ABSTRACTS OF ORAL PRESENTATION

NANO2020/P001

Simulating the effect of iron-doping on the tensile strength of single-walled zirconia nanotubes using finite element analysis

Muhammad, I.D[1*] and Awang, M[2]
[1]Department of Mechanical Engineering, University of Abuja, Abuja, Nigeria
[2]Department of Mechanical Engineering, Universiti Teknologi PETRONAS, Seri Iskandar, Malaysia
*d.ibrahim@uniabuja.edu.ng

The effect of doping single-walled zirconia nanotubes (SWZNTs) with varying amount (1-5%) of iron was investigated by numerical simulation via Finite Element Analysis. It was found out that there is decrease in the intensity of tensile strength as the content of Fe increases, with the intensity of change dependent on the type and geometry of the SWZNTs. The zigzag-type SWZNTs have relatively higher tensile strength with comparatively constant rate of reduction (12%); while armchair-type have lower strength in addition to irregular reduction (12-24%) as the amount of dopant increases. Thus, in order to obtain needed tensile strength in the areas of applications, minimal amount of iron nanoparticles should be added to SWZNTs.

Keywords: Zirconia nanotubes; doping; tensile strength; finite element analysis

NANO2020/P002

Evaluation of the application of nanotechnology in solar energy harvesting

Ajisegiri, G.O[1*] and Adiya, Z.I.S.G[2]
[1]Department of Industrial and Production Engineering, University of Ibadan, Nigeria
[2]Department of Pure and Applied Chemistry, Usman Danfodiyo University, Sokoto, Nigeria
*ajisegiriganiyu@gmail.com

Presently, nanotechnology is one of the broadest research areas of science and technology. This is due to the fact that it merges understanding from different disciplines including but not limited to Chemistry, Physics, Biology, and Engineering. It is an enabling technology that provides an extensive range of resources to resolve energy-related problems. As the developing components and appliances are smaller than 100 nm, they provide the new ways to catch, store and exchange energy. The sun shines daily with huge amount of energy and energy potential thereby opening different research works on solar harvesting technology with the help of nanomaterials. In this study, evaluation of nanotechnology in solar energy harvesting is conducted. The different types of modern solar collecting technologies that use nanomaterials will be analyzed to know how effective and efficient they are. Life-cycle analysis of the different materials will also be carried out. The challenges in using nanotechnology will also be addressed. It is anticipated that the findings and analysis of this study will generate categorization of nanomaterials for solar energy studies.

Keywords: Nanomaterials, nanotechnology, solar, energy, lifecycle analysis

NANO2020/P003
Preparation and characterization of polyacrylamide loaded with silver nanoparticles as a conductive hydrogel

Yahaya, S[1*], Adiya, Z.I.S.G[1], Adamu, S.S[2], Bature, H.B[1] and Ibrahim, I.B[2]
[1]Department of Pure and Applied Chemistry, Usmanu Danfodiyo University, Sokoto, Nigeria
[2]Advanced Science Laboratory Complex, Usmanu Danfodiyo University, Sokoto, Nigeria
*chemicalshams@gmail.com

Polyacrylamide/silver nanoparticles (PAAm/AgNPs) composite was synthesized via free radical polymerization using potassium persulphate as an intiator in the presence of N'N-methylenebisacrylamide as crosslinking agent and colloidal solution of silver nanoparticles. Silver nanoparticles (AgNPs) have been prepared by *in situ* chemical reduction method, using silver benzoate salt as the metal precursor and trisodium citrate as the reducing agent. The prepared samples were characterized using SEM, XRD, FTIR, swelling analysis and conductivity measurements. SEM image of AgNPs shows spherical shape which was present on the network of the hydrogel. The conductivity of the hydrogel increased from 105.98µS for PAAM to 4620µS for PAAm/AgNPs due to impregnation of AgNPs. The XRD result shows the crystallize size of the PAAM and PAAm/AgNPs with monoclinic lattice plane for PAAm/AgNPs and the size was calculated to be 26.5 nm. Percentage swelling analysis shows high swelling at pH 13 and lower swelling at pH 2. The increased swelling was due to the impregnation of AgNPs in the hydrogel network which also increased the crystallinity of the hydrogel. This study demonstrated the preparation of polyacrylamide hydrogel loaded with silver nanoparticles with important characteristics for useful biomedical and engineering applications.

Keywords: Hydrogel, polyacrylamide, silver nanoparticles, swelling, conductivity, SEM, XRD

NANO2020/P004
Polypyrrole DNA nanocomposite-chemical, morphological and electrical characterization for nanoelectronic applications

Yahaya, M.I
Department of Chemistry, Sokoto State University, Sokoto, Nigeria
ymansur64@gmail.com

In this research, polypyrrole DNA (PPyDNA) templated nanowires were created by using simple fabrication method that applied DNA as a template. Their morphology, chemical state and electrical properties were analyzed by microscopic (AFM and SEM), spectroscopic (FTIR, UV-Vis and XPS) and current voltage measurement (I-V) methods respectively. Both FTIR and UV-Vis results have indicated that the PPyDNA nanocomposite is not a simple mixtures of DNA and PPy, but rather an intimate interaction of DNA with PPy in the hybrid polymer because of the several notable shifts in the peak positions and intensities observed as well as the continuous variation of wavelength and intensity of bands results from the interaction of PPy with DNA.

From AFM studies, PPy/DNA templated nanowires structures revealed an average height of 1.60 nm for free DNA and 9-10 nm for PPyDNA. Diluted sample gave images that showed individual nanowires whilst concentrated samples gave dense rope-like networks of nanowires. All microscopic techniques showed that increased incubation time for the nanowires synthesis produced structures with increased diameter and vice versa. The electrical properties of PPyDNA nanowires as drop-cast films were investigated by two-terminal current voltage (I-V) measurements on a probe station. The nanowires were drop-cast onto platinum micro band electrodes. The conductance of these films at 20 ^{o}C was of the order of 10-100 µS. The above results have shown that the composite have potentials for use in different nanoelectronic devices.

Keywords: Polypyrrole, nanocomposite, characterization, nanoelectronic, DNA

NANO2020/B005
Formulation development of an herbal hand sanitizer containing *Moringa oleifera* silver nanoparticles

Oyeniyi, Y.J[1*] and Mumuni, A.M[2]
[1]Department of Pharmaceutics and Pharmaceutical Microbiology, Faculty of Pharmaceutical Sciences, Usmanu Danfodiyo University, Sokoto, Nigeria, [2]Department of Pharmaceutical Technology, Faculty of Pharmaceutical Sciences, University of Nigeria, Nsukka, Nigeria
*drdeyinkaoyeniyi@gmail.com

The antimicrobial activity of *Moringa oleifera* methanol leaf extract had been reported in the literature; however there is little or no known effort to develop the extract into useful pharmaceutical products that is clinically relevant. This study aimed to develop an alcohol base herbal hand sanitizer containing synthesized *Moringa oleifera* silver nanoparticles as the active ingredient for use in personal hygiene and for combating the spread of outbreak of communicable diseases. *Moringa* leaf extract (MLE), obtained by macerating the dried leaves with methanol was reacted with 1 mM silver nitrate solution to produce batches of *Moringa* silver nanoparticles (MSN). The morphology of MSN was obtained using a scanning electron microscope, the particle sizes; polydispersity index and the zeta potential were however determined using a ZS-90 Zetasizer with dynamic and electrophoretic light scattering capabilities. MSN antimicrobial activities against some selected clinically isolated bacterial were evaluated by agar diffusion method, while the microbial lethal action of the formulated herbal hand sanitizers were carried out through microbial cell viability assay technique using the BacTiter-Glo^{TM} test kit. The time for color change indicating the formation of MSN as well as all other MSN parameters significantly varied from batch to batch ($p \leq 0.05$) indicating the need of process optimization. The MSN were moderately dispersed, negatively charged and stable with PDI and ZP values ranging 0.11-0.39 and 22- 33 mV respectively. FA and FB with yields above 50 % and mean particle sizes of about 30 and 38 nm were scaled up for formulation and production. The lethal actions of the formulated hand sanitizer (FA1 and FB1) were both 100 % showing an improvement above the WHO formulation of 99.9 % microbial death. Therefore,

alcohol base herbal hand sanitizers were successful formulated with synthesized MSN which demonstrated an improved microbial lethal action when compared with the WHO alcohol base hand sanitizer. These novel herbal hand sanitizers could be readily deployed to combat the spread of communicable diseases such as the current covid-19 pandemic.

Keywords: Antimicrobial activity, green synthesis, silver nanoparticles, hand sanitizer, *Moringa oleifera*

NANO2020/B006

Antidiabetic activity of phytosynthesized gold nanoparticles from *Blighia sapida* husk extract

Oladipo, I.C[1*], Lateef, A[2], Azeez, M.A[2], Asafa, T.B[3], Yekeen, T.A[2], Ogunsona, S.B[1], Akintola, A.O[1], Irshad, H.M[4], and Hakeem, A.S[5]

[1]Department of Science Laboratory Technology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [2]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [3]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [4]Faculty of Materials and Chemical Engineering, Ghulam Ishaq Khan Institute of Engineering, Science and Technology, Pakistan, [5]Center for Excellence in Nanotechnology, King Fahd University of Petroleum and Minerals, Saudi Arabia
*icoladipo@lautech.edu.ng

The antidiabetic potentials of gold nanoparticles biosynthesized from *Blighia sapida* husk extract was investigated in this study. Forty two healthy male albino rats with body weight ranges of 150±20 g were acclimatized for 7 days after which they were randomly divided into 7 groups (A-G) of 6 animals each. Group A, the control was not induced while the other six groups (B-G) were induced with 150 mg/kg of Alloxan by intraperitoneal administration. After 72 h, measurement of the tail vein blood glucose was done to confirm hyperglycemia. Experimental rats with fasting glucose levels (5.6-6.9 mmol/l) were considered diabetic. Group B received no treatment, group C received 1000 µg/kg of *Blighia sapida* husk aqueous extract, Group D received 500 µg/ml of AuNPs Group E received 750 µg/ml of AuNPs, Group F received 1000 µg/ml of AuNPs and Group G received 1000 µg/ml of standard drug (glibenclamide). After treatment for 21 days, the result showed that treatment with AuNPs down regulated the blood sugar unlike the untreated groups. Increases in aspartate aminotransferase (AST), alanine aminotransferase (ALT), alkaline phosphatase (ALP), urea and creatinine levels in the serum of rats, were significantly reduced after the treatment with *Blighia sapida* husk aqueous extract and the synthesized nanoparticles at 500-1000 µg/ ml. Furthermore, increase in the oxidative stress markers of alloxan induced diabetic rats (glutathione concentration and superoxide dismutase activity) were also reduced after treatment with with *Blighia sapida* husk aqueous extract and the synthesized nanoparticles at 500-1000 µg/ ml. Conclusively, the results obtained showed that the phytosynthesized AuNPs have potentials to stimulate the regeneration of the insulin producing pancreatic cells, therefore, abrogating hyperglycaemia, and limiting diabetic complications.

Keywords: *Blighia sapida*, gold nanoparticles, phytosynthesis, antidiabetic activity, rat

NANO2020/P007

Influence of Zycosoil nanochemical on properties of asphaltic concrete

Ajileye, V.O, Olaniyan, O.S*, Adegbola, A.A and Ayanlola, J.A
Department of Civil Engineering, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria
*osolaniyan@lautech.edu.ng

Asphaltic concrete are flexible pavements that reverse the deformation caused by the load. Failure of asphaltic concrete due to stripping of its content is more pronounced on road networks in Nigeria. Zycosoil nanochemical has been reported to possess excellent anti stripping property. In this study, properties of asphaltic concrete admix with Zycosil nanochemical was examined. Asphalt binder VG 30 (60-70) grade was heated to a temperature of 170^{o}C, and .0.5 ml of Zycosoil was measured using a plastic syringe and mixed with 5 ml of methylated spirit. The Zycosoil-methylated spirit mixture was added to 500 g of heated asphalt binder volumetrically and stirred for 20 min. Asphaltic mix was prepared by mixing required amount of asphalt binder containing Zycosoil and heated aggregate at mixing temperature of 160 ^{o}C. Similarly, control sample was prepared without Zycosoil. The standard temperature and procedure was followed according to ASTM D1559. The bulk density, maximum density, percentage air void, marshal stability, marshal flow, and percentage bitumen content were determined for control and other specimen admix with Zycosil. Test samples (control and specimen admix withzycosoil) for anti-stripping were prepared in accordance with standard procedures. The samples were boiled separately at 100 ^{o}C for 10 min, 1 h and 6 h. Total hydrocarbon (THC) and oil/grease contents were determined from water sample after boiling. The bulk density, maximum density, percentage air void, marshal tability, marshal flow, and percentage bitumen content for the control and asphaltic mix specimen with Zycosoil varied from 2.290-2.316 Kg/mm^3, 2.462-2.472 Kg/mm^3, 5.9-8.3%, 383-912 Kg/min, 3-5 min and 4.6-4.9%, respectively. The THC and oil/grease content of water sample after boiling were 0.06 and 0.02 mg/l. Zycosoil solution improves the marshal stability, flow values, bitumen contents and anti-stripping property of asphalt concrete. The nanochemical is recommended for selected federal highways in poor condition or those under construction.

Keywords: Zycosoil, nanochemical, asphaltic concrete, bitumen, anti-stripping

NANO2020/P008

A study of the effect of *Momordica augustisepala* stem nanofiber on moisture absorption property of polyester reinforced composite using genetic programming modeling and sensitivity analysis

Adeyi, A.J[1,2*], Durowoju, M.O[1], Adeyi, O[3], Ogunsola, A.D[1], Olalere O.A[4], and Owoloja, A.O[2]

[1]Department of Mechanical Engineering, Ladoke Akintola University of Technology, P.M.B 4000,Ogbomoso, Oyo State.Nigeria, [2]Forestry Research Institute of Nigeria, P.M.B. 5054, Ibadan, Oyo State, Nigeria, [3]Department of Chemical Engineering, Michael Okpara University of Agriculture, P.M.B 7267, Umudike, Abia State, Nigeria.

[4]University Sains Malaysia, Malaysia

*adeyi.abiola@yahoo.com

Environmental concerns leading to global anti-synthetic material campaign is encouraging the development of cellulose fiber reinforced composite; however, the inherent hydrophilic nature of cellulose reinforcements leading to high water absorption in cellulose fiber reinforced composites is still a vibrant research focus. In this study, nanofibres were extracted from *Momordica augustisepala* stem plant using combined alkalization, bleaching and sulphuric acid hydrolysis procedure. Transmission Electron Microscope (TEM) was used to confirm the size of the extracted nanofibers and the effect of different nanofiber loading (0.00, 0.50 and 1.00 wt. %) on 10-day water absorption property of cured *Momordica augustisepala* nanofiber reinforced polyester plastic was investigated. The observed water absorption data were modeled using genetic programming in MatlabR2018a software and the degree of contribution of composites' water soaking time and *Momordica augustisepala* nanofibre loading to composites' water absorption variances was determined using oracle crystalball software. TEM showed that the nanofibers have diameter in nanometer and water absorption behavior increased as the quantity of nanofiber loading increased. Genetic programming modeling had a R^2 value of 0.9954 and RMSE of 0.0218. The sensitivity of the analysis revealed that water absorption was 85.60 and 14.4% sensitive to fiber weight fraction and composite soaking time, respectively. It is concluded that *Momordica augustisepala* nanofiber reinforcement contributed positively to water absorption of polyester-reinforced composites and the water absorption is more dependent on fiber loading than composite's water soaking time. Therefore, low fiber reinforcement is recommended when reinforced composite intended for use in wet environment.

Keywords: *Momordica augustisepala*, nanofiber reinforcement, polyester, TEM, composite, water absorption

NANO2020/B009
Lemon grass-synthesized silver nanoparticles as preservative of fermented locust beans

Saliu, B.K[1], Agbabiaka, T.O[1*], and Akolade, J.O[2,3]

[1]Department of Microbiology, Faculty of Life Sciences, University of Ilorin, PMB 1515, Ilorin, Nigeria, [2]Polymers and Composites, Materials Science and Manufacturing, Council for Scientific and Industrial Research, Pretoria, South Africa, [3]Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria
*tariqagbabiaka@gmail.com

The effectiveness of lemon grass-synthesised silver nanoparticles (LSSNP) as a preservative of fermented locust beans (FLB) was investigated. The LSSNP was prepared, characterized and used to treat fresh FLB at 10% v/w. The LSSNP-treated FLB was stored at room temperature (28±2 ºC) and withdrawn periodically for microbial and organoleptic analysis. Susceptibility of the microbial isolates to LSSNP and effect of the treated FLB on hepatic histology in rats were also investigated. DLS analysis revealed a mean hydrodynamic size of 89 nm for the LSSNP, while TEM showed roughly spherical particles with an average size of 100 nm. *Bacillus* spp, *Paenibacillus barcinonensis, Lysinibacillus sphaericus, Staphylococcus aureus* subsp. *aureus*, *Enterobacter xiangfangensis* M5S2B6, and *Serratia marcescens* were isolated. All isolates were susceptible to LSSNP with comparable zones of inhibition to reference antibiotics. Significant reduction of the microbial load of FLB by up to 63.7% due to LSSNP treatment was achieved. The organoleptic and proximate properties of LSSNP-treated FLB were preserved. Histomorphological study showed normal hepatic architecture in rats fed with LSSNP-treated FLB. Results from this study indicate that LSSNP is a green and safe alternative for the preservation of FLB.

Keywords: Lemon grass, silver nanoparticles, fermented locust bean, preservation, antibacterial, proximate composition

NANO2020/P010
Evaluation of the compressive properties of binary blend alkaline activated mortar

Nmadu, H.G[1*], Ogunbode, E.B[2], Wuna, M.A[3] and Lawal, T.A[4]
Department of Building, Federal University of Technology Minna
*helen.nmadu@futminna.edu.ng

Alkaline activated materials (AAMs) have proven recently to be a good way of converting agricultural, thermal and industrial waste into construction repair materials. This paper evaluates the compressive properties of cassava peel ash (CPA) incorporated metakaolin (MK) based geopolymer mortar. Sodium silicate (Na_2SiO_3) and sodium hydroxide (NaOH) solution were used as alkaline activator and NaOH in varying concentration of 6, 9 and 12 M. The mass ratios of sodium silicate to sodium hydroxide (NS: NH) and the binder to fine aggregate (B: A) were fixed to 2.5 and 0.4 respectively. The specimens were subjected to elevated temperature curing at

100 ºC for the duration of 24 hours. The compressive strength of the synthesized AAMs was determined at 3, 7 and 28 days. It was demonstrated that 50% of MK replaced CPA treated with 12 M of NaOH achieved the highest compressive strength as much as 45.2 MPa at 28 days curing. The bond strength results have proven that AAMs is a suitable alternative repair material.

Keywords: Alkaline activated binder, metakaolin, cassava peel ash, compressive strength

NANO2020/P011

Waste water treatment by green synthesized zinc oxide nanorods (ZnONRs)

Adeleke, J.T[1*], Thanguruma, T[2], Kalai, V.P[2], Ajayeoba A.Y[1], Alabi, A.B[3] and Akomolafe, T[3]

[1]Department of Physics, Osun State University, Osogbo, Nigeria, [2]International Research Centre, Kalasalingam University, Krishankoil – 626 126, Tamil Nadu, India, [3]Department of Physics, University of Ilorin, Ilorin, Nigeria
*joshua.adeleke@uniosun.edu.ng

Zinc oxide nanorods (ZnONRs) have been successfully synthesized by green method using the leaf extract of *Moringa oleifera* and evaluated for applications in waste water treatment. Fourier Transform Infra-Red (FTIR) spectroscopic analysis was carried out on the synthesized ZnONRs to identify the functional groups responsible for its synthesis, while the elemental constituents, were analyzed using Energy Dispersive Spectroscopy (EDX). Its structural and morphological properties were studied using X-ray Powder Diffractometer (XRD) patterns and Scanning Electron Microscopy (SEM) images respectively. The optical properties of the nanoparticles were derived from UV-Visible spectral studies. The green synthesized ZnONRs were studied for photocatalytic activities on methyl red (MR), Congo Red, Rhodamine B dyes (visualized by UV-Visible spectroscopy) and were further used for the treatment of domestic and industrial waste water. From the results obtained, the SEM micrograph showed nanorods morphology with good hexagonal, crystalline nature and granular nano sized range (8-25 nm). The EDX spectrum revealed its high purity chemical composition as only Zinc (Zn), and oxygen (O) signals were detected and no other signal of secondary phase or impurity was detected. The X-ray Diffraction (XRD) pattern of the ZnONRs show highly oriented and crystalline structure with average grain size of 7.67 nm. The synthesized nanorods were effective for photocatalytic degradation of organic dyes. The green synthesized ZnONRs in domestic and industry waste water showed 93.95% and 93.45% of chemical oxygen demand (COD) reduction respectively in 75 minutes.

Keywords: ZnO, nanorods, green synthesis, *Moringa oleifera*, photodegradation, waste water treatment

NANO2020/P012

Evaluation of photovoltaic properties of green synthesized zinc oxide nanoparticles from extract of *Carica papaya* for anode buffer film layer of polymer solar cells

Balogun, S.W[1*], Oyeshola, H.O[2], Adewale, A[3], Abiodun, A.J[4] and Sanusi, Y.K[2]
[1]Department of Materials Science and Engineering, Kwara State University Malete, Ilorin, Nigeria, [2]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [3]Department of Physics and Materials Science Kwara State University Malete, Kwara State, [4]Department of Computer and Physical Sciences (Physics Unit) Lead City University, Ibadan, Oyo State Nigeria
*sbalogun94@gmail.com

Challenges in energy sector coupled with quest for eco-friendly and environment friendly sources of energy have called for more research in solar cells technology. This work examines the photovoltaic properties of biosynthesized zinc oxide nanoparticles as anode buffer layer of polymer solar cells. The deposition was done onto a glass substrate by spin-coating technique from a precursor solution containing zinc acetate and pawpaw leaf extract solutions synthesized using a simple precipitation method. The thin films were annealed from 50 to 650 ^{o}C with an interval of 100 ^{o}C. ZnONPs thin film devices were analyzed using UV-Vis spectroscopy, scanning electron microscopy (SEM) with electron dispersive X-ray (EDX), Fourier transform infra-red spectroscopy and Keithley source meter. SEM images showed uniform distribution of ZnONPs. FTIR reveals chemical structure of material using vibrational states to recognize the presence of specific bonds. The film devices exhibited high transparency (>85%) in the spectral range from 300 to 400 nm in UV and 400 to 900 nm in the visible region of the spectrum. The energy band gap ranges between 3.4 - 3.8 eV, which decreases with increase in annealing temperature attributed to an increase in its grain size. Band-gap of 3.4 eV indicates that ZnONPs could be used in metal oxide semiconductor-based devices. Also, effect of gradual heat treatment in tuning the properties of device showed that its properties can be altered by annealing temperature. The film device fabricated has power conversion efficiency of 4.35 % under illumination which indicates that ZnONPs could be used as an anode buffer layer in solar cell to enhance its photovoltaic performance.

Keywords: Thin film, ZnONPS, optical properties, pawpaw leaf, annealing, solar energy efficiency

NANO2020/P013
Review on synthesis, characterization and application of titanium dioxide (TiO_2) nanoparticles

Ogundeji, S.T, Awodele, M.K*and Oyeshola, H.O
Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.
*mkawodele@lautech.edu.ng

The major threat to health and quality life of humanity and the world today is pollution such that anthropogenic activities of man like industrialization, mining, combustion of fossils fuels among others release harmful contaminant in to the air, water and land. Inevitably, this has caused critical environmental difficulties that have become a crucial concern. Several attempts have been made all over the world by researchers on various approaches to address this issue. In the process of time, it was revealed that photocatalysis is a promising method to reduce environmental pollution. Titanium dioxides (TiO_2) have received enormous attention due to its unique and amazing properties. This work focuses on review of TiO_2 with different synthesis approach, characterization and its applications. Its photocatalytic properties enable it to be utilized as an additive in paint in order to improve its self-cleaning properties, mineralize indoor outdoor air pollutants, remediation of emerging contaminants from wastewater and as electron transport medium in dye-sensitized solar cells.

Keywords: Titanium dioxide (TiO_2), photocatalyst, energy, environment

NANO2020/P014
Impact of nanoparticles on the filtration characteristics of carboxymethyl cellulose solution in drilling operations

Alabison, R.M[1*], Akinpelu, F.O[2,3], Olaleye, O.A[1] and Olalude, G.A[2]
[1]Department of Statistics, The Federal Polytechnic, Ede, Osun State, Nigeria
[2]Department of Pure and Applied Mathematics, Ladoke Akintola University, Ogbomoso, Oyo State, Nigeria, [3]Currently of the Department of Mathematics, University of Lagos, Akoka, Lagos, Nigeria
*ralabison@yahoo.com

Drilling fluid loss is one of the major impediments to successful drilling operations. Novel advances in nanotechnology have developed fluids with improved drilling properties to control fluid losses. This theoretical study is centred on the effects of copper oxide (CuO) nanoparticles on the rheological and filtration properties of carboxymethyl cellulose (CMC) solution at different temperature change. The permeability and the porosity of the medium were considered. The fluid flow was modelled mathematically into a set of non-linear partial differential equations (PDE) and solved numerically using Runge-Kutta Scheme of order four with shooting method. The results revealed that the presence of the nanoparticles enhanced the rheological and filtration properties of the CMC solution by increasing the viscosity and decreasing the volume of the

filtrate. This consequently will be observed to retard the formation of filter cake on the medium and reduce fluid loss as compared with existing literature reports.

Keywords: Carboxymethyl cellulose, nanofluids, drilling operations, CuO nanoparticles, Runge-Kutta scheme

NANO2020/P015

Optimization of process parameters for stir cast aluminium alloy (Al), graphene (G) and rice husk ash (RHA) composite

Yekinni, A.A[1,2*], Durowoju, M.O[2], Agunsoye, J.O[3] and Mudashiru, L.O[2]
[1]Department of Mechanical Engineering, Lagos state Polytechnic, Ikorodu, Nigeria, [2]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [3]Department of Metallurgical and Materials Engineering, University of Lagos, Akoka, Nigeria
*kunleyk2003@yahoo.com

A deep understanding of influences of process parameters to achieve desirable mechanical properties is inevitable in stir casting of aluminium composites. While the need for an efficient and systematic decision-making approach drives the quest for optimization strategies, optimization technique could be employed to obtain the right level or value of parameters that have to be maintained for obtaining quality output. In this study, Response Surface Methodology (RSM) was used to generate experimental runs. The blends of composites of Al/RHA/G were produced by sir casting from recycled aluminium cans, rice husk ash particulate between 150-600 µmat 0.8, 1.2 and 1.6 wt.% and 0.4 wt.% graphene at constant stirring speed of 140 rpm and stirring time of 2 minutes. The cast produced were machined in accordance with ASTM standard into appropriate coupon for tensile and hardness tests. Data obtained were subjected to ANOVA at 5 % level of significance and linear regression equations developed for the properties of composites produced under these conditions. The results obtained have shown that the wt. % and particle size of RHA with 0.4 wt. % of G have a significant effect on the hardness and tensile strength of the composites while the particle size is the most influential casting parameter. The regression equations generated are capable of predicting these properties to the acceptable level of accuracies with high level of significance.

Keywords: Optimization, particle size, weight fraction, stir casting, aluminium, rice husk ash, graphene

NANO2020/P016

Impact of graphene nanoparticles on poly (vinylidene fluoride) polymer fiber composite on electromagnetic absorption

Sikiru, S.O[1*], Ayodele, A.O.J[2], Sanusi, Y.K[3]

[1]Fundamental and Applied Science Department, Universiti Teknologi PETRONAS, 32610 Seri Iskandar, Perak, Malaysia, [2]Department of Computer and Physical Sciences (Physics Unit), Lead City University, Ibadan, Oyo State, Nigeria, [3]Department of Pure and Applied Physics, Lakoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria

*surajuden86@gmail.com

Graphene based polymer fiber composite were fabricated for electromagnetic absorption with minimum thickness. It is proved that the tailoring of the desired EM properties can be achieved with proper choice of the filler and the matrix. This study aims to fabricate a conductive polymer fiber for electromagnetic wave absorption. The magnetic and dielectric performance and thermal properties of polymer fiber composites based on Polyvinylidene fluoride (PVDF) can be improve by the addition of additive such as graphene due to its excellent electrical and dielectric properties. The behaviour of magnetic and dielectric properties of such a composite material depends on shape, the amount of filler concentration and size. The PVDF polymer fibers were prepared by solvent induced phase separation through the electro-spinning equipment. The effectiveness of graphene as a dielectric material was studied on the polymer fibers composites materials using X-band 8.2–12.4 GHz regions of key sight ENA series Network Analyzer E5071C. It was revealed from the results obtained that the fiber with graphene has high real permittivity of 6.08F/M compared to 2.0F/M of conversional polymer fiber composite. Based on the result obtained, the addition of graphene successfully polarized the polymer fiber composite; this is due to dielectric field dependence of graphene. Then graphene is a material with unique behaviour due to its electronic structure and linear dispersion near the fermi level. It was observed from the result that the increase in the viscosity of dope solution of PVDF led to brittleness of the polymer-fiber which has a negative effect on mechanical properties of the fiber.

Keywords: Graphene, polymer fiber, polyvinylidene fluoride, electromagnetic absorption, dielectric material

NANO2020/B017

Development of bread fruit seed oil-based self-nanoemulsifying drug delivery system for the enhancement of oral absorption of aceclofenac

Omeh, R.C[1,2*], Onyechi, J.O[1]., Onunkwo, G.C[1], Momoh, A.M[3], Kenechukwu, F.C[3], Mbah, C.C[1], and Ali, F.B[2]

[1]Department of Pharmaceutical Technology and Industrial Pharmacy, University of Nigeria, Nsukka, [2]Department of Pharmaceutics and Pharmaceutical Technology, Enugu State University of Science and Technology, Agbani campus, Enugu, [3]Drug Delivery Unit, Department of Pharmaceutics, University of Nigeria, Nsukka

[*]chijiokerom@gmail.com

Effective per oral delivery of many drugs like Aceclofenac is limited by their poor aqueous solubility. Improved solubility and gastrointestinal absorption of such drugs may be achieved by formulating them as self-nanoemulsifying drug delivery systems (SNEDDS). The suitability of locally sourced bread fruit oil for the formulation of SNEDDS has not been investigated. The objective of the study was to formulate SNEDDS of Aceclofenac (a non-steroidal anti-inflammatory drug) using bread fruit oil with view to improving the gastrointestinal solubility of the drug and investigating the suitability of the oil for such formulation. Oil extracted from bread fruit seeds was purified, enzymatically modified and characterized for percentage yield, and other physicochemical properties. The solubility of Aceclofenac in the oil and some surfactants was determined using the saturation solubility method. Emulsification studies and phase diagrams were used to optimize the composition of the SNEDDS which was then fabricated by phase inversion technique. The optimized version was then characterized and subjected to *in vitro* drug release studies. The acid, iodine, peroxide, saponification and viscosity values of the oil were 3.40, 17.50 ± 0.05, 4.20 ± 0.01, 201.46 ± 0.02 and 29 cp respectively. The average droplet size and zeta-potential of the SNEDDS were 105.55 ± 0.37 nm and -2.03 ± 0.16 mV respectively. There were 28.95 and 46.27% increase in drug release by the SNEDDS over a commercial and a pure Aceclofenac sample respectively. It can be concluded that formulation of Aceclofenac as bread fruit oil-based SNEDDS has the potential of enhancing its aqueous solubility and per oral delivery.

Keywords: Bread fruit oil, Aceclofenac, self-nanoemulsifying drug delivery system, surfactant, co-surfactant

NANO2020/B018

Green synthesis of silver nanoparticles using leaf extract of *Tapinanthus globiferus* and their *in vitro* anti-trypanosomal activity

Abedo, A.J[1]*, Nock, I.H[2], and Ndams, I[2]
[1]Vector and Parasitology Department, Nigerian Institute for Trypanosomiasis Research (NITR), Surami Road, Kaduna State, Nigeria, [2]Department of Zoology, Ahmadu Bello University, Zaria, Nigeria
*onyinoyi1999@gmail.com

Synthesis and use of silver nanoparticles (AgNPs) are new developmental area of research and there is increase commercial demand for nanoparticles. The most employed method is the chemical reduction for the preparation of metallic nanoparticles. This investigation reports cost effective, eco-friendly, and green approach for the synthesis AgNPs using aqueous leaf extract of *Tapinanthus globiferus*. The phytochemical examination of the plant extract revealed the presence of some secondary metabolites such as alkaloids, tannins, and saponins among others which act as both reducing and capping agents. Stable controlled AgNPs were formed within 35-55 minutes of slow heating at 50 ^{o}C and were mostly cubical in shape with average size of 7-10 nm. The synthesized AgNPs were characterized with UV-visible spectroscopy, Scanning Electron Microscopy (SEM), Fourier Transform Infrared Spectroscopy (FTIR) and X-ray Diffractometer (XRD). The UV-visible spectrum of colloidal solutions had absorbance peaks at 370-400 nm. The synthesized nanoparticles were tested for *in vitro* anti-parasitic activity on *Trypanosoma congolese* which showed activity with MIC at 0.98 µg/ml, while the leaf extract showed activity at 6.25 µg/ml. This result agrees with the existing phenomenon with nanoparticles synthesized displaying higher activity than their bulk forms.

Keywords: Green synthesis, *Tapinanthus globiferus*, silver nanoparticles, anti-trypanosomal activity

NANO2020/P019

Hydrothermal assisted-green synthesis of Fe/N co-doped TiO_2 nanocomposites using *Vernonia amygdalina* leaf extract

Amigun, A.T[1, 2*], Adekola, F.A[2], Tijani, J.O[3, 4], Mustapha, S[3, 4], and Eleburuike, N.A[1]
[1]Department of Chemical and Geological Sciences, Al-Hikmah University, Ilorin, PMB1601 Nigeria, [2]Department of Industrial Chemistry, University of Ilorin, PMB 1515, Ilorin, Nigeria, [3]Department of Chemistry, Federal University of Technology, Bosso Campus, Minna, PMB 65, Nigeria, [4]Nanotechnology Research Group, Center for Genetic Engineering and Biotechnology, Federal University of Technology, Minna, PMB 65, Niger State, Nigeria
*azeezahage@gmail.com

In this paper, pure TiO_2 and Fe/N co-doped TiO_2 nanocomposites were prepared via hydrothermal-assisted-green synthesis method using aqueous extract of bitter leaf, *Vernonia amygdalina*. The doping of pure TiO_2 was by wet impregnation of titanium isopropoxide with NH_4NO_3 and $FeCl_3.6H_2O$ such that the theoretical Fe/N doped Ti molar ratio was 4:1. The

prepared nanocomposites were annealed at 450 ^{o}C and characterized by High resolution thermal electron microscopy (HRTEM), X-ray diffraction (XRD), X-ray photoelectron spectroscopy (XPS) and Brunauer–Emmett–Teller (BET) measurements methods. The XRD patterns confirmed the formation of anatase for pure TiO_2 and rutile phase for Fe/N co-doped TiO_2 samples. The phase transformation from anatase to rutile was linked to electronic movement between 3d and 2p orbitals of Fe and N respectively. The increase in average crystallite size of 37.4 nm observed for Fe-N-TiO_2 was attributed to complete phase change from anatase to rutile. The HRTEM images of the as-synthesized Fe/N co-doped TiO_2 shows an agglomeration of small spherical shape nanoparticles with sizes in good agreement with the sizes obtained from XRD measurements. The co-doping effect of Fe and N was responsible for the increased surface area from 10.37 m^2/g for pure TiO_2 to 25.48 m^2/g for Fe/N co-doped TiO_2 nanocomposites respectively. This study demonstrated that the microstructural, textural, phase types and oxidation states of TiO_2 were influenced by Fe and N.

Keywords: TiO_2 nanocomposites, hydrothermal-assisted-green synthesis, *Vernonia amygdalina* crystallite size, anatase-rutile, surface area, impregnation

NANO2020/P020

On the performance of blended mixtures of henna and black plum plants as a co-sensitizer in dye-sensitized solar cells (DSSCs)

Dauda, A.K[1, 2*], Jain, M[3], Awodele, M.K[2], Odeyemi, O[4], and Awodugba, A.O[2]

[1]Department of Science Infrastructure, National Agency for Science and Engineering Infrastructure, FCT, Abuja, Nigeria, [2]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Nigeria, [3]Department of Physics, University of The Gambia, Gambia, [4]Department of Electrical and Electronic Engineering, Federal University of Technology, Akure, Ondo State, Nigeria

*adekunle084real@yahoo.com

Natural dyes are ecologically and economically superior to ruthenium-based dyes because they are non-toxic and cheap. Dye sensitizer is an important factor to the performance of dye sensitized solar cell (DSSC). This research used extracted dye from both dried blended henna leaf and black plum leaf, which were mixed in ratios 25:75, 50:50 and 75:25 as natural dyes for a dye sensitized solar cell using the modified Soxhlet technique in other to enhance the absorption of extracted natural dye because of the low efficiency in DSSCs. Blended henna and black plum leaves were first placed separately in a neat white container and were soaked with n-hexane for defatting, to wash away fat and oil from the specimen. Thereafter, chlorophyll of the two plants and their ratios was extracted through acetone to serve as the natural dyes for use in DSSCs. Five DSSCs based on the extracted dyes were fabricated and the photo-electrochemical parameters such as power conversion efficiencies, fill factor, short circuit current and open circuit voltage were calculated and the dye extracted from the black plum leaves gave an energy efficiency of 0.67%, henna leaves 0.13%, blended 50:50 henna: black plum leaves gave 2.16%, 25:75 henna: black plum leaves (0.78%), and 75:25 henna: black plum leaves (0.26%) performance efficiency using TiO_2 synthetic and carbon soot as counter-electrode. The result suggested that the

combination of henna and black plum at 50:50 is the optimum energy conversion efficiency when compared to the other formulations, and as such can be improved upon to get the best photosensitizer for DSSCs.

Keywords: DSSCs, plum dye, henna dye, dye sensitizer, energy conversion efficiency, solar energy

NANO2020/B021

In vitro antidiabetic activity of phytosynthesized zinc oxide nanoparticles from *Tetrapleura tetraptera* husk extract

Oladipo, I.C[1*], Lateef, A[2], Azeez, M.A[2], Asafa, T.B[3], Yekeen, T.A[2], Ogunsona, S.B[1], Adewoyin, A.G[1], Irshad, H.M[4], and Hakeem, A.S[5]

[1]Department of Science Laboratory Technology, Ladoke Akintola University of Technology, Ogbomoso, Oyo State Nigeria, [2]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Oyo State Nigeria, [3]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Oyo State Nigeria, [4]Faculty of Materials and Chemical Engineering, Ghulam Ishaq Khan Institute of Engineering, Science and Technology, Pakistan, [5]Center for Excellence in Nanotechnology, King Fahd University of Petroleum and Minerals, Saudi Arabia

*icoladipo@lautech.edu.ng

The phytofabricated ZnO nanoparticles synthesized using *Tetrapleura tetraptera* husk aqueous extract was investigated for antifungal and *in-vitro* anti-diabetic activities. The ZnONPs was characterized using UV-vis spectroscopy which displayed clear peaks at 218.0 and 222.0 nm, Fourier transform infrared spectroscopy (FTIR) spectrum also displayed prominent peaks at 3670.33, 3410.39, 3071.19 cm^{-1}, Energy-dispersive X-ray spectroscopy (EDX) showed Zinc as the most prominent element showing the yield of 78.2% and scanning electron microscopy (SEM) showed agglomerated and roughly spherical shapes. The ZnONPs was tested against five toxigenic fungi and the result showed that *Fusarium solani* growth was inhibited by 75.75%, *Aspergillus flavus* by 73.07%, *Aspergillus niger* by 61.17%, and *Aspergillus fumigatus* by 75.37%. Also, the α-amylase and α-glucosidase activities of ZnONPs and *T. tetraptera aqueous* husk extract were determined by spectrophotometric method. *T. tetraptera* aqueous husk extract showed α-glucosidase inhibitory activity with IC_{50} value of 1.24 µg/ml, while the ZnONPs had an IC_{50} value of 48.00 µg/ml. For the α-amylase inhibitory activity, ZnONPs showed the highest α-amylase inhibitory activity with an IC_{50} value of 695.35 µg/ml, while the extracts showed lower inhibitory potential with IC_{50} value of 798.86 µg/ml. Acarbose showed inhibition percentage range of 31.81±0.18 and 44.94±0.07 with IC_{50} value of 602.15 µg/ml. The result revealed potent inhibitory potentials of the ZnONPs and extracts for α-amylase and α-glucosidase judging from the IC_{50} values relative to the standard. The results show the anti-diabetic efficacy of zinc oxide derived nanoparticles and *T. tetraptera* aqueous husk extract.

Keywords: ZnONPs, green synthesis, *Tetrapleura tetraptera*, antifungal, anti-diabetic, *in vitro* activities

NANO2020/P022

Enhancing functionalities of paints with nanoparticles: A review

Olawore, A.S[1], Asafa, T.B[2, 3*], Lateef, A[3, 4], Durowoju, M.O[2, 3], and Oladosu, K.O[1]

[1]Department of Mechanical Engineering, Kwara State University, Malete, Kwara Sate, Nigeria, [2]Departmental of Mechanical Engineering, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Oyo State, Nigeria, [3]Nanotechnology Research Group (*NANO*$^{+}$), [4]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Oyo State, Nigeria

*tbasafa@lautech.edu.ng

Nano-modified paints have shown huge potentials in a wide range of functionalities such as surface protection, self-cleaning, antifouling, corrosion resistance, slip resistance, abrasion resistance among others. Consequently, they have been deployed for several industrial applications including pipeline, buildings, automobile, and electronics to mention a few. To further enhance functionalities, paint industries have expended huge resources on research and development of advanced paints which are compatible and suitable for today's aggressive environments. Studies have been conducted on utilization of degradable biocides such as silver nanoparticles (AgNPs), copper nanoparticles (CuNPs), zinc oxide nanoparticles (ZnONPs), photocatalytic-active nanotitanium dioxide (TiO_2 NPs) and silica dioxide nanoparticle (SiO_2 NPs) as major additives in paints. These additives are designed to offer improved surface protection against microbial, physical and chemical deteriorations as well as enhanced scratch resistance. However, addition of nanoparticles to paints is not without its demerits. Nanoparticles can agglomerate within the paint matrix which can be minimized with effective dispersion. In addition, the health and safety concerns from human exposure to emissions of nanoparticles must be adequately addressed. A few reported studies on toxicology of nanoparticles are either short termed or having variant or inconclusive results. This paper reports a critical assessment of nanoparticles as additives in paints. Extensive characterization of nanoparticle-modified paints is reported while the implications on the environment are also explored. The new direction targeting enhanced functionalities and lower toxicity is proposed.

Keywords: Nanoparticles, paint, coating, anti-fouling, toxicology

NANO2020/B023

Green synthesis, characterization and preliminary antimicrobial study of nanoparticles using extract of stem bark of *Annona senegalensis*

Olabemiwo, O.M[1], Waheed, A.A[1], Okunlola, D.S[1], Akinwale, D.R[1], Adeyinka, G.C[2], Adeniji, T.W[3], and Akintelu, S.A[1, 4*]

[1]Department of Pure and Applied Chemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [2]Department of Chemical Engineering, Mangosuthu University of Technology, KwaZulu-Natal, South Africa, [3]Department of Medical Microbiology, LAUTECH Teaching Hospital, Ogbomoso, Nigeria, [4]School of Chemistry and Chemical Engineering, Beijing Institute of Technology, Beijing, China

*akintelusundayadewale@gmail.com

The green synthesis of nanoparticles has been a vital aspect in the search for novel antimicrobial agents. This research aimed at biosynthesis, characterization and preliminary evaluation of the antibacterial and antifungal properties of silver nanoparticles (AgNPs) from the back extract of *Annona senegalensis*. The bark of *Annona senegalensis* was scraped from the stem, washed, air-dried, pulverized and extracted to synthesize the nanoparticles. The synthesized AgNPs were characterized with UV-visible spectrophotometer (UV), Fourier transform infrared (FTIR), scanning electron microscope (SEM), transmission electron microscope (TEM), energy-dispersive X-ray (EDX) spectroscopy to ascertain the physico-chemical and morphological properties of the AgNPs. The antimicrobial investigation was carried out following standard method. The observation of colour change (pale yellow to dark brown) during the synthesis and maximum absorbance at wavelength 431.19 nm in the UV spectrum confirmed the formation of AgNPs. The FTIR analysis showed that the biomolecules responsible for the reduction of silver ion contain O-H functional groups. The electron microscopy studies indicated that the AgNPs are spherical in shape with nanoparticles sizes of 11-24.76 nm. EDX analysis showed that the AgNPs contain high amount of silver and few other elements. The antimicrobial study showed high zones of inhibition 22.75-33.75 mm and 20.00 to 27.00 mm against tested bacteria and fungi respectively. The simplicity of the synthesis of AgNPs from *Annona senegalensis* extract and relatively high zones of inhibitions shown by the AgNPs are strong evidences of the possible application of *Annona senegalensis* in the synthesis of novel therapeutic agent against infections from bacteria and fungi.

Keywords: Silver nanoparticles, green synthesis, characterization, antimicrobial activity, *Annona senegalensis*

NANO2020/B024

Green synthesis, characterization and preliminary antimicrobial study of silver nanoparticles from *Parquetina nigrescens* (Afzel)

Ogoko, E.C[1], Olabemiwo, O.M[2], Adeyinka, G.C[3], Abiola, B.E[2*], Oyelakin, J.O[2], Ajibade, M.O[2], Omotoso, M.O[2], and Akintelu, S.A[4]

[1]Department of Pure and Applied Sciences, National Open University, Abuja, Nigeria, [2]Department of Pure and Applied Chemistry, Ladoke Akintola University of Technology, P.M.B 4000, Ogbomoso, Oyo State, Nigeria, [3]Department of Chemical Engineering, Mangosuthu University of Technology, Kwazulu-Natal, South Africa, [4]School of Chemistry and Chemical Engineering, Beijing Institute of Technology Beijing, China

*babawale2008@gmail.com

The recent geometrical increase in the applications of nanosized materials in almost all areas of human endeavor has continued to draw keen interest of scientists to investigations on nanoscience and nanotechnology. To meet the increasing demands for commercial nanoparticles, green synthesis method, which is simple and eco-friendly is the widely preferred option of production of nanoparticles at laboratory and industrial scales. This study reports the synthesis of silver nanoparticles using *Parquetina nigrescens* (Afzel) extract and its characterization using ultra-violet visible spectroscopy, Fourier Transform infrared spectroscopy (FTIR), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Five grams of the pulverized plant sample was added to 150 ml distilled water and stirred continuously. Four (4ml) of the aqueous bark extract was mixed with 36 ml of silver nitrate and shaken continuously for 1 hour until a deep brown colour was observed. TEM analysis shows that the synthesized AgNPs were spherical, with sizes ranging from 0.092 to 0.375 µm as shown by SEM analysis. The UV-visible spectroscopy of the synthesized *Parquetina nigrescens* silver nanoparticles showed maximum absorbance at 436.92 nm. The FTIR spectrum showed strong peaks at 3334.23, 2872.60, 2095.63 and 1625.94 cm^{-1}. The synthesized AgNPs showed inhibition against the growth of *Pseudomonas* sp, *Aspergillus flavus* (76%), *Aspergillus niger* (81.17%) and *Aspergillus fumigatus* (44.87%). This study has shown that the green synthesized AgNPs from *Parquetina nigrescens* has strong antimicrobial activity and potential biomedical applications.

Keywords: *Parquetina nigrescens*, green synthesis, AgNPs, antimicrobial activities, biomedical application

NANO2020/B025
Green synthesis of silver nanoparticles (AgNPs) using *Parkia biglobosa* and its antimicrobial activities

Aguda, O.N*, and Lateef, A
Laboratory of Industrial Microbiology and Nanobiotechnology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
*opeaguda@gmail.com

The synthesis of nanoparticles using the green route has continued to receive a great attention due to its simplicity of processes, eco-friendliness, and notable reduction of chemical involvement. In this work, *Parkia biglobosa* waste water (PBWW) was used as bio-material for the green synthesis of silver nanoparticles (AgNPs) and their antimicrobial potencies were investigated. The dark brown synthesized PBWW-AgNPs were characterized by the UV-visible spectroscopy and the effects of conditions of synthesis such as concentration gradient (0.2-1 mM) and pH (4-10) were optimized and examined by the UV-visible spectroscopy. The potential of the PBWW-AgNPs as an antimicrobial agent against some antibiotic resistant clinical isolates and filamentous fungi was also examined. The maximum absorbance occurred at 390 nm as revealed by UV-visible spectroscopy. The 1 mM concentration of the precursor, $AgNO_3$, and pH 4 of the synthesized AgNPs were found desirable as they showed highest absorbance peak at 390 nm and 400 nm respectively. The investigation of the antimicrobial activities of the nanoparticles at various concentrations (10-100 µg/ml) on antibiotic resistant clinical strains such as *Klebsiella oxytoca* and *Pseudomonas aeruginosa* were found positive and concentration dependent with inhibition zone ranging from 10-23 mm and 10–26 mm respectively. The growth of filamentous fungi such as *Aspergillus niger* and *Aspergillus flavus* were also inhibited at 100 µg/ml and 150 µg/ml. This study has successfully demonstrated the possibility of green synthesis of AgNPs using PBWW and has equally showed its potency as antimicrobial agent. To the best of our knowledge, this work may be the first to use PBWW as a bio-material for the green synthesis of nanoparticles.

Keywords: Green synthesis, *Parkia biglobosa*, AgNPs, antimicrobial activity

NANO2020/P026
Development and characterization of cellulosic nanofiber from luffa and baobab fibers

Adamu, Y*, Joji, A.S, and Musa, S
Department of Chemical Engineering, Ahmadu Bello University, Zaria, Nigeria
*****yusufbinadam@yahoo.com

Investigation was made into the development and characterization of cellulosic nanofibers from luffa and baobab. The fibers were collected and treated using sodium hydroxide. FTIR analysis shows that non-cellulosic materials like wax, hemicellulose and lignin were removed after the treatment. The fibers were later passed through liquid nitrogen and afterwards ball milled for size reduction. Dynamic light scattering (DLS) analysis was used for sizing and distribution of the

nanomaterial. It was found that 95.10% of the milled luffa fibers fall within the nano range of 1-100 nm with an average size of 37.17 nm. It was also found that 95.30% of the milled baobab fibers fall with the range, with an average size of 44.36 nm. From this result, it is clear that the development of cellulosic nano-fibers from luffa and baobab fibers was a success.

Keywords: Luffa, baobab, fiber, NaOH treatment, FTIR, dynamic light scattering

NANO2020/B027

Modelling particle size, drug loading and release of BSA encapsulated into PLGA nanoparticles

Adebileje, T[1, 2*], and Amani, A[2, 3]

[1]Department of Medical Nanotechnology, School of Advanced Technologies in Medicine, International Campus, Tehran University of Medical Sciences, Tehran, Iran, [2]Department of Medical Nanotechnology, School of Advanced Technologies in Medicine, Tehran University of Medical Sciences, Tehran, Iran, [3]Medical Biomaterials Research Center, Tehran University of Medical Sciences, Tehran, Iran

*tajudeenadebileje@gmail.com

Nanoparticle's (NPs) size, drug loading (DL) and drug release from NPs are critical physiochemical parameters to be considered while designing a polymeric carrier encapsulating therapeutic agents. In this study, bovine serum albumin (BSA) was chosen as a model protein to be encapsulated into poly (lactic-co-glycolic) acid (PLGA) NPs by double emulsion solvent evaporation method (DESE). Statistical Box-Behnken design (BBD) was used to investigate the effects and interactions of selected independent parameters of DESE (i.e. concentration of BSA (CBSA) and PVA (CPVA) as well as volume ratio (VR) between external aqueous phase and primary emulsion) on both particle size and DL. From the developed model, all the three parameters showed effects on size while only CBSA had a significant effect on DL. Based on the obtained model, mean (SD) of particle size, DL and entrapment efficiency of optimized samples were measured as 278.67 (9.29) (nm), 7.27 (0.02) (%w/w) and 86.6 (0.56) (%w/w) respectively. *In vitro* release of BSA was determined and subsequently fitted into different models (i.e. zero order, Korsmeyer-Peppas and Higuchi) that describe the release behavior of therapeutic agents. A mean (SD) cumulative release of 44.20 (1.35%) of the encapsulated drug was determined during the first 24 h, Korsmeyer-Peppas model was found to be the best describing model for release from the carrier.

Keywords: PLGA NPs, BSA, particle size, drug loading, drug release, Box-Behnken design

NANO2020/P028
Synthesis and characterization of polydispersed poly(styrene-methyl-methacrylate acrylic acid)

Ikhuoria, E.U[1*], and Ikhazuagbe, H.I[2]
[1]Department of Chemistry, University of Benin, Benin City, Edo State, Nigeria, [2]Product Development Laboratory, Rubber Research Institute of Nigeria, PMB 1049, Benin City, Nigeria

*esther.ikhuoria@uniben.edu

Great attention has been given to the synthesis of monodispersed and uniform colloidal polymer particles with controllable particle size. However, reports on the preparation of polydisperse polymer particles to meet the new demands of the modern markets are limited. This study, therefore, synthesized polydispersed poly(styrene-methyl-methacrylate acrylic acid) (P(St-MMA-AA)) via emulsion polymerization synthetic approach under unstable reaction conditions. The synthesized P(St-MMA-AA) microparticles were characterized using Fourier transform infrared spectroscopy (FTIR), dynamic light scattering (DLS), a thermo-gravimetric analyzer (TGA) and scanning electron microscope (SEM). The DLS results revealed that the obtained P(St-MMA-AA) microparticles are highly polydispersed with broad particle size, ranging from 300-730 nm. SEM analysis showed that the particles are spherical and also further confirmed their polydispersed nature. This research showed polydispersed polymer particles for biomedical and other industrial applications can be achieved by via emulsion polymerization technique.

Keywords: emulsion polymerization, polydispersed, polymer, P(St-MMA-AA)

NANO2020/B029
Antimicrobial proficiency of biosynthesized nanoparticles from *Staphylococcus aureus* strain OS associated with naira notes

Ajayi, O.S[1]*, and Olusola-Makinde, O.O[2]
[1]Department of Agricultural Science, Adeyemi College of Education, Ondo, Nigeria
[2]Department of Microbiology, Federal University of Technology, Akure, Nigeria
*ajayiolayiwola8@gmail.com

This work focused on the biosynthesis of silver nanoparticles using a reduction of Ag^+ with the culture supernatants of *S. aureus* isolated from naira notes which were randomly collected from fifteen (15) each of poultry product sellers (PPS), food vendors (FV), fish sellers (FS) and shop keepers (SK) in Ondo community. Molecular identification of *S. aureus* of strain OS isolated from the collected naira notes were carried out using PCR. Biosynthesis of AgNPs was done using $AgNO_3$ and supernatant of *S. aureus*. A total of (120) AgNPs coated and non-coated paper samples were improvised as currencies and randomly distributed among the respondents. Antibacterial and antifungal activities of AgNPs in comparison with conventional antibiotics were assayed against isolated microorganisms using agar well diffusion method. The bacteria isolated from this study were *S. pyogenes*, *B. subtilis*, *P. aeruginosa*, *E. coli*, and *S. typhi*, while

fungi include *A. flavus* and *R. stolonifer*. *S. typhi* had the highest counts from naira notes collected from sellers of (PP) and (FV) with 1.32×10^9 cfu/ml and 1.55×10^9 cfu/ml respectively. From the naira notes collected, *A. flavus* had the highest counts with (FS: 1.44×10^9 sfu/ml), (FV: 1.10×10^9 sfu/ml), (PPS: 1.32×10^9 sfu/ml) and (SK: 1.03×10^9 sfu/ml). This study showed that AgNPs can penetrate into the bacteria or fungi and inhibit protein synthesis as a result of ribosomes denaturation. Also, AgNPs has high antimicrobial potential against pathogenic microorganisms and can be used as one of the coating agents during currency production.

Keywords: *S. aureus*, silver nanoparticles, conventional antibiotics, bacteria, fungi, currency notes

NANO2020/B030

Cytogenotoxicity and haemolytic potential of *Annona muricata* aqueous leaf extract and its photo-fabricated silver nanoparticles

Badmus, J.A[1*], Oyemomi, S.A[1], Yekeen, T.A[2], Azeez, M.A[2], and Adebayo, E.A[b]
[1]Department of Biochemistry, [2]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
*jabadmus@lautech.edu.ng

Nanotechnology, though a relatively new area of research, has been extensively explored as an agent of biomedical importance with possible inherent toxicity. Toxicological effects of *Annona muricata* aqueous leaf extract (AME) and its biofabricated silver nanoparticles (AME-AgNPs) were evaluated using human blood erythrocytic and *Allium cepa* assays. Haemolytic assay was evaluated using H_2O_2–induced haemolytic erythrocyte in the presence of different concentrations of AME and AME-AgNPs. *A. cepa* root cells were exposed to distilled water (Control), AME, $AgNO_3$, AME-AgNPs, cyclophosphamide, AME and cyclophosphamide, and AME-AgNPs and cyclophosphamide. Cytogenotoxic effects of the treatments on *A. cepa* cells were evaluated at 24 and 48 h, while root number and length were observed at 72 h. The result showed that AME-AgNPs and AME protected erythrocyte cells at low concentration from H_2O_2-induced haemolysis with significance observed for AME ($P<0.05$). AME-AgNPs alone or in combination with cyclophosphamide induced significant dose dependent decrease in *A. cepa* root length, while no growth was observed in $AgNO_3$ solution when compared with the control roots. Contrarily, *A. cepa* roots treated with AME showed increase in root length and significantly ameliorated cyclophosphamide-induced decrease in root length. $AgNO_3$, highest concentration of AgNPs alone and in combination with cyclophosphamide induced total cell arrest. Chromosomal aberrations such as anaphase bridge, c-mitosis and sticky metaphase were observed in all the treatments except in the control, lowest concentration of AME-AgNPs and in combination with cyclophosphamide. Cytogenotoxic potential of the nanoparticles implies its guided usage while its antiproliferative effect could be explored in cancer cell lines.

Keywords: Nanotechnology, cytogenotoxicity, *Annona muricata*, silver nanoparticles, haemolysis, chromosomal aberration

NANO2020/P031
Comparative analysis of thermal characteristics of metallic and non-metallic water-based nanofluids in a square cavity

Sangotayo, E.O[*] and Itabiyi, O.E
Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria.
[*]eosangotayo@lautech.edu.ng

Heat transfer fluids are a vital factor that influences the size and costs of heat exchangers. However, low thermal properties of available coolants like water and oils place setback on the growth of heat transfer to attain high-performance cooling. The paper presents a numerical analysis of a comparative study on thermal characteristics of Al_2O_3, CuO, AlN, and SiC water-based nanofluids in a square cavity. The cavity is surrounded by a hot moving horizontal plate, an adiabatic vertical wall on the right, and the left vertical and lower horizontal sides by cold isothermal walls. The governing equations were solved using finite approximation techniques to assess the thermal characteristics of the four different nanofluids in the enclosure with varying sizes of nanoparticle in the range of $1\% \leq \varphi \leq 10\%$. The results reveal that CuO has a different pattern of heat characteristics compared to other nanofluids. CuO has the highest Nusset number of 58.4715, and Al_2O_3 has the least value of 58.4634 at a 10 % volume fraction. Nanoparticle size has a substantial influence on the thermal attributes of the four nanofluids. This work indicates that different nanofluids have satisfactory thermal properties than water-based fluid, which determines its applications.

Keywords: Cavity, nanofluid, natural convection, heat transfer enhancement

NANO2020/B032
Acute and chronic toxicological effects of animal fur mediated silver nanoparticles on exposed *Clarias gariepinus*

Yekeen, T.A[1, 6*], Azeez, M.A[1, 6], Lateef, A[2, 6], Badmus, J.A[3, 6], Oladipo, I.C[4, 6], Abodunrin, A.E[1], Momoh, G.B[1], Omotunji, D.A[1], Ajana, U.I[1], Akinremi, T.O[1], and Fawole, O.O[5]
[1]Laboratory of Ecotoxicology, Genetics and Nanobiotechnology, Environmental Biology Unit, Department of Pure and Applied Biology, [2]Laboratory of Industrial Microbiology and Nanobiotechnology, Microbiology Unit, Department of Pure and Applied Biology, [3]Department of Biochemistry, [4]Department of Science Laboratory Technology, [5]Environmental Biology Unit, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria, [6]Nanotechnology Research Group (*NANO*[+])
(www.nanotech.lautech.edu.ng)
*tayekeen@lautech.edu.ng

Continuous production and utilization of nano-based products has raised concerns about potential hazards in the environment. Green syntheses are proposed due to their perceived non-toxic nature and eco-friendliness. This study evaluated acute and chronic toxicity of animal fur (goat) mediated silver nanoparticles (AF-AgNPs) on cat fish (*Clarias gariepinus*). Hydrolyzed

animal fur (1 ml) was reacted with 40 ml of 1 mM $AgNO_3$ to produce AF-AgNPs, and characterized using UV-visible, Fourier transform infrared (FTIR) spectroscopy and transmission electron microscopy (TEM). Acute toxicity of AF-AgNPs was evaluated using 750, 850, 900, 950 and 1000 µg/ml with LC_{50} determined after 96 h. *Clarias gariepinus* (25) was exposed to 5, 10, 50 and 100 µg/ml of both Ag-salt and AF-AgNPs out of which blood samples were taken for haematological and micronucleus assays on day 14, 28 and 42, while biochemical parameters were evaluated only on day 42. The AF-AgNPs was brownish with surface plasmon resonance at 419 nm while FTIR showed protein molecules as capping and stabilizing agents. Morphologically, AF-AgNPs were spherical with 11-32 nm size range. Abnormal behavioural changes were observed for *C. gariepinus* exposed to acute concentrations, while LC_{50} of 904.6µg/ml was obtained. Significant alterations in the haematology and biochemical parameters were observed for *C. gariepinus* exposed to various concentrations of AgNPs. Induction of micronucleus and other cell aberrations were observed especially at higher concentrations of Ag-salt and AF-AgNPs. With increase in the production and utilization of nanoparticles, its exposure cannot be ruled out, thus thorough toxicological evaluation and caution is required.

Keywords: Green synthesis, silver nanoparticles, animal fur, haematology, micronucleus assay, nanotoxicology, *Clarias gariepinus*

NANO2020/P033
Nanotechnology in bio-degradation of waste water using gold functionalized TiO_2 nanoparticles

Daramola, O.O[1, 2*], Adeleke, J.T[1, 3], Ayeni, A.A[1], Alabi, A.B[1], and Akomolafe, T[1]
[1]Department of Physics, University of Ilorin, Kwara State, Nigeria, [2]Department of Physical Science, Kings University, Odeomu, Osun State, Nigeria, [3]Department of Physical Science, Osun State University, Osogbo, Osun State, Nigeria
*oo.daramola@kingsuniversity.edu.ng

Sol-gel synthesized titanium dioxide nanoparticles were functionalized with two drops of gold nanoparticles after aged for 24 hours. The functionalized and unfunctionalized samples were filtered and oven dried at temperature of 50 ^oC for two hours. The samples were characterized by scanning electron microscopy SEM, Fourier Transform Infrared (FTIR) spectroscopy, Powdered X-Ray Diffractometers (PXRD) spectroscopy and UV-Visible Spectroscopy for morphology, functional group analysis, structural and optical property analyses. The functionalized sample exhibited rutile phase at no or low heat treatment with grain size of 5.83 nm compared with 5.08 nm of the unfunctionalized sample. It shows a very low band gap of 3.34 eV compared with 3.65 eV of the unfunctionalized sample using Tauc equation. The SEM results revealed that functionalized samples are more porous than the unfunctionalized nanoparticles. The conductivities of functionalized samples were less than unfunctionalized nanoparticles which results in efficiency as dielectric material and this was as a result of surface coverage of gold nanoparticles with it surface plasmon resonance property. Gold functionalized titanium dioxide

sample shows better effect in biodegradation with efficiency of about 0.36 % over pure synthesized TiO_2.

Keywords: Sol-gel, functionalization, bio- degradation, titanium dioxide, gold nanoparticles

NANO2020/B034

Applications and benefits of dietary nanoparticles in fish nutrition: a review

Omosanya, T.A[1], Yekeen, T.A[1, 2, 4*], Fawole, O.O[1], Adewoye, S.O[1], Azeez, M.A[1, 2, 4], Lateef, A[3, 4], and Ajala, O.O[1]

[1]Environmental Biology Unit, [2]Laboratory of Ecotoxicology, Genetics and Nanobiotechnology, [3]Laboratory of Industrial Microbiology and Nanobiotechnology, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria
[4]Nanotechnology Research Group (*NANO*$^+$) (www.nanotech.lautech.edu.ng)
*tayekeen@lautech.edu.ng

Fish nutrition is the single most important input in aquaculture production. It influences fish growth, quality, health, production and waste production. Nanotechnology is an emerging concept with diverse applications including fish nutrition. It involves the use of nanoparticles (NPs) within the scale 1-100 nm in size. The physiological role of nanoparticles depends on their structural and functional characteristics. In aquaculture, nanotechnology techniques have been reported to be efficient in water treatment, while nanodelivery system has been perceived as a safer and more efficient alternative procedure for fish vaccination, nutrient delivery, and effective in fish diagnosis and disease treatment. Fortification of fish diets with nutrient and non-nutrient bioactive components enhance the total nutrient profile balance of a diet and supplement nutrients recovery during feed processing. Administration of dietary nanoparticles provides an increased surface area available for interaction with biological support. Nanoparticles are incorporated into fish diet to improve fish production and when employed as encapsulating materials, they serve as carriers for essential oils, flavor, antioxidants, vitamins, minerals and phytochemicals to improve their bioavailability to fish. Important nanoparticles to fish nutrition include those produced from chitosan, copper (Cu), selenium (Se), iron (Fe), gold (Au), zinc oxide (ZnO_2) and silver (Ag). Application of nanotechnology in fish nutrition is beneficial but not without potential adverse effects on fish, which could be overcome by usage within safety limit.

Keywords: Nutrition, nanotechnology, aquaculture, administration, bioavailability

NANO2020/P035
Application of nanotechnology to ambient air quality and safety in Niger Delta, Nigeria

Wansah, J.F*, Akeredolu, J.B, Iseh, A.J, Iyen, C, and Ocheje, A.J
Department of Pure and Applied Physics, Federal University, Wukari, Nigeria
*fomunyuydzesinyuy@gmail.com

An assessment of the extent of pollutants present in the ambient air in the Niger Delta region of Nigeria relative to permissible levels has been reviewed with respect to the National Ambient Air Quality Standards. Man's activities such as deforestation, urbanization, industrialization, transportation, oil exploration and exploitation, gas flaring, unlimited usage of pesticides and herbicides, for sustenance in the region have led to the degradation of the ambient air quality drastically. Results from ambient air quality assessments show that levels of concentrations of carbon oxides, nitrogen oxides, sulphur oxide and total particulate matter exceed existing Federal Environmental Protection Agency Standards. These pollutants are a threat to ambient air quality and safety of water, plants, animals and humans. These environmental pollutants are found as mixture in the air and are very difficult to remediate using existing conventional technologies. Overcoming this Promethean Paradigm requires latest technologies that control reactions at the nanoscale using engineered nanomaterials. Nanomaterials having relatively larger surface area per unit mass, utilize their unique physical and chemical characteristics to combat environment air pollution through pollution prevention, remediation and sensing of pollutants. Therefore using nanotechnology can facilitate green manufacturing resulting in cleaner, more efficient industrial processes, improved ability to detect and eliminate pollutants thus improving ambient air quality in the Niger Delta. In any case, a comprehensive risk assessment of the safety on human health and environmental impact should be adequately evaluated at all stages of nanotechnology applications.

Keywords: Air quality, assessment, nanotechnology, Niger Delta, pollution, safety

NANO2020/B036
Green chemistry and potential for plant improvement: a perspective

Durodola, F.A[1], Lawal, B.A[2], Azeez, M.A[1*], Yekeen, T.A[1], Lateef, A[1], Oladipo, I.C[3], and Badmus, J.A[4]
[1]Department of Pure and Applied Biology, [2]Department of Crop and Environmental Protection, [3]Department of Science Laboratory Technology, [4]Department of Biochemistry, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria
*maazeez@lautech.edu.ng

Activities in nanotechnology have been going on for decades with tremendous potential for its applications in virtually different fields. Until recently, most approaches employed in the synthesis of nanoparticles and nanomaterials have been either physical or chemical methods, which are generally adjudged to be expensive, cumbersome, with high energy requirements, and use of hazardous and toxic chemicals. The popular demand for cheap, very easy and cost

effective, less energy demanding environmental friendly technology led to the development of green technology, otherwise termed 'Green Chemistry'. Advent of green chemistry has provided pathways for scientists to use biological materials of various origins for synthesis of metallic nanoparticles. Many of the research efforts have been directed towards the use of metallic nanoparticles synthesized in medical and industrial applications with very little on its exploitation in a sustainable way to bring about crop improvement. Most studies on nanoparticles interaction with plants have been directed towards toxicity, with few on mechanism of interference for plant growth and development that may probably be adapted to bring about plant improvement. Unraveling the physiological, biochemical and molecular mechanisms of nanoparticles in plant become very important with a view to produce better plant growth and development. Therefore, this work explore green synthesis of metallic nanoparticles, its various applications in plants with associated challenges to provide direction for future endeavours that will translate to better plant products and resources for the benefit of humanity.

Keywords: Green synthesis, nanoparticles, plant growth, crop improvement, sustainable agriculture

NANO2020/P037

Application of Fe_2O_3-decorated carbon nanofibers (CNFs) in the adsorptive removal of cadmium from wastewater

Oyehan, T.A[1*], Oyehan, I.A[2], and Badmus, S.O[1]

[1]Environmental Sciences Program, Department of Geosciences, College of Petroleum Engineering and Geosciences (CPG), King Fahd University of Petroleum and Minerals, Dhahran-31261, Saudi Arabia, [2]Department of Chemical Engineering, Obafemi Awolowo University, Ile-Ife, Nigeria

*tajudeenoyehan@kfupm.edu.sa

Carbon nanofibers (CNFs) are a group of very light carbon-rich nanomaterials having exceptional surface properties. They have been applied in many areas of research including water treatment by adsorption. However, their efficiency in trace metals treatment has not been promising. In this study, CNFs were modified by decorating their surfaces with 10% ferric oxide (Fe_2O_3) nanoparticles to improve their adsorption capacity for trace metals. The success of the impregnation was confirmed by characterization usingfield emission scanning electron microscope (FESEM) with EDX, thermo-graphic analysis (TGA), Fourier transform infrared (FTIR) spectroscopy and X-Ray spectroscopy (XRF and XRD). Several batch adsorption runs were carried out to investigate the removal efficiency of cadmium (Cd) from water at various treatment conditions of pH, adsorbent dose, contaminant concentration, contact time and agitation speed. Results of the study showed that the iron oxide-impregnated CNFs achieved more than 99% Cd removal at pH 9, 2.0 g/L CNFs in 15 min, while similar amount of non-modified CNFs removed only 82% Cd under similar conditions. Lastly, the study showed that decorating CNFs with Fe_2O_3 nanoparticles enhances their adsorptive properties for toxic trace metal from wastewater.

Keywords: Carbon nanofibres, Fe_2O_3 nanoparticles, Cd, trace metal, wastewater, adsorption

NANO2020/B038

Phytosynthesis of gold nanoparticles using leaf and stem bark extract of *Cassia fistula*: biological activities against food-borne pathogenic fungi

Ajayi, V.A[1, 2*], and Lateef, A[2]

[1]Department of Science Laboratory Technology, [2]Laboratory of Industrial Microbiology and Nanobiotechnology, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, PMB 4000, Ogbomoso, Nigeria

*veikkya@gmail.com

The impact of fungi as food-borne pathogens are often underestimated, however some fungi are capable of producing mycotoxins that can cause mild to fatal intoxication. Also, biosynthesized nanomaterials are being employed in recent times to combat challenges related to microbial contamination of food materials. In this study, gold nanoparticles (AuNPs) was biosynthesized using crude aqueous extract of leaf (CFL) and stem bark (CFS) of *Cassia fistula* and was investigated for their biological activities against food-borne pathogenic fungi. The biosynthesis of AuNPs was monitored by visual observation of the colour change and examined via UV-visible spectrophotometer. Scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) analysis was used to characterize the AuNPs. The AuNPs were also studied for antifungal activities against selected food-borne pathogenic fungi. The biosynthesized AuNPs displayed colour change to dark brown (CFL-AuNPs) and purple (CFS-AuNPs) with maximum absorbance at 580 and 542 nm respectively. SEM examination revealed both spherical and irregularly shapes particles, while the EDX analysis showed gold as the prominent metal present. Moreover, the biosynthesized CFL-AuNPs showed significant inhibitory effect against the growth of *Fusarium solani* (47.65%), *Aspergillus flavus* (50.70%), *A. fumigatus* (47.73%), and *A. niger* (44.29%). Similarly biosynthesized CFS-AuNPs also displayed inhibitory effect against the growth of *F. solani* (51.01%), *A. flavus* (62.67%), *A. fumigatus* (65.15%), and *A. niger* (52.85%). The results obtained in this study revealed the potential of the biosynthesized AuNPs in the control of food-borne pathogenic fungi which can be applied in packaging and storage of food.

Keywords: Gold nanoparticles, biosynthesis, *Cassia fistula*, food-borne fungi, antifungal activity

NANO2020/P039

Design, simulation and optimization of a bamboo fibre reinforced nanocomposite

Chira, C.V[1]*, Muhammad, I.D[1], Dagwa, I.M[1], and Osuchukwu, O.A[2]

[1]Department of Mechanical Engineering, University of Abuja, Nigeria, [2]Department of Mechanical Engineering, Bayero University, Kano, Nigeria

*chikechira@gmail.com

The extensive applications of polymeric materials within the 21st century frontiers of technological advancements can never be over-emphasized; thereby making its diverse research very limitless and unending. Even though polymers are increasingly replacing metals; owing to how much they offer a combination of properties which are more flexible and attractive to

designers, the application of nanotechnology to the production of these polymeric composites have also made them possess tremendous properties that have fostered special applications of these polymeric materials. In an attempt to saving cost of experimentation as well as optimization of the nanocomposites, there is the strong need to design, model, test, as well as optimize these nanocomposites virtually. Hence in this paper, DOE was made for bamboo fibre, nanoclay and epoxy on minitab having an L9 orthogonal array for three (3) distinct levels accordingly. Hence, ultimate tensile test and flexural test were systematically modelled and simulated within SolidWorks, employing finite element analysis (FEA) and adopting the ASTM Standard specimen and procedure. After conducting the designing, modelling and simulation of all the nine (9) experimental runs, the optimal ultimate tensile strength (UTS) of the bamboo fibre reinforced nanocomposite was observed at experiment 9 to be 7.668 GPa; while the optimal flexural strength (FS) of the bamboo fibre reinforced nanocomposite was observed at experiment 1 to be 198.5 MPa. Bamboo fibre was also seen to be the most significant control factor in the experiment. Considering the values for the UTS and FS of the bamboo fibre reinforced nanocomposite, reliable applications of this material could be highly impactful in structural deckings, window frames, door panels and chairs.

Keywords: Nanoclay, bamboo fibre, mechanical properties, simulation, SolidWorks, Minitab

NANO2020/P040

Catalytic dehydrogenation of propane on Cu-based single-atom alloy and Pt(111) catalysts surfaces: a density functional theory study

Ibrahim, A.O*, and Momoh, O.R
Department of Chemical Engineering, Ahmadu Bello University, Zaria, Nigeria
*aoibrahim63@gmail.com

Density functional theory has been used to study the catalytic dehydrogenation of propane to propylene on Pt(1 1 1), Pd-doped Cu(1 1 1) and Pt-doped Cu(1 1 1) surfaces. A four-layer slab with a p(4×2) supercell was used to achieve the coverage of adsorbate of 0.25 monolayer (ML). The adsorption configurations of the adsorbates were compared with reported experimental data to check out the dependability of our calculations. To evaluate the dehydrogenation of propane to propylene, the adsorption energies, reaction energies and reaction barriers on the catalyst surface were determined. The calculated adsorption energies of the different surfaces ranked in decreasing order, are as follows; Pd-doped Cu(1 1 1) > Pt-doped Cu(1 1 1) > Pt(1 1 1). Cu-based single-atom alloy catalysts showed markedly improved performance over Pt(1 1 1) catalysts.

Keywords: Heterogenous catalysis, propane dehydrogenation, single alloy catalyst, density function theory

NANO2020/P041
Treatment of wastewater from offshore oil and gas industry by using nanotechnologies

Amakiri, K.T*, Angelis-Dimakis, A, and Molinari, M
Department of Chemical Sciences, University of Huddersfield, Huddersfield, UK
*kingsley.amakiri@hud.ac.uk

Among many organics in oilfield produced water, polycyclic aromatic hydrocarbons (PAHs) have drawn growing attention due to their long-term mutagenic and carcinogenic effects on marine biota and their resistance to biodegradation. Several studies on the application of nanostructured catalytic materials have made considerable progress, and it is fundamental to enhance the catalytic activity of these materials. Nano-crystalline titanium dioxide finds extensive applications in photocatalytic degradation of harmful organic compounds pollutants in water. Here the effect of environmentally friendly and thermally stable iron oxides when doped with titanium dioxide for the treatment of toxic organic compounds was investigated. The prepared nanoparticles were characterized using XRD, FTIR, SEM, and EDS which provided information about the catalysts' structure, chemical composition, purity, and morphology. The catalytic and photocatalytic activities of $CuFe_2O_4$ samples were tested and evaluated for the degradation of phenol using HPLC. $CuFe_2O_4$ nanoparticles showed a higher catalytic activity compared with TiO_2 nanoparticles.

Keywords: Wastewater, photocatalysis, nanomaterials, synthesis, hydroxyl radicals, PAH

NANO2020/P042
Studies on the thermal stability of nanostructured materials

Momoh-Jimoh, I
Department of Mechanical Engineering Technology, University of Hafr AlBatin, Saudi Arabia
imomohjimoh@uhb.edu.sa

Continuous efforts have been devoted towards the fabrications of nanomaterials because of their unique properties which are key for the advancement of nanotechnology. The extreme mechanical and functional performances of nanomaterials are possible as a result of the nanofeatures called 'nanostructured' which exist in nanometer range (1-100 nm). Nanomaterials synthesis and processing are usually done beyond equilibrium state; thus possess an excess Gibbs free energy. It therefore, means that the activation processes such as radiation, corrosion, deformations, and other defects can promote diffusion, recovery, homogenization, and grain growth that could lead to the partial or entire loss of nanostructures and interesting properties. This study is therefore devoted to the investigation of the thermal stability of nanostructured metallic alloys through the kinetic and thermodynamic approach. The various means of stabilizing nanostructured materials shall be discussed and the mechanism of stabilization through grain boundary migration and grain rotation shall be explained.

Keywords: Nanostructured, grain boundaries, grain rotation, equilibrium, mechanical properties

NANO2020/B043

Larvicidal activities of different nanoparticles synthesized using bioflocculants and extracts of *Persea americana*, *Opuntia ficus-indica*, and *Pleurotus pulmonarius*

Adebayo, E.A, Ayantola, M.M*, Oyinloye, O.E, Salaudeen, A.O, Ademola, A.T, Adewale, H.B, Balogun, H.A, and Adeleke, I.E

Microbiology and Biotechnology Laboratory, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, P.M.B. 4000, Ogbomoso, Nigeria
*ayantolamuinat@yahoo.com

Malaria is causing millions of death every year; this has effects on economic activities of most African nations. The incidence of mosquito's resistance to synthetic insecticides, which may also cause adverse environmental effects, has led to the search for other methods of destruction of mosquitoes at larva stage. In this study, silver (AgNPs), gold (AuNPs) and silver-gold alloy nanoparticles (Ag-AuNPs) were biosynthesized using aqueous extract from *Persea americana* (PA), *Opuntia ficus-indica* (OF), *Pleurotus pulmonarius* (PP) and bioflocculants (BF) and investigated for larvicidal activities against the larva of *Anopheles gambiense* mosquito. The synthesized PA and OF-AgNPs, AuNPs and Ag-AuNPs were previously characterized while PP and BF were characterized by UV-vis and Fourier transforms infrared spectroscopy (FTIR). Larvae were exposed to varying concentrations of synthesized AgNPs, AuNPs and Ag-AuNPs for 24h with the extract and salt solutions as control. For the biosynthesized AgNPs, higher percentage of (100%) mortality rate was observed in PA-AgNPs at 20µg/ml within 12h, while OF-AgNPs gave the lowest percentage (80%) of mortality rate within 24h at 20µg/ml. For the biosynthesized AuNPs, maximum efficacy of (70%) mortality rate was observed in BF-AuNPs at 5µg/ml in 24h, while OF-AuNPs and PP-AuNPs has no significant effect, PA-AuNPs has no effect at all. For the biosynthesized Ag-AuNPs, PP-Ag-AuNPs has maximum efficacy of (100%) mortality rate at 15µg/ml in 12h, while BF-Ag-AuNPs has lowest efficacy of (60%) mortality rate at 20µg/ml in 24h. The result suggests that the synthesized nanoparticles of PA, OF, PP and BF have larvicidal activity against *Anopheles gambiense* mosquito, and could be used as an effective and eco-friendly approach for the control of malaria vector.

Keywords: Biosynthesis, nanoparticles, larvicidal activity, mosquito, biomedical application, AgNPs, AuNPs, Ag-AuNPs