanical families were Rutaceae, Lamiaceae, Cucurbitaceae, Meliaceae, and Capparaceae. The network pharmacology of these six herbal plants showed that the flavonoids quercetin, kaempferol, and β-sitosterol were the main active ingredients of the Benin herbal medicine. Chinese and Beninese herbal medicine are similar in that they have the same targets and pathways in inflammation and oxidative stress relief. Mild COVID-19-related targets come from C. aurantiifolia and M. charantia, and severe COVID-19-related targets come from A. indica A. Juss. Cell viability

and enzyme-linked immunosorbent assay results confirmed that six major compounds could protect BEAS-2B cells against injury by inhibiting the expression of inflammatory factors, among which quercetin and isoimperatorin were more effective. Docking verified that the six compounds have good binding potential with COVID-19 related targets. **Conclusions:** These results suggest that Benin herbal medicine and Chinese herbal medicine overlap in compounds, targets, and pathways to a certain extent. Among the commonly used plants in Benin, C. aurantiifolia and M. charantia may have a good curative effect on the treatment of mild COVID-19, while for severe COVID-19, A. indica can be added on this basis.

Neem-based products as potential eco-friendly mosquito control agents over conventional eco-toxic chemical pesticides-A review.

Chatterjee S, Bag S, Biswal D, Sarkar Paria D, Bandyopadhyay R, Sarkar B, Mandal A, Dangar TK.Acta Trop. 2023 Feb 5:106858. doi: 10.1016/j.actatropica.2023.106858. PMID: 36750152

Mosquitoes cause serious health hazards for millions of people across the globe by acting as vectors of deadly communicable diseases like malaria, filariasis, dengue and yellow fever. Use of conventional chemical insecticides to control mosquito vectors has led to the development of biological resistance in them along with adverse environmental consequences. In this light, the recent years have witnessed enormous efforts of researchers to develop eco-friendly and cost-effective alternatives with special emphasis on plant-derived mosquitocidal compounds. Neem oil, derived from neem seeds (Azadirachta indica A. Juss, Meliaceae), has been proved to be an excellent candidate against a wide range of vectors of medical and veterinary importance including mosquitoes. It is environment-friendly, and target-specific at the same time. The active ingredients of neem oil include limonoids like azadirachtin A, nimbin, salannin and numerous other substances that are still waiting to be discovered. Of these, azadirachtin has been shown to be very effective and is mainly responsible for its toxic effects. The quality of the neem oil depends on its azadirachtin content which, in turn, depends on its manufacturing process. Neem oil can be used directly or as nanoemulsions or nanoparticles or even in the form of effervescent tablets. When added to natural breeding habitat waters they exert their mosquitocidal effects by acting as ovicides, larvicides, pupicides and/or oviposition repellents. The effects are generated by impairing the physiological pathways of the immature stages of mosquitoes or directly by causing physical deformities that impede their development. Neem oil when used directly has certain disadvantages mainly related to its disintegration under atmospheric conditions rendering it ineffective. However, many of its formulations have been reported to remain stable under environmental conditions retaining its efficiency for a long time. Similarly, neem seed cake has also been found to be effective against the mosquito vectors. The greatest advantage is that the target species do not develop resistance against neem-based products mainly because of the innumerable number of chemicals present in neem and their combinations. This makes neem-based products highly potential yet unexplored candidates of mosquito control agents. The current review helps to elucidate the roles of neem oil and its various derivatives on mosquito vectors of public health concern.

Can natural irrigants replace sodium hypochlorite? A systematic review.

Susila AV, Sai S, Sharma N, Balasubramaniam A, Veronica AK, Nivedhitha S. Clin Oral Investig. 2023 Feb 18. doi: 10.1007/s00784-023-04913-7. PMID: 36808559

Context: Sodium hypochlorite, a gold standard for irrigation in endodontics, has disadvantages like toxicity and root dentin weakening. Alternatives derived from natural products are being explored. **Aims:** This systematic review was done to understand the clinical benefits of natural irrigants when compared with a standard irrigant, sodium hypochlorite. **Settings and design registration:** This systematic review was registered with PROSPERO (2018 CRD42018112837) METHODS AND MATERIAL: This review was done in conformation to the Preferred Reporting Items for Systematic Reviews and Meta-analysis (PRISMA 2020) statement. In vivo studies using at least one natural irrigant and sodium hypochlorite (NaOCl) were included. Studies using them as medicaments were excluded. PubMed, Cochrane and SCOPUS were searched. RevMan tool for Risk of Bias 2 (RoB 2) and risk-of-bias tool to assess non-randomized studies of interventions (ROBINS-I) were used. GRADEpro was used to assess certainty of evidence. **Results:** Ten articles (6 RCTs and 4 clinical studies) on approximately 442 patients were included. Seven natural irrigants were evaluated clinically. Due to the heterogeneity, meta-analysis could not be conducted. Antimicrobial efficacy was found to be similar for castor oil, neem, garlic-lemon, noni, papaine and NaOCl. Neem, papaine-chloramine, neem-NaOCl and neem-CHX were superior, while propolis, miswak and garlic were inferior to NaOCl. Post-operative pain was less for neem. There was no significant difference between papaine-chloramine, garlic extract and sodium hypochlorite in clinical/radiographic success. **Conclusions:** The studied natural irrigants are not more efficacious than NaOCl. At the moment, they cannot replace NaOCl routinely and may only substitute in select cases.

Deacetyl **epoxyazadiradione** protects aminoglycoside antibiotic-induced renal cell apoptosis, in vitro.

Murugan R, Rajesh R, Velayutham M, Juliet A, Gopinath P, Arockiaraj J.

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Aminoglycoside antibiotics such as gentamicin are used frequently to treat bacterial infections in humans. Excessive consumption of these antibiotics lead to renal dysfunction. One of the factors contributing to renal dysfunction is oxidative damage, which causes apoptosis. Hence, this study investigates the effect of the antioxidant compound deacetyl epoxyazadiradione (DEA) in reducing cell death induced by gentamicin treatment in kidney cells (Madin-Darby canine kidney cells). The antioxidant experiments showed that reactive oxygen species level is decreased up to 27.06 ± 0.18% in 150 µM of DEA treatment. At this concentration, the activity of antioxidant enzymes such as superoxide dismutase increased from 0.4 ± 0.04 to 1.46 ± 0.05 µmol/min/L and catalase increased from 7.48 ± 0.39 to 17.6 ± 0.74 U/mg. The relative folds of gene expression of mitochondrial enzymes such as GST, GPx and GR restored from 0.596 ± 0.019, 0.521 ± 0.013 and 0.775 ± 0.014 to 0.866 ± 0.013, 0.669 ± 0.015 and 0.8615 ± 0.028, respectively. Consequently, the percentage of cell viability increases upto 91.8 ± 2.01 from 61.93 ± 1.63 with much less fragmentation in genomic DNA. Additionally, molecular docking results showed that DEA could bind to Bax, Bcl- 2, Caspase- 3 and Caspase- 9 proteins. These results indicate that DEA could reduce cell apoptosis by reducing oxidative stress due to antibiotics and interrupting the apoptotic signal pathway in kidney cells.

Sustainable Synthesis of Iron-Zinc Nanocomposites by ***Azadirachta indica*** Leaves Extract for RSM-Optimized Sono-Adsorptive Removal of Crystal Violet Dye.

Tahir H, Saad M, Attala OA, El-Saoud WA, Attia KA, Jabeen S, Zeb J.

Materials (Basel). 2023 Jan 23;16(3):1023. doi: 10.3390/ma16031023.PMID: 36770029

Environmental pollution has exacerbated the availability of clean water to mankind. In this study, *Azadirachta indica* leaf extract was used for sustainable synthesis of Fe-Zn nanocomposites (IZNC). The instrumental techniques of Fourier transformed infrared (FTIR) spectroscopy, energy dispersive X-ray spectroscopy (EDS), and scanning electron microscopy (SEM) were used to determine the structural and chemical composition. The overall surface was mildly acidic in nature, as the pH_{PZC} was observed to be 6.00. The ultrasonicated adsorption experiments were designed by central composite design (CCD). The best responses, which proposed a contaminants removal of 80.39%, were assessed using the response surface methodology (RSM). By repeating experimental runs at the expected optimum operating parameters (OOP), the method was experimentally affirmed with the %mean error and $\%RSD_9$ being 2.695% and 1.648%, respectively. The interaction of CV dye and the nanocomposite showed tremendous adsorption efficiency towards crystal violet (CV) dye, as revealed by isotherm studies. Fitting kinetics and isotherm models were affirmed by root mean square error (RMSE), $\chi 2$, and a Pearson regression coefficient. Thermodynamic studies proved spontaneity of the CV dye adsorption over the nanocomposites. The values for ΔG^o, ΔH^o, and ΔS^o were observed to be -1.089 kJ/mol, 28.59 kJ/mol, and -3.546 kJ/mol, respectively. Recovery of CV dye was carried out in a variety of media, including NaOH, NaCl, and CH_3COOH. The maximum CV recovery was achieved in an acidic media. The robustness of adsorption was affirmed by the interference of various matrix ions, including KCl, LiCl, NaCl, and $MgCl_2$, which did not significantly affect the adsorption process. The maximum adsorption capacity was obtained at a low concentration of LiCl. The results show that a green synthesis approach for nanocomposite synthesis might be an effective and economical way to remove organic contaminants from wastewater. Moreover, it is also effective for effluent treatment plants (ETP) for waste management purposes, in which it may be coupled with chlorine as a disinfectant to purify water that can be used for domestic and irrigation purposes.

Tribological and Morphological Study of AISI 316L Stainless Steel during Turning under Different Lubrication Conditions

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Due to growing environmental concerns and economical and social problems in manufacturing sectors, there is a huge demand for the substitution of existing cutting fluids. Further, the cutting fluids selected are expected to reduce the cutting force, improve the surface roughness and also minimize the tool wear during machining operations. Hence, this paper discusses the tribological and morphological behaviour of AISI 316L stainless steel while turning under minimum quantity lubrication (MQL) such as oil–water emulsion, mineral oil, simarouba oil, pongam oil and neem oil based on Taguchi L25 orthogonal array. From the extensive experimentation, it was observed that neem oil MQL with cutting speed of (140, 140, 60 m/min), feed of (0.30, 0.20, 0.10 mm/rev) and depth of cut of (1.0, 1.0, 1.0 mm) resulted in the lowest surface roughness (0.36 µm),cutting force (235.34 N) and tool wear (100.32 microns), respectively. Further, main effects plots and analysis of variance (ANOVA) can be successfully used to identify the optimum process input parameters and their percentage of contribution (P%) on the output parameters during turning of AISI 316L steel under MQL applications. The results clearly indicate that from both an ecological and economical standpoint, neem oil is the most effective lubricant in reducing cutting forces, tool wear and surface roughness during turning of AISI 316L stainless steel under MQL.