



ACS Chapter
Nigeria



6th ANNUAL SYMPOSIUM OF THE AMERICAN CHEMICAL SOCIETY Nigeria International Chemical Sciences Chapter

THEME:

**DESIGNING A SUSTAINABLE FUTURE: CHEMISTRY IN A COVID-19
SOCIETY AND ECONOMY**

TECHNICAL SESSION DISTRIBUTION & BOOK OF ABSTRACTS

OTA, 2021

DATE: FEBRUARY 28 – MARCH 3, 2021



PROGRAMME FOR TECHNICAL SESSION AND BOOK OF ABSTRACTS

TECHNICAL SESSION 1
Monday, March 1, 2021
 Chair: Dr. M.M. Solomon
 Co-Chair: Dr. O.A. Aladesuyi
 Venue: CUCRID Auditorium

Paper No	Title	Authors	Presentation Time
106	Effect of pentaerythritol on the efficacy of some ammonium phosphates in flame retardation of poly(vinyl chloride) (PVC) sheets	Abba, H., Musa, H. and Iji, M.	1:15 – 1:25 pm Virtual
112	Contemporary Breakthroughs in Chemistry: Catalyst for Sustainable Development	L. G. Hassan and Mustapha Salihu*	1:25 – 1:35 pm Virtual
121	Proximate and Minerals Composition of Rhizomes and Leaves of Turmeric Plant (<i>Curcuma longa Linn</i>)	Ede Bala Osu, S. S. Audu, Emaime, Jimmy Uwanta	1:35 – 1:45 pm
122	Phytochemical Composition of Rhizomes and Leaves of Turmeric Plant (<i>Curcuma longa Lin</i>)	Ede Bala Osu, S. S. Audu, Emaime, Jimmy Uwanta.	1:45 -1:55 pm
124	Synthesis of copper oxide nanoparticles mediated by the fruit and leaf extracts of <i>Crataegus ambigua</i> and their antibacterial, antioxidant and antiplasmodial effect.	Okoh, S.O*· Ojemaye, M.O., Okoh, O.O., Okoh, A.I	1:55 – 2:05 pm
127	Metal sulphide quantum dots and nanocrystals from metal dithiocarbamate complexes: Morphological studies, <i>in vitro</i> anticancer potentials and photocatalytic degradation of organic dyes	Peter A. Ajibade*, Abimbola E. Oluwalana, Fartisincha P. Andrew	2:05 – 2:15 pm
129	Green Synthesis, characterisation and cytotoxicity investigation of nanoparticles of aqueous extract of <i>Senna occidentalis</i> leaf	Owolarafe, T. A.; Salawu, K. ; Ihegboro, G. O.; Ononamadu C. J. ; Salau, A. K.; Asibi, D. T. Fidelis R. K.; Nkanu, W. M.; Owoeye V. O; Joshua, G. I.	2:15 – 2:25 pm
130	Schiff Base Metal Complexes Derived from Salicylidene-4-Aminoantipyrine and its Derivatives: A Review	Ebosie, N.P. and Ogwuegbu, M.O.C.	2:25 – 2:35 pm Virtual

134	Modelling of Lead-free Perovskite Solar Cell Using SCAPS-1D	Muhammed A O., Eli D*, Boduku H. P., Tasiu J., Ahmad M. S., Usman N.	2:35 – 2:45 pm Virtual
135	A Review on Lanthanide (III) Complexes of Schiff Bases Derived From 4-aminoantipyrine and its Derivatives	Ebosie, N.P. Ogwuegbu, M.O.C Onyedika, G.O. Onwumere, F.C.	2:45 – 2:55 pm Virtual
136	Comparative study of biodegradation of sucrose-plasticised thermoplastic mango starch biofilms in water and soil	Ernest C. Agwamba, Lawal G. Hassan, M. Achor and Abdullahi M. Sokoto	2:55 – 3:05 pm Virtual
140	Reactivity study of metal oxide supported bimetallic catalysts for upgrading of lignin derived bio-oil to hydrocarbons fuels	Murtala M. Ambursa, Aminu K. Rabi, Yahaya yakubu, Sayudi Haruna, Ibrahim G. Wawata	3:05 – 3:15 pm Virtual
141	Simple ultrasound-heating process for preparation of magnetite-sulfur adsorbent for rapid uptake of phosphate solution	Owolabi M. Bankole*, Adeniyi S. Ogunlaja, Moses A. Adeyemo, Segun E. Olaseni, Olayinka S. Adanlawo, Kehinde I. Ojibola, Andy O. Enijuni	3:15 – 3:25 pm
143	Proximate Analysis and Functional Properties of Physically Modified of Kidney Bean (<i>Phaseolus vulgaris</i> . L.) Starch	Mary Oluwaseun Okekunle, Chidinma Gloria Ugwuja, Kayode Oyeboade Adebowale	3:25 – 3:35 pm Virtual
145	Preparation and advantage of adhesive (glue) from Styrofoam and gasoline in Nigeria economy	Aderibigbe S.A* and Raji H.O	3:35 – 3:45 pm Virtual
146	Preparation and characterization of rice husk activated carbon supported zinc oxide nanocomposite	Adewumi O. Dada*, Adejumo A. Inyinbor, Olugbenga S. Bello, Blessing E. Tokula*	3:45 – 3:55 pm
147	Cellulose nanocrystals prepared and characterised from underutilised sugarcane peel	Chioma Vivian Abiazem, Cyril Osereme Ehi-Eromosele, Leslie Felicia Petrik, Akan Bassey Williams	3:55 – 4:05 pm Virtual
TECHNICAL SESSION II Tuesday, March 2, 2021 Chair: Dr. T.O. Siyanbola Co-Chair: Dr. E.I. Udeme Venue: CUCRID Conference Room I			
Paper No	Title	Authors	Time
101	GC-MS screening, oral toxicity and <i>in vivo</i> antidiabetic activity of the methanol whole plant extract of <i>Plantago rugelii</i> (Plantaginaceae)	C. Ogbiko*, C.J. Eboka. L.G. Hassan and A.S. Yelwa	11:40 – 11:50 am Virtual

102	Phytochemical antioxidant and antimicrobial study of the crude extract of <i>Curvularia sp.</i> isolated from the leaves of the medicinal plant <i>Piliostigma thonningii</i> (Fabaceae)	C. Ogbiko*, F.B.C. Okoye., C.J. Eboka and Okezie, U.M	11:50 – 12:00 pm Virtual
107	HSQC-NMR Spectroscopy and Exploratory Data Analysis of Oil residue in relation to the time of spill	Menkiti, N.D. *Isanbor, C.I. and Ayejuyo O.O.	12:00 – 12:10 pm
108	Isolation of squalene and its derivative from the leaf of <i>Ficus sycamorous</i> L. (Moraceae)	*Atiku I., Pateh U.U., Sule M.I. and Isyaka M.S.	12:10 – 12:20 pm
109	Production of bioethanol from sorghum straw	Zainab Ibrahim S G Adiya* and Thompson Izuagie	12:20 – 12:30 pm
110	Antiproliferative Effects of Diterpenoids from African <i>Croton</i> Species	Sani M. Isyaka*, Eduard Mas-Claret, Moses K. Langat and Dulcie A. Mulholland	12:30 – 12:40 pm
115	Extraction, Fractionation, Characterization and Screening of Aqueous Extract of <i>Persea americana</i> Seeds for Hypoglycaemic Potential	Tajudeen Afolayan Lawal	12:40 – 12:50 pm
116	Phytochemical, nutritional and antimicrobial status of the leaves of Nigerian <i>Ziziphus spina</i> – Christi (L.) Willd against selected pediatric infectious diseases	Ogbiko, C*, Adiya, Z.I.S.G., Adamu, S.S., Isah, A.M. and Ibrahim, I.	12:50 – 1:00 pm Virtual
117	Extraction and assessment of physicochemical properties of african walnut (<i>Plukenetiaconophorum</i>) oil	Olagoke, H.B* and Akintayo, C.O ¹	1:00 -1:10 pm Virtual
118	Green Synthesis, characterisation and cytotoxicity investigation of nanoparticles of aqueous extract of <i>Senna occidentalis</i> leaf.	Owolarafe, T. A.; Salawu, K.; Ihegboro, G. O.; Ononamadu C. J. ; Salau, A. K.; Asibi, D. T. ; Fidelis R. K.; Nkanu, W. M.; Owoeye V.; Joshua, G. I.	1:10 – 1:20 pm
119	Efficacy of the Column purified Fractions of <i>Sinna occidentalis</i> and <i>Moringa oleifera</i> (Leaves) Against Selected Enzymes of <i>Bulinus globosus</i> (Intermediate Host of Urinary Schistosomes) From Shagari and Goronyo Dams of Sokoto State, Nigeria	*Suleiman, J., Muhammad, M. T. and Lema, S. Y.	1:20 – 1:30 pm Virtual
120	Phytonutrients and antioxidant vitamins of <i>Sclerocarya birrea</i> fruits pulp obtained in Sokoto state, Nigeria	*Muhammad Sirajo and Thompson Izuagie	1:30 – 1:40 pm

126	Physicochemical and Antioxidant Activity of Methanol Extract of Peels of <i>Saccharum officinarum</i> Linn.	<u>Halilu, M.E.</u> , Jibril, A. and Mathias, S.N	1:40 – 1:50 pm
131	Isotherm and Statistical Validity Modelings of Adsorption of Endocrine Disruptive Cr(VI) onto Calcinated Earthworm Cast	A.O. Dada*, S.O. Olusanya, G.O. Adediran, F.A. Adekola,	1:50 – 2:00 pm
137	Evaluation of tableting properties of ethylated cassava starch	A. Uba, L. G. Hassan, M. Achor, E. C. Agwamba and A. Gidado	2:00 – 2:10 pm Virtual
138	<i>In vitro</i> antimicrobial, antioxidant, and antidiabetic activities of extracts of <i>Senecio Abyssinicus</i> leaves	Godshelp O. Egharevba*, Omotayo O. Dosumu, Ikponmwosa. O. Evbuomwan, Njinga S. Ngaitad, Abimbola P. Oluyori, Abdulmumeen, A. Hamid	2:10 – 2:20 pm
144	Phytochemical and Antioxidant Evaluation of <i>Albizia zygia</i> , <i>Trema orientalis</i> and <i>Psidium guajava</i> : A drug discovery pathway for combating obesity	Taiwo O. F., Olugbuyiro* J.A.O. and Adebayo A.H.	2:20 – 2:25 pm
149	Commodity Plastics of the Future: Polyhydroxyalkanoates (Review)	S. O. Egharevba	2:25 – 2:30 pm
150	Synthesis of Faujasite zeolite X from silica extracted from rice husk ash for the removal of heavy metals from aqueous solution by batch process: Kinetic and equilibrium study	Akinjokun Adebola Iyabode*, Petrik Leslie Felicia, Ojumu Tunde Victor, Ajao John and Ogunfowokan Aderemi Okunola	2:30 – 2:40 pm

TECHNICAL SESSION III

Tuesday, March 2, 2021

Chair: Dr. J.A. Adekoya

Co-Chair: Dr. E.A. Adedapo

Venue: CUCRID Conference Room II

Paper No	Title	Authors	Presentation Time
103	Ecotoxicological risk assessment of organic micropollutants in sediments of Lagos lagoon	John P. Unyimadu* and Nsikak U. Benson	11:40 – 11:50 am
104	Geochemical characterization of soil and underground water in Goronyo local government area of Sokoto state	*Nasiru, Y., Muhammad, U., Alhassan, M., Suleiman, M., Garba, A.A Kasim Abubakar and Usaman J	11:50 – 12:00 pm
105	Comparative Analysis of Mineral Elements in <i>Adonsonia Digitata</i> (Baobab Tree) Fruit Pulp and Seed	*Nasiru, Y., Gado Mustapha., Alhassan, M., Suleiman, M., Garba A. A and Kasim Abubakar	12:00 – 12:10 pm

111	Heavy metals impact on farm soil in Bagega and Jabaka mining communities	Sholadoye .Q. Oyeniyi, W.L.O Jimoh, Onoyima C. C. & Sabo Yusuf	12:10 – 12:20 pm
113	Impact of Covid-19 and the future of chemistry teaching and learning	L. G. Hassan and Mustapha Salihu*	12:20 – 12:30 pm Virtual
114	Adsorption of Pb ²⁺ and Hg ²⁺ from aqueous solution by azomethine functionalized magnetic nanoparticles: kinetics, isotherm and thermodynamic studies	Mike O. Ojemaye, Omobola O. Okoh and Anthony I. Okoh	12:30 – 12:40 pm
123	Prevalence of Trypanosomiasis among Cattle Slaughtered at Sokoto Modern Abattoir, Sokoto State, Nigeria	*Suleiman, J., Lema S. Y., Muhammad, I. N. and Galadima, L. G	12:40 – 12:50 pm Virtual
125	Efficacy of chitosan as a coagulant aid to alum precipitation of congo red in wastewater	*Adelagun R.O.A., Dibah B.J. and Kamba E.A.	12:50 – 1:00 pm
128	Distribution, sources and risk assessment of polychlorinated biphenyls in urban freshwater ecosystem of Ikpa River Basin (Nigeria)	Ubong V. Ebong, Edu J. Inam*, Akwaowo I. Inyangudoh, Nnanake-Abasi O. Offiong, Joseph P. Essien	1:00 -1:10 pm Virtual
132	Bamboo Supported Fe ₃ O ₄ Nanocomposite (B-Fe ₃ O ₄ -NC) for Effective Adsorption of Cu(II) ions: Effect of Operational Parameters on Removal Efficiency	Adewumi O. Dada*, Folahan A Adekola, Olugbenga S. Bello, Olarewaju A Dada, Fehintoluwa E. Dada, Osazuwa O. Nath,	1:10 – 1:20 pm
133	Effect of Lead and Cadmium on Soil Microbial Activities	Olajide Akinnibosun, Abeni Beshiru and Etinosa O. Igbinsosa*	1:20 – 1:30 pm
139	Effect of Sonication Time on Dispersion of Pristine Single-Wall Carbon Nanotubes in 1,2-dichloroethane	Aminu K. Rabiu*, Murtala M. Ambursa, Yakubu Yahaya, Ibrahim G. Wawata and Sayudi Haruna	1:30 – 1:40 pm Virtual
142	Insight into the corrosion mechanism and mitigation effect of benzimidazole derivative on Cu-Ni alloys corrosion in a simulated acid cleaning environment	Moses M. Solomon	1:40 – 1:50 pm
148	Optimization of process variables for the leaching of dolomite in hydrochloric (HCl)/perchloric (HClO ₄) acid system	Are Comfort Temitope*, Yisa Jonathan, Suleiman Mohammed Abubakar Tanko, Auta Manase, and Joseph, Isaac Adekunle	1:50 – 2:00 pm Virtual
151	Thermal, transparency and water sensitivity properties of bleached, cross-linked cassava starch film	J. Y. Jiya, J. S. Enaburekhan, M. T. Jimoh, E. C. Egwim, I. A. Joseph	2:00 – 2:10 pm Virtual

152	The Effect of motion and pattern of diamagnetic Motion to destroy Corona Virus	Abdul Nurudeen	2:10 – 2:20 pm Virtual
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THE ABSTRACTS

Paper 101

GC-MS screening, oral toxicity and *in vivo* antidiabetic activity of the methanol whole plant extract of *Plantago rugelii* (Plantaginaceae)

C. Ogbiko^{1*}, C.J. Eboka², L.G. Hassan¹ and A.S. Yelwa¹

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²Department of Pharmaceutical Chemistry, Faculty of Pharmaceutical Sciences, University of Benin, Benin City Edo State Nigeria.

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Abstract

Metabolic disorder like Diabetes Mellitus requires serious attention to prevent its associated long-term complications. *Plantago rugelii* is an important medicinal plant used in South-South Nigeria for the management and treatment of diabetes mellitus amongst others. The present investigation focusses on the GC-MS profile, oral acute toxicity, and the antidiabetic potential of the methanol whole plant extract of the plant. The fresh whole plant was obtained, air-dried, pulverized, cold macerated using absolute methanol and concentrated to dryness. Acute oral toxicity was conducted using the Lorke procedure. Diabetes was induced by a single intraperitoneal injection of alloxan monohydrate (160 mg/kg) in ice-cold 0.9% v/v normal saline. The extracts at 50, 100 and 200 mg/kg body weight reduced glycaemia by 30.43%, 43.78% and 59.54% respectively as against the glibenclamide treated rats, which has a 82.77% reduction. There were no mortality at 4 g/kg p.o. after 24 hours and no sign of delayed toxicity or mortality after 14 days of observation. The GC-MS spectra revealed twenty-one (21) phytoconstituents of which some have established antidiabetic effect. The antidiabetic effect of the plant could be attributed to the presence of the established biological phytochemicals; however, bioassay-guided isolation and characterization of the phytocompound(s) should be carried out to identify the lead compound(s).

Keywords: *Plantago rugelii*, GC-MS, diabetes, antidiabetic, toxicity

Paper 102

Phytochemical antioxidant and antimicrobial study of the crude extract of *Curvularia sp.* isolated from the leaves of the medicinal plant *Piliostigma thonningii* (Fabaceae).

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Abstract

Recently, there is biotechnological interest in their secondary metabolite of endophytes since they have been shown to be capable of producing substances of pharmacological importance. *Piliostigma thonningii* is a tree whose parts are widely employed in Nigeria for diverse medicinal applications. The aim of this study is to investigate the phytochemical composition, the antiradical, and *in vitro* antimicrobial potentials of the crude ethyl acetate extract of *Curvularia sp* isolated from the leaves of the plant. The endophytic fungus was isolated, purified, and identified using conventional methods. Quantitative estimation of the total phenol and flavonoid were done by spectrophotometric method using gallic acid and quercetin as standards, respectively. While the antioxidant activity was determined by DPPH scavenging assay, the agar well diffusion method was employed to screen for its antimicrobial capabilities. Results showed the presence of important phytoconstituents notably alkaloid, flavonoid, phenolics, tannin, saponins among others. While the antioxidant assay showed the total phenolic and flavonoid contents to be 212.55 ± 1.2 mgGAE/g extract and 143.16 ± 0.8 mgQE/g extract respectively, a $74.45 \pm 0.11\%$ free radical scavenging activity was observed compared to ascorbic acid standard that exhibited a $87.92 \pm 0.17\%$ inhibition. At the highest investigated concentration of 1 mg/mL, the extract produced significant ($p < 0.05$) antibacterial activity against all the microbes except for the fungi where no sensitivity was noticed. The results showed that the extract exhibits marked antioxidant and antibacterial effects thus justifying the assertion that endophyte bioactive compounds have promising applications in the field of medicine.

Keywords: Antioxidant, Antimicrobial, *Curvularia sp*, Phytochemical, Secondary Metabolites

Paper 103

Ecotoxicological risk assessment of organic micropollutants in sediments of Lagos lagoon

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Abstract

The occurrence and potential ecotoxic risk assessment of organic micropollutants including twenty-seven polychlorinated biphenyls (PCBs) and twenty organochlorine pesticides (OCPs) was investigated in sediment samples from Lagos lagoon. Eighteen sediment samples were obtained from eighteen designated sites along the Lagos lagoon using a Van Veen grab sampler. The samples were extracted, cleaned up and analysed using gas chromatography coupled with electron capture detector (ECD). Most target micropollutants were detected in all the sediment samples. The total PCBs ranged between 234-6760 $\mu\text{g}/\text{kg}$ dry wt., which however exceeded the TEC and PEC guidelines of 59.8 and 676.0 $\mu\text{g}/\text{kg}$ dry wt., respectively. High levels of total organochlorine pesticides were found in sediment samples at all the locations and ranged between 222 and 2586 $\mu\text{g}/\text{kg}$ dry wt. The threshold effect concentration (TEC) associated with Sediment Quality Guidelines was exceeded in 100% of the locations for DDD, Σ DDT, heptachlor epoxide, and 90-99% of the stations for chlordane, dieldrin, DDE, endrin and lindane. More so, the probable effect concentration (PEC) was exceeded 100 % for DDD, total DDT, 88% for heptachlor epoxide, and 27% for DDE. The results of this evaluation have provided proof for classifying 75% of the Lagos lagoon sediment as toxic and could pose considerable ecotoxic risk to benthic fauna in the lagoonal ecosystem.

Keywords: Organochlorine pesticides; Polychlorinated biphenyls; Risk assessment; Sediment Quality Guidelines; Lagos lagoon.

Paper 104

Geochemical characterization of soil and underground water in Goronyo local government area of Sokoto State

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Abstract

This study was carried out to assess the quality of drinking water and soil of Goronyo Local Government of Sokoto State, Nigeria. Water samples were collected from three functional boreholes using standard techniques. The concentrations of Pb, Fe, Mn, Cr, Na and K were

assessed using standard analytical methods. All elements under study were detected at the three locations. The concentration range obtained for Pb, Fe, Mn, Cr, Na and K in soil samples A, B and C were 8.76 ± 1.54 , 124.90 ± 26.90 , 57.10 ± 25.60 , 1.37 ± 0.52 , 88.42 ± 4.98 and 126.92 ± 56.71 mg/kg respectively while the concentration range obtained for Pb, Fe, Mn, Cr, Na and K in water samples A, B and C were in the order 0.0148 ± 0.006 , 1.009 ± 0.2 , 0.1683 ± 0.003 , 0.154 ± 0.001 , 36.23 ± 2.34 and 13.17 ± 1.21 mg/kg. Except for Mn in soil and Na in water samples the remaining elements were above the permissible limit recommended by WHO. In light of these findings, periodic analysis of samples from boreholes is recommended. Such analysis will reveal pollution status of groundwater soil in this area and to determine the best method for water treatment, to intimate consumers and other users of the groundwater, and also to safeguard their health against the subsequent impact that may arise from drinking polluted water.

Keywords: Geochemical, Soil, Water, Goronyo, Underground.

Paper 105

Comparative Analysis of Mineral Elements in *Adansonia Digitata* (Baobab Tree) Fruit Pulp and Seed

*Nasiru, Y¹., Gado Mustapha., Alhassan, M¹., Suleiman, M¹., Garba A. A¹ and Kasim Abubakar¹

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Abstract

The fruit pulp and seed of Baobab (*Adansonia digitata*) were analyzed for mineral elements using spectrophotometric method of analysis. The pulp and seeds were found to contain substantial quantities of calcium, magnesium, zinc, iron and manganese which were found to be 15462.88, 759.21, 4.05, 78.28 4.44 mg/Kg and 11640, 754.08, 4.18, 2.61, 4.22 mg/Kg respectively for seed and fruit pulp. This result shows that the pulp and seed of Baobab are very rich in mineral element contents and therefore can be recommended as supplement for the investigated mineral elements as they will contribute greatly to the daily recommended intake of these mineral elements.

Keywords: Baobab, spectrophotometric, Seed, pulp.

Paper 106

Effect of pentaerythritol on the efficacy of some ammonium phosphates in flame retardation of poly(vinyl chloride) (PVC) sheets

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Abstract

15 g each of three ammonium phosphates [(NH₄)₃PO₄, NH₄H₂PO₄ and (NH₄)₂HPO₄] were added, separately, to 100 g of PVC and compression molded to prepare a sheet measuring 45.2 × 11.6 × 2.3 mm³ to serve as control. 1.5, 3.0, 4.5, 6.0, 7.5, 9.0, 10.5, 12.0 and 13.5 g of pentaerythritol was added to the 100 g of PVC to prepare nine sheets of the same dimension. Cone calorimeter was used to assess the mass loss rate (MLR), heat of combustion (ΔH_c), total heat release (THR) and peak heat release rate (PHRR) of the 10 (control and nine pentaerythritol-containing) samples. Limiting oxygen index (LOI) and vertical burn rating tests were also carried out to evaluate the flammability of the 10 samples. The experimental results showed that although the three ammonium phosphates exhibited good flame retardancy in the PVC, their performance was found to improve with increase in concentration of pentaerythritol. The efficiency of the ammonium phosphates in the flame retardation of PVC sheets was found to follow the order (NH₄)₃PO₄ > NH₄H₂PO₄ > (NH₄)₂HPO₄ with the trend attributed to the quantity and ease with which ammonia (NH₃) gas is released on heating the ammonium phosphate-containing PVC sheets. The cone calorimeter results showed decrease in values of all the four parameters investigated with increase in concentration of pentaerythritol with the difference between the control and the least pentaerythritol-containing sample being the highest (0.07 gs⁻¹ in mass loss rate, 14.36 MJkg⁻¹ in heat of combustion, 22.06 MJm⁻² in total heat release rate and 222.12 kWm⁻² in peak heat release rate). The LOI values and the vertical burn ratings of the samples were also in the order (NH₄)₃PO₄ > NH₄H₂PO₄ > (NH₄)₂HPO₄. The ammonia gas released renders any combustible gas nonflammable by acting as a strong base in the condensed phase and as a diluent in the gas phase of the combustion process and, in combination with pentaerythritol, a polyhydric alcohol that burns to produce CO₂ and water vapor, have greatly enhanced the flame resistance of PVC. Since combination of pentaerythritol and the three ammonium phosphates used in this study are highly efficient in flame retardation and biodegradable, they are recommended for use as substitutes to the non-biodegradable, environment hostile and toxic flame retardants and synergists in commercial production of PVC and its products.

Keywords: Ammonia, cone calorimeter, flammability, pentaerythritol, PVC

Paper 107

HSQC-NMR spectroscopy and exploratory data analysis of oil residue in relation to the time of spill

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Abstract

Eight oil residues extracted from crude oil spill site have been investigated for natural attenuation by the means of a 2D HSQC NMR spectroscopy. Using the exploratory data analysis (EDA) techniques; PCA and HCA, the predictive ability of the NMR technique with regards to similarities and differences in the composition of the oil residue over time was explored. The first three PCs from PCA accounted for 87 % of the total variance while three clusters each were obtained from HCA analysis based on similarity in samples and NMR areas. Both exploratory analysis revealed that the $-\text{CH}_3/-\text{CH}_2$ types, aliphatic and aromatic content of the oil residue are the main factors responsible for compositional differences. The euclidean distance constructed from PCA indicated real differences between fresh crude oil, aged and younger residue. If the exposure time of oil spill is known, HSQC coupled with exploratory data analysis would be a useful tool in evaluating the structural and compositional transformation of oil residue in the environment. This may be useful as a guide in deciding which remediation strategy is implemented in an oil spill environment like the Niger Delta region.

Keywords: Oil residue, HSQC, Natural Attenuation, Remediation, Exploratory Data Analysis

Paper 108

Isolation of squalene and its derivative from the leaf of *Ficus sycomorosa* L. (Moraceae)

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Department of Pharmaceutical and Medicinal Chemistry, Ahmadu Bello University Zaria, Nigeria.

Abstract

Ficus sycomorosa (Family: Moraceae) is a plant used in African traditional medicine to treat mental illness, dysentery, cough, diarrhea, tuberculosis and cancer. The aim of this study is to identify and characterize some compounds from the leaf extract of the plant. The dried pulverized leaf of the plant was extracted using dichloromethane for 72 hours. The extract was drained and filtered. The DCM extract was subjected to Flash Column Chromatography using mobile phase, which progressed from 100% n-hexane to 1:1 mixture of Dichloromethane and ethyl acetate and Silica gel (60-120) as stationary phase. This resulted in the isolation of

Squalene and Squalenol. The structures of these compounds were established by careful analysis of their spectral (^1H , ^{13}C and 2D NMR) data and comparing them with those reported in the literature.

Keywords: *Ficus sycomorosa*, Moraceae, Squalene, *Squalenol*, NMR

Paper 109

Production of bioethanol from sorghum straw

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Abstract

Bioethanol is an attractive and sustainable energy source of fuel for transportation. It is seen as a good alternative fuel as it emits zero carbon into the atmosphere. In this study, bioethanol was produced from sorghum straw using *saccharomyces cerevisiae* yeast. The sample was collected locally from Sharma village, in Sokoto state, Nigeria. It (sorghum straw) was air-dried for seven days to remove all the moisture present in it, ground to powdered form using pestle and mortar and then sieved. The sieved powder was subjected to acidic pre-treatment, reducing sugar determination and fermentation in a shaking incubator for twelve days. The product was purified by distillation and characterized by FT-IR analysis. The results showed that the sample contained reducing sugar of 5.18 g/cm³ while the percentage yield was found to be 4.28 %. The presence of peaks for amide and alcoholic functional groups in the FTIR spectra validated the product as bioethanol. The study showed that the feedstock (sorghum straw) gave low percentage yield. Further studies are underway to improve the yield of the product.

Keywords: Bioethanol, Sorghum, *Saccharomyces cerevisiae*, Fuel and Energy

Paper 110

Antiproliferative Effects of Diterpenoids from African *Croton* Species.

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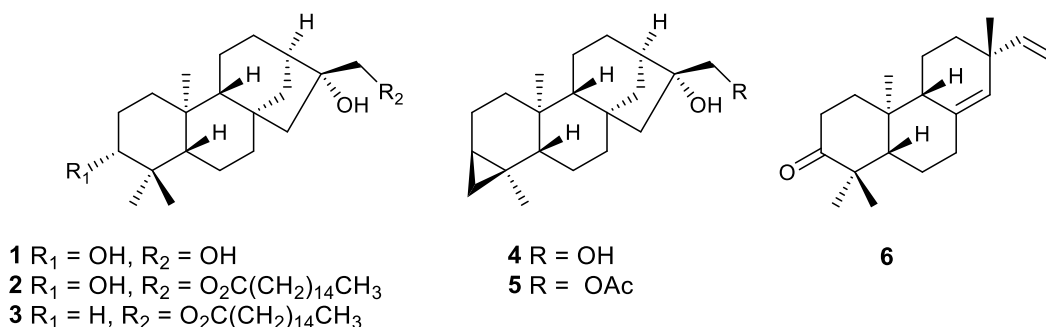
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Abstract

We report the chemistry and pharmacological investigation of three Central and East African *Croton* species, *Croton mubango* Mull. Arg. and *Croton haumanianus* J. Leonard from the Democratic Republic of Congo, and *Croton dictyophlebodes* Radcl. - Sm from Tanzania. Sixty diterpenoids, including forty-five previously undescribed, three triterpenoids, three

sesquiterpenoids, three phytosterols, two phenolic compounds, one ferulic acid derivative, linoleic acid and two chlorophyll derivatives were isolated from these species. Thirty diterpenoids were submitted to the Development Therapeutics Program (DTP) of the National Cancer Institute (NCI) in the United States of America for the NCI 60 anticancer cell line screening programme. Compounds **1-5** and **6** (figure 1) showed selective antiproliferative effects against three of the NCI 60 cancer cell lines. Compounds **1-5** were found to show 100% lethality against colon (HCT-116), melanoma (M14) and renal (786-0) cancer cell lines whereas **6** gave 99%, 89% and 82% cell lethality against melanoma (MALME-3M), renal (UO-31) and ovarian cancer (IGROV1) cell lines respectively at a concentration of 10^{-5} M.



Graphical Abstract: Cytotoxic diterpenoids at a single dose of 10^{-5} M

Paper 111

Heavy metals impact on farm soil in Bagega and Jabaka mining communities

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Abstract

Soil samples were collected from farm soil at the depth of 0-15cm from Bagega (BAG) and Jabaka (JBK) mining Areas, Zamfara State. The level of soil contamination were assessed by Geo-accumulation Index (Igeo) and Pollution Load Index (PLI). The Geo-accumulation studies show that the soil were moderately polluted by Pb (1.21 mg/kg), Fe (0.9 mg/kg), Zn (0.91 mg/kg) and Cu (1.46 mg/kg) for Bagega farm soil and Pb (1.31 mg/kg), Fe (0.95 mg/kg) and Zn (1.41 mg/kg) for Jabaka farm soil. The Pollution Load Index result show that farm soil were polluted, with PLI value of 2.12 for Bagega farm soil and value of 3.7 for Jabaka farm soil. Also, the geochemical distribution of the metals in the soil samples were revealed by sequential extraction procedures, 90% of the metal concentrations were found in the residual fractions. This shows that the high level of contamination of the farm soil is associated to the mining activities going on the communities.

Keywords: Bagega, Jabaka, Geo-accumulation Index (Igeo), Pollution Load Index (PLI), Geo- chemical distribution.

Paper 112

Contemporary Breakthroughs in Chemistry: Catalyst for Sustainable Development

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Abstract

In a world with increasing population and limited resources, only research discoveries and innovations will allow the rapid development in economics, social networks and process that will fulfill the requirement for sustainability. Therefore, the idea of sustainable development with special attention to contemporary breakthroughs in chemistry cannot be overemphasized. The method used in this study is the qualitative descriptive analysis which consist of content analysis technique, and confirmation pattern analysis of recent literatures on contemporary breakthroughs and advances in chemistry. The result of this analysis revealed that, the major life-improving breakthroughs of the last and present centuries in such areas in organic, in organic, medicinal, pharmaceutical, natural products, green chemistry and the overall global economy etc. have been apparently dependent on Chemistry and chemical related technology. The contemporary breakthroughs and advances in chemistry discussed in this paper also have a synergy to sustainable development. However, for breakthroughs in chemistry to act as a catalyst for sustainable development, special attention should be pay to practical methods of creating these molecules, substances, or products with available materials for mass applications.

Keywords: Breakthroughs in Chemistry; Sustainable Development; Contemporary; Catalyst

Paper 113

Impact of COVID-19 and the future of chemistry teaching and learning

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Abstract

The Severe Acute Respiratory Syndrome CoronaVirus-2 (SARS-COV-2) otherwise known as CoronaVirus Disease 2019 (COVID-19) has affected every sphere of life; resulting to hundreds of thousands death across the world. Currently, there is no approved medication or vaccine for the virus and therefore requires safety measures (such as the use of face mask, social or physical distancing, regular washing of hands etc) between individuals to languid it transmission. As such the usual methods of teaching and learning chemistry in universities requires a more pragmatic approach to resolution. The economic condensation in most African states including Nigeria due to COVID-19 threatens the ability for many countries to invest heavily in education. Upon all the sectors affected by COVID-19 in Nigeria, education particularly the

tertiary institutions appeared to have been severely affected, coupled with the industrial strike by Academic Staff Union of Universities (ASUU). The methodology used in this mini review is the qualitative descriptive analysis which consist of content analysis technique and confirmation pattern analysis of recent literatures on impact of COVID-19 on science education, chemistry teaching and chemistry research in the midst of COVID-19. The result indicated that, the COVID-19 would greatly affect the quality of chemistry teaching & learning, research and insufficient of e-learning facilities coupled with students over population in Nigerian universities. However, the authors suggested more funding, recruiting of more staff and provision of COVID-19 testing centers in all public universities in Nigeria.

Keyword: COVID-19, Chemistry, Education, Economy, Teaching & Learning

Paper 114

Adsorption of Pb^{2+} and Hg^{2+} by azomethine grafted onto magnetic nanoparticles from aqueous solution

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Abstract

The efficacy of synthesized azomethine grafted onto magnetite for the removal of Pb^{2+} and Hg^{2+} from wastewater was assessed herein. Studies on the kinetics and isotherm of the adsorption was conducted. Series of adsorption experiments on the influence of solution pH indicates that adsorption capacity for Pb^{2+} and Hg^{2+} was high at pH values of 6.0 and 7.0 respectively. Influence of time at three different adsorbate concentrations showed that adsorption capacity increases as a function of time and initial adsorbate concentrations for both Pb^{2+} and Hg^{2+} . Equilibrium was attained after 10 and 60 minutes for Pb^{2+} and Hg^{2+} respectively. From the kinetic studies, we observed that pseudo 2nd order kinetics was suitable for the adsorption processes. The adsorption of Pb^{2+} and Hg^{2+} was noticed to show adsorption maxima between 58.24 - 84.25 mg g⁻¹ from 293 K to 318 K and 59.24 - 75.02 mg g⁻¹ from 293 K to 303 K respectively. Gibbs free energy calculation on Pb^{2+} reveals that its adsorption process was spontaneous and possible. These results therefore reflect the effectiveness of this adsorbent for the uptake of Pb^{2+} and Hg^{2+} from wastewater.

Paper 115

Extraction, fractionation, characterization and screening of aqueous extract of *persea americana* seeds for hypoglycaemic potential

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Abstract

Activity of α -glucosidase enzyme in gastrointestinal tract has been implicated in postprandial hyperglycaemia. If not properly control, postprandial hyperglycaemia might lead to diabetes mellitus. Diabetes mellitus is a metabolic disorder, indicated by hyperglycaemia (abnormal high blood sugar). The present study extracted, fractionated, characterised, and screened the fractions of *Persea americana* seeds for hypoglycaemic potential. The seed extract was subjected to fractionation to separate the constituents into various fractions and subfractions through column and preparative thin layer chromatography respectively. α -glucosidase inhibitory activities of the fractions and subfractions were tested for. The most active subfractions were then subjected to Fourier-Transform Infrared (FTIR) and gas chromatography mass spectroscopy (GC-MS) analysis. Subfraction-3 showed a significant inhibition ($p < 0.05$) against α -glucosidase. The subfraction competitively inhibits α -glucosidase (with $IC_{50} = 09.48 \pm 0.58\mu\text{g/mL}$). FTIR analysis of the most active subfraction (subfraction-3) showed the presence of carbonyl group, hydroxy group, carboxyl group, double bonds, methylene and methyl groups. GC-MS analysis suggests the presence of Cis-11,14-eicosadienoic acid methyl ester, catechin and chlorogenic acid as the active components of *Persea americana* seed. In conclusion, subfraction-3 is the most active subfraction of *Persea americana* seed. This subfraction showed prominent inhibition against α -glucosidase activity. The components (inhibitors) obtained from this study can be synthesised in the laboratory to confirm their hypoglycaemic activity. Extract and fractions from this seed can be explored in the treatment or management of diabetes mellitus.

Keywords: Diabetes mellitus; extract, fraction; *Persea americana*; Fourier-Transform Infrared; gas chromatography mass spectroscopy.

Paper 116

Phytochemical, nutritional and antimicrobial status of the leaves of Nigerian *Ziziphus spina* – Christi (L.) Wild against selected pediatric infectious diseases

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Abstract

Pediatric infectious disease is of particular concern since it is associated with high infant mortality and morbidity. *Z. spina* found in the tropical regions of the world is a small tree capable of resisting heat and drought. Traditionally, the leaves of the plant are preserved as feed for animals during intense drought as well as used to treat external wounds, swellings, diarrhea, and intestinal spasm among others. The research aims to ascertain the phytoconstituents, verify the nutritive value as well as challenge the methanol leaf extract with common pediatric infectious microorganisms using standard procedures. The result of the phytochemical screening confirmed the presence of flavonoid, tannins, saponins, reducing sugars among others. Moisture content (27.24 ± 1.19 %), total ash (29.11 ± 0.66 %), acid insoluble ash (1.43 ± 0.06 %), alcohol-soluble extractive (0.26 ± 0.14 %) and water-soluble extractive (0.72 ± 0.12 %) values were obtained from the quantitative proximate analysis. The mineral analysis revealed 52.14% carbohydrate content as well as (14 ± 0.09), (135 ± 1.29) and (1.05 ± 0.19) mg/100 g dry weight as the sodium, potassium and phosphorus composition, respectively. *Escherichia coli* was found to be the most susceptible to the extract with an MIC value of 0.25 ± 0.12 mg/ml while *Staphylococcus aureus* was the most resistant strain among the tested microbes. Conclusively, the leaves of the plant may find use in food formulation operations as well as explored further for the treatment of microbial infections especially pediatric infectious diseases.

Keywords: Antimicrobial, MIC, Nutritional, Pediatric, *Ziziphus spina*

Paper 117

Extraction and assessment of physicochemical properties of African walnut (*Plukenetiaconophorum*) oil

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Abstract

The rise in demand and diverse use of oils encourages the hunt for vegetable and seed oils that are of high quality to meet up with the rising rate of its demand worldwide. African walnut (*Plukenetiaconophorum*) is an underutilized nut, and its seed is a potential source of edible oil

and other valuable materials. Extraction of edible oil from kernel of African walnut (*Plukenetiaconophorum*) seeds was done using soxhlet extraction method. The oil hauled out was analysed to examine the physicochemical characteristics including the percentage oil yield, acid value, iodine value, saponification value and water content. GC-MS analysis performed on *Plukenetiaconophora* and found that the number of composites and the molecular weight of the composites present were gotten from seed hauled outs analyzed with gas-chromatography mass spectrometry. The physical properties of the oil compare favourably with those of the conventional vegetable and seed oils like tung oil, linseed oil, poppy seed oil and walnut oil among others. The output gotten for the chemical properties showed the percentage oil yield (43.2%), acid value (3.08), iodine value (157.04 mg/g), saponification value (190.40mg/g), water content (5.32%), free fatty acid (1.55), refractive index (1.468) and specific gravity of (0.926). The findings revealed that African walnut oil is suitable for use in some manufacturing firms such as ink, paint and polymer firms being that of its drying properties which is due to its high iodine value.

Keywords: *Plukenetiaconophorum*, iodine value, Seed oil, acid value

Paper 118

Green Synthesis, characterisation and cytotoxicity investigation of nanoparticles of aqueous extract of *Senna occidentalis* leaf.

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Abstract

Since the presentation of Nobel laureate Richard P. Feynman famous 1959 lecture “There’s Plenty of Room at the Bottom”, the field of nanoparticle research have grown tremendously and in recent times the production of nanoparticle from plant extract have open a new era in phytomedicine research. The aim of this study is to synthesis, characterize and evaluate potential toxicity of nanoparticle of *Senna occidentalis* leaf extract. The nanoparticle of the aqueous extract of *Senna occidentalis* leaf were synthesised using standard method and were characterised using standard methods (UV spectrophotometry, Fourier Transmission Infra-Red, Scanning Electron Microscopy and Transmission Electron Microscopy and elemental composition using XRD. Cytotoxicity were evaluated with brine shrimp lethality assay (BSLA). The study revealed that the nanoparticles of aqueous extract of *Senna occidentalis* leaf on FTIR spectral with peaks at 3264;42.940, 2110;95.555, 1640;65.489 and 61;36.336 and highest absorbance at 900 nm though out the reaction for UV-Vis spectrophotometry spectral. Morphological Characterisation showed that these nanoparticles are spherical in shape and well distributed with statistic average size ranges from 10- 20 \pm 3.52 nm. Their elemental composition reveals presence of oxygen, silicon, silver, Gold Calcium, Sodium, Magnesium,

Nitrogen, carbon and Aluminium and the brine shrimp lethality assay showed these particles to be moderately toxic. These results showed that the nanoparticles of aqueous extract of *Senna occidentalis* leaf may be toxic and also useful for induction of apoptosis of cancerous cells.

Keywords: Cytotoxicity, SEM, TEM, BSLA , *Senna occidentalis*, Nanoparticles

Paper 119

Efficacy of the Column purified Fractions of *Senna occidentalis* and *Moringa oleifera* (Leaves) Against Selected Enzymes of *Bulinus globosus* (Intermediate Host of Urinary Schistosomes) From Shagari and Goronyo Dams of Sokoto State, Nigeria

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Abstract

Toxicity of plants molluscicides on the enzymes of schistosomes' vectors was among the method of identifying the mode of action for the molluscicidal plants used in controlling of *B. globosus*. The Aim of this research was to investigate the efficacy of *S. occidentalis* and *M. oleifera* against selected enzymes of *B. globosus* from Shagari and Goronyo Dams of Sokoto Nigeria. The leaves of the plants were collected from Shagari then identified and authenticated by taxonomist, the leaves were dried under shade, grinded using pestle and mortar, the extracts were purified using column chromatography, and concentration was obtained using serial dilution. The snails were collected from Shagari and Goronyo dams, each of the snails was identified and authenticated by malacologist, four treatments with five replicates were exposed to various fractions and quantities for Aspartate trans-aminase (AST), alkaline phosphatase (ALP) and Amylase were measured, data obtained were subjected for ANOVA using SPSS 20.0 Version and significant differences were recorded at $P \leq 0.05$. AST quantity of snails in F₄ extracts for combination of the plants showed significantly highest decreased [57.62% (<42.38)], ALP quantities of snails treated with combination of the two plants also showed highest decreased [59.72% (<40.28)] followed by those in F₄ of *S. occidentalis* [86.32% (<13.68)] then F₂ of *M. oleifera* [87.95% (<12.05)]. However, F₄ showed significantly highest increase of amylase quantity in general. In conclusion, the quantities of AST and ALP enzymes decreased with increase in toxicity of the while Amylase enzymes increases its quantity with increase in toxicity.

Keywords: Efficacy, *B. globosus*, Aspartate trans-aminase, alkaline phosphatase, Amylase, *S. occidentalis*, *M. oleifera*

Paper 120

Phytonutrients and antioxidant vitamins of *Sclerocarya birrea* fruits pulp obtained in Sokoto State, Nigeria

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Abstract

The study was carried out to evaluate the phytonutrients and antioxidant vitamins content of *Sclerocarya birrea* fruits pulp. The sample was collected at More district of Kware Local Government Area, Sokoto State, Nigeria. The total polyphenols and anthocyanins content on dry weight (DW) are 380.20 ± 1.90 mg/100g Garlic acid equivalent and 48.81 ± 1.80 mg/100g respectively. The content of antioxidant vitamins on dry weight basis are 38.70 ± 1.90 mg/100g vitamin C, 0.75 ± 0.10 mg/100g vitamin E, and 98.48 ± 2.90 mg/100g β -carotene. The results indicate that the fruit is an excellent source of polyphenols, anthocyanins and antioxidant vitamins, therefore, if properly utilized it could be relied on as a potential source of raw material for industries, and as supplement of nutrients in fighting hunger and some nutrient deficiencies.

Keywords: *Sclerocarya birrea*, Fruit pulp, Phytonutrients, Antioxidants, Vitamins

Paper 121

Proximate and minerals composition of rhizomes and leaves of turmeric plant (*Curcuma longa* Linn)

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Abstract

The nutritional values of natural food plants will reduce the challenge of unaffordable market price of food by common people in the developing countries, Nigeria inclusive. The rhizomes and leaves of turmeric plant were obtained from a local farmer in Kwoi, Jaba Local Government Area of Kaduna State and then identified at Chemistry Laboratory Unit, SHESTCO, Garki-Abuja. Nigeria. The fresh rhizomes and leaves of turmeric were separately washed, and each was grouped into two equal parts; raw and boiled samples. All samples (raw rhizomes, boiled rhizomes, raw leaves and boiled leaves) were separately sliced, room-dried, ground into powdery form for proximate analyses using standard analytical techniques. Minerals analyse were determined using Atomic Absorption Spectrophotometer (AAS). The results of proximate analysis showed that the moisture content of the samples ranged between 4.56-10.15%, crude fibres 4.12-12.31%, crude fats 2.16-7.21%, crude protein 6.10-14.20%, ash 8.11-11.20%, and carbohydrate 50.33-69.07%. The results of minerals analyses revealed that Ca; 9.47-13.22 mg/10g, Mg; 3.95-11.34 mg/10g, Fe; 3.51-6.40 mg/10g, P; 1.56-2.82

mg/10g, Mn; 0.22-1.62 mg/10g, Zn; 0.21-0.39 mg/10g, Cu; 0.059-0.61 mg/10g, Cd; 0.00-0.016 mg/10g, Cr; 0.0074-0.012 mg/10g. The results of this study revealed that both rhizomes and leaves of turmeric plant contained appreciable amounts of proximate and mineral constituents especially the boiled rhizomes and raw leaves which recommended in our daily meals as food supplements.

Keywords: Proximate, Minerals, and Supplement.

Paper 122

Phytochemical Composition of Rhizomes and Leaves of Turmeric Plant (*Curcuma longa* Lin)

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Abstract

The medicinal values of natural plants will reduce the challenge of drug-resistance and unaffordable market price of orthodox drugs by common people in the developing countries, Nigeria inclusive. The rhizomes and leaves of turmeric plant were obtained from a local farmer in Kwoi, Jaba Local Government Area of Kaduna State and then identified at Chemistry Laboratory Unit, Sheda Science & Technology Complex (SHESTCO), Garki-Abuja. Nigeria. The fresh rhizomes and leaves of turmeric were separately washed, and each was grouped into two equal parts; raw and boiled samples. All samples (raw rhizomes, boiled rhizomes, raw leaves and boiled leaves) were separately sliced, room-dried, ground into powdery form for phytochemical analyses using standard analytical techniques. The results of phytochemical analyses revealed that the phenol contents ranged between 0.55-3.48mg/100g, alkaloids; 1.05-3.15mg/100g, saponins; 0.00-1.04mg/100mg, flavonoids 2.05-4.12mg/100g, tannins 0.25-3.04mg/100g, cardiac glycosides 0.44-0.64mg/100g, resins 1.26-3.21mg/100g. The results of this study revealed that both rhizomes and leaves of turmeric plant contained appreciable amounts of phytochemical constituents especially the boiled rhizomes and raw leaves which recommended in herbal medicine for the treatments of different health problems.

Paper 123

Prevalence of trypanosomiasis among cattle slaughtered at Sokoto modern abattoir, Sokoto State, Nigeria

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Abstract

A survey for the prevalence of trypanosomiasis among cattle slaughtered at Sokoto modern abattoir was conducted between march and November 2019, two hundred (200) blood samples were collected from the vein of each cattle using needles and syringes, the sample were transported into EDTA bottles and examined microscopically using thick film method in the laboratory; Chi-square statistical analysis was conducted to determine significant association at $P \leq 0.05$. Out of 200 samples examined for the prevalence of trypanosomiasis among cattle, five (5) samples were positive given overall prevalence of 2.50%, female were highly infected (2.00%) than the male (0.50%) with no significant association. Based on breed it was found that, White Fulani and Red Bororo cattle had higher infection rate (1.00%) followed by Sokoto-Gudali (0.50%) and Kutekou had least infection (0.00), however there is no significant association. cattle aged between 61-84 months had highest prevalence (2.00%) then those aged ≥ 84 -months (0.50%) and those aged between 25-60 months and 12-24 months had least of infection rate (0.00), with no significant association. In conclusion, according to this study, animal trypanosomiasis still exist in the study area; however, the prevalence was low with no significant association based on gender, breed and age of the cattle. Therefore, government should keep on providing necessary items for the complete eradication of the disease in the study area

Keywords: *Trypanosomiasis, Cattle, Abattoir, Prevalence*

Paper 124

Synthesis of copper oxide nanoparticles mediated by the fruit and leaf extracts of *Crataegus ambigua* and their antibacterial, antioxidant and antiplasmodial effect

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Abstract

We synthesized, characterized two nanomaterials (CuO-NPs) mediated by the fruit and leaf extracts of *C. ambigua* and investigated their efficacy of against free radical, bacterial strains and malarial parasites. The two CuO-NPs were obtained with the crude aqueous extracts of leaf and fruit parts of *C. ambigua* and characterized by UV-Vis Spectrophotometer, Fourier Transform Infrared (FT-IR) Spectroscopy, X-Ray Diffractometer (XRD), Energy Dispersive

X-ray Spectroscopy (EDX), Scanning Electron Microscope (SEM), and Transmission Electron Microscope (TEM) in order to confirm the successful reduction of CuNO_3 by fruit and leaf extracts of *C. ambigua* into CuO-NPs. The antibacterial, antimalarial and antioxidant efficacy of two nanoparticles were studied by two-fold serial dilution, parasite viability and spectrophotometric protocols respectively. The results obtained displayed spherical structure nanomaterials with an average size of between 23-31 nanometres. Significant antibacterial activity was confirmed on the two CuO-NPs with MIC ranging between 15-30 mg/mL for Gram-negative and 7.50 -15.00 mg/mL for Gram-negative test bacterial strains. Both CuO-NPs converted the test radical (DPPH) to a non-radical molecule (DPPH-H), achieving 50 % conversion at 0.42 mg/mL (as IC_{50} value) for the leaf mediated CuO-NPs (nanoleaf) and 1.10 mg/mL for the fruit mediated CuO-NPs (nanofruit). Antiplasmodial analysis showed that the two nanoparticles were effective against malarial parasite compared to the plant extract. The CuO-NPs were observed to inhibit bacterial strains and have strong antioxidant and antimalarial activities indicating that plant parts of *C. ambigua* are good precursors for non-artificial anti-microbial, antioxidant and antimalarial drugs.

Keywords: *C. ambigua*, antibacterial, antioxidant, Copper oxide nanoparticles, antimalarial.

Paper 125

Efficacy of chitosan as a coagulant aid to alum precipitation of congo red in wastewater

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Abstract

The use of chitosan prepared from prawn shells as coagulant aid for congo red (CR) dye removal from wastewater was investigated in this study. Characterisation of the prepared chitosan samples showed characteristics similar to commercially available ones. The coagulation –flocculation experiment was carried out using the jar test procedure. Both chitosan and alum were used separately for the dye precipitation and then combined. The usage of alum alone showed no precipitating effect on the CR dye molecule, while chitosan was able to considerably reduce the concentration of the dye in solution. When chitosan was used as a coagulant aid in the alum precipitation, the amount (%) of dye removed increased greatly. Optimization of the process via study of effect of pH and flocculation time at optimum alum – chitosan combination indicated that pH 4-5 and settling time of 40 min were suitable conditions for maximum decolourisation of CR dye wastewater with about 98% efficiency. Moreover, study of settling characteristics of the sludge produced from the alum-chitosan synergy was better than that produced from either of them alone. Also, occurrence of redispersion and restabilization of the precipitate was not encountered.

Keywords: Alum, chitosan, coagulation, dye, flocculation, sludge.

Paper 126

Physicochemical and Antioxidant Activity of Methanol Extract of Peels of *Saccharum officinarum* Linn.

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Abstract

Saccharum officinarum (sugarcane) belongs to the family poaceae. The peel is used by traditional healers in Northern Nigeria in the management of diabetes and other diseases. The study was aimed at preliminary evaluation of the physicochemical, phytochemical, chromatographic and free radical scavenging activity of the peel. The physicochemical evaluation was carried out using standard protocols. The peel was defatted using n-hexane and then extracted by maceration using methanol. The phytochemical screening of the methanol extract was done using standard procedures. The thin layer chromatographic (TLC) separation was determined using suitable solvent systems. The qualitative and quantitative determination of free radical scavenging activity were carried out using 1,1-Diphenyl-2-PicrylHydrazyl (DPPH) on TLC plate and UV-Vis method respectively. The results of the physicochemical evaluations revealed moisture content (6.1%), total ash (9.5%), acid insoluble ash (7.5%), alcohol soluble extractive value (9.2%) and water-soluble extractive value (6.8%). The phytochemical screening revealed the presence of saponins, flavonoids, tannins, glycosides, steroids and triterpenoids. The TLC separation in solvent system (methanol: n-hexane 8:2) produced two spots with R_f 0.68 and 0.88. The result of the qualitative free radical scavenging activity showed yellow spot against purple background. The quantitative antioxidant activity at 5, 10, 15 and 20 mg/mL showed % Inhibition of 74.82%, 58.75%, 22.97% and 9.16% respectively. This result was found to be low when compared with the % Inhibition of ascorbic acid (standard). The results obtained from this study have provided preliminary evidence of the presence of phytochemicals in the extract that are responsible for the usage of the peels in the treatment of diseases whose etiologies are related to free radicals.

Keywords: Sugarcane, phytochemicals, TLC, phenolic compounds, free radicals.

Paper 127

Metal sulphide quantum dots and nanocrystals from metal dithiocarbamate complexes: Morphological studies, *in vitro* anticancer potentials and photocatalytic degradation of organic dyes

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Abstract

Metal complexes of dithiocarbamate were synthesized and characterized by single-crystal X-ray crystallography. The complexes crystallized as four coordinates tetrahedral, seesaw or square planar geometry with the dithiocarbamate anions acting as bidentate chelating ligands. The compounds were used as single source precursors, thermolyzed at different temperature to prepare hexadecylamine, oleyamine and octadecylamine capped quantum dots and metal sulphide nanocrystals. The morphological properties of the as-synthesized metal sulphide nanoparticles revealed spherically shaped quantum dots with particle size of 3-6 nm while the nanocrystal varied in shapes with particle size in the range 13-76 nm. The photodegradation of organic dyes by the nanoparticles showed degradation efficiency of up to 87% after 360 mins. The anticancer studies of the as-prepared metal sulphide nanocrystals were evaluated against five cancer cell lines. The compounds showed high to moderate cytotoxicity against the cancer cells. Some of the compounds are much more potent than 5-fluorouracil and cis-platin which indicates they can be consider for further development as potential therapeutic agents.

Paper 128

Distribution, sources and risk assessment of polychlorinated biphenyls in urban freshwater ecosystem of Ikpa River Basin (Nigeria)

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Abstract

In this study, the distribution, sources, as well as age- and -congener-delineated health risks of polychlorinated biphenyls (PCBs) were evaluated in water and sediment samples collected from Ikpa River Basin in Southern Nigeria. We considered the PCBs in two categories (the dioxin-like- and non-dioxin-like- congeners). In water samples, we recorded highly varied overall mean levels of 0.80 ± 1.10 and 3.00 ± 3.15 ng/L, for dioxin-like and non-dioxin-like

congeners, respectively. On the other hand, for the sediment samples, we recorded overall mean levels of 22.22 ± 11.27 and 274.21 ± 404.64 ng/g, for dioxin-like and non-dioxin-like congeners, respectively. Hierarchical cluster analysis (HCA) as a statistical tool for source apportionment provided better prediction for the PCB congeners in sediment than water samples. Furthermore, the non-dioxin-like congeners constituted the major exposure route across all the age groups considered in both matrices. Non-carcinogenic (toxic) risk due to exposure through oral ingestion of water were within the unconditional acceptable limits as the hazard quotients (HQs) values were less than 1. Estimated cancer risks due to oral ingestion of water were minimal while cancer risk due to skin dermal contact with sediment indicated high values in comparison with the unconditional acceptable value of (1×10^{-6}) recommended by the United States Environmental Protection Agency.

Keywords: polychlorinated biphenyls (PCBs); Ikpa River Basin, Nigeria; source apportionment; risk assessment.

Paper 129

Green Synthesis, characterisation and cytotoxicity investigation of nanoparticles of aqueous extract of *Senna occidentalis* leaf

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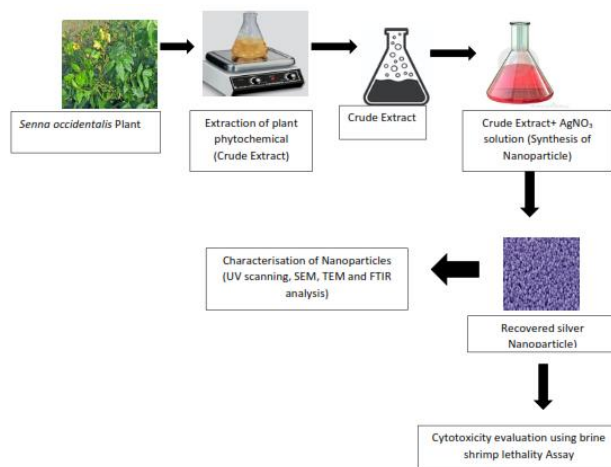
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Abstract

Since the presentation of Nobel laureate Richard P. Feynman famous 1959 lecture “There’s Plenty of Room at the Bottom”, the field of nanoparticle research have grown tremendously and in recent times the production of nanoparticle from plant extract have open a new era in phytomedicine research. The aim of this study is to synthesis, characterize and evaluate potential toxicity of nanoparticle of *Senna occidentalis* leaf extract. The nanoparticle of the aqueous extract of *Senna occidentalis* leaf were synthesised using standard method and were characterised using standard methods (UV spectrophotometry, Fourier Transmission Infra-Red, Scanning Electron Microscopy and Transmission Electron Microscopy and elemental composition using XRD. Cytotoxicity were evaluated with brine shrimp lethality assay (BSLA). The study revealed that the nanoparticles of aqueous extract of *Senna occidentalis* leaf on FTIR spectral with peaks at 3264;42.940, 2110;95.555, 1640;65.489 and 61;36.336 and highest absorbance at 900 nm though out the reaction for UV-Vis spectrophotometry spectral. Morphological characterisation showed that these nanoparticles are spherical in shape and well distributed with statistic average size ranges from 10- 20 ± 3.52 nm. Their elemental composition reveal presence of oxygen, silicon, silver, Gold Calcium, Sodium, Magnesium, Nitrogen, carbon and Aluminium and the brine shrimp lethality assay showed these particles

to be moderately toxic. These results showed that the nanoparticles of aqueous extract of *Senna occidentalis* leaf may be toxic and also useful for induction of apoptosis of cancerous cells.

Keywords: Cytotoxicity, SEM, TEM, BSLA, *Senna occidentalis*, Nanoparticles



Graphical abstract of synthesis, characterisation and cytotoxicity of Senna Occidentalis Leaf

Paper 130

Schiff Base Metal Complexes Derived from Salicylidene-4-Aminoantipyrine and Its Derivatives: A Review

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Abstract

Schiff bases are organic compounds formed from the condensation reaction between a primary amine and a carbonyl compound. In Schiff bases, the carbonyl group of the ketone or aldehyde is replaced by an azomethine group. This literature review explores the Schiff bases derived from Salicylidene-4-aminoantipyrine, its derivatives and metal complexes which include transition metals and lanthanides. The Schiff bases and their metal complexes were synthesized and characterised based on various spectroscopic methods from which different geometries were proposed. This review covers a broad range of Schiff bases derived from Salicylidene-4-aminoantipyrine and its complexes synthesized over the years and aims at drawing the attention of other researchers on its biological and analytical applications.

Paper 131

Isotherm and Statistical Validity Modelings of Adsorption of Endocrine Disruptive Cr(VI) onto Calcinated Earthworm Cast

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Abstract

Heavy metals discharge by diverse anthropogenic activities has been identified to be hazardous and pose dangerous health effects and environmental challenge. Adsorption is an alternative waste water treatment technique used in the removal of these non-biodegradable toxic wastes from water. This study focused on isotherm and statistical validity modeling of adsorption of endocrine disruptive Chromium (VI) ions using Calcinated Earthworm Cast (CEC). Equilibrium data obtained from adsorption of Cr(VI) onto CEC by batch technique were fitted to Langmuir, Freundlich, Temkin, Dubinin-Kaganer-Raduskevich (DKR), Elovich, Jovanovic, Halsey and Henry isotherm models. Beyond the linear regression coefficient, the suitability of the isotherm model in describing the equilibrium data were established using nine rigorous statistical error validity models (Sum of Square Error (SSE), sum of absolute error (EABS), Marquardt's percent standard deviation (MPSD), Hybrid fractional error function (HYBRD), Non-linear Chi-Square Test (χ^2), Residual root mean square error (RMSE), average percentage error (APE), Average relative error (ARE), Standard deviation of relative errors (S_{RE}). Adsorption was best described by Freundlich isotherm model based on $R^2 > 0.99$ and validated by low statistical validity model. Langmuir isotherm monolayer capacity ($Q_{\max} = 129.37$ mg/g) surpassed those previously investigated as compared. Adsorption of Cr(VI) was by physisorption mechanism process based on the free energy value from DKR being less than 8 kJmol⁻¹. Isotherm models parameters predicted the efficacy of CEC and its relevance in the design of wastewater treatment reactor. The performance and capacity of CEC enlisted among sustainable material for treatment of endocrine disruptive compounds.

Keywords: Adsorption; Heavy metal; Endocrine Disruptive; Isotherm; Statistical Modeling

Paper 132

Bamboo Supported Fe₃O₄ Nanocomposite (B-Fe₃O₄-NC) for Effective Adsorption of Cu(II) ions: Effect of Operational Parameters on Removal Efficiency

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Abstract

Effect of operational parameters on efficiency of Bamboo supported Fe₃O₄ nanocomposites (B-Fe₃O₄-NC) in adsorption of Cu(II) ions was investigated. Adsorption of Cu(II) onto B-Fe₃O₄-NC by batch technique was found to be dependent on five operational parameters. The effects of initial concentration (20 – 100 mg/L), contact time (10 – 120 mins), pH (3 – 7), temperature (ambient, 50 °C and 60 °C) and B-MnO₂-NC dosage (0.02 – 0.1 g) influenced the removal efficiency and quantity adsorbed. Maximum of 99.7% removal efficiency was obtained at optimum conditions of pH 6.5, contact time 90 min, adsorbent dose 0.1 g, equilibrium concentration 100 mg/L. High efficiency of B-Fe₃O₄-NC for Cu(II) adsorption is attributed to its physicochemical properties (BET surface area 182.08 m²/g, Langmuir surface area 275.75 m²/g, pore size 24.34 Å, pore width 0.112 cm³/L and point of zero charge (PZC) 6). This study further justified the imperativeness of operational parameters to adsorption studies. The performance of B-Fe₃O₄-NC enlisted it as promising nanocomposites for treatment of heavy metal ions and endocrine disruptive compounds (EDC) polluted water.

Keywords: Adsorption; Nanocomposites; Heavy metals; Operational Parameters

Paper 133

Effect of Lead and Cadmium on Soil Microbial Activities

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Abstract

This study aimed to assess the responses of microbial functional dynamics and enzymes of the soil to different concentrations of cadmium (Cd), lead (Pb) and a mixture of cadmium and lead (Cd/Pb). This study was done for 12 weeks in a greenhouse at $26\pm 2^{\circ}\text{C}$ and the soil moisture content was regularly rectified to a water holding capacity of 60% maintained using deionized water throughout the incubation period. Soil treatments Cd₁, Pb₁ and Cd₁/Pb₁ demonstrated the highest acid phosphatase activity (780 mg *p*-nitrophenol/kg/h) while least activity was observed in Cd₃/Pb₃ (533 mg *p*-nitrophenol/kg/h). Soil treatments with the highest urease activity are Cd₃, Pb₃ and Cd₃/Pb₃ (312 mg N/kg/h) while the least urease activity was observed in soil treatment Cd₃ (211 mg N/kg/h). Soil treatment with the highest microbial biomass carbon was Cd₁ (125 mg/kg) while the least microbial biomass carbon was observed in Cd₃/Pb₃ (71 mg/kg). The soil treatment with the most heterotrophic bacteria, actinomycetes, and fungi counts were Cd₂/Pb₂ (72.3×10^8 CFU g⁻¹), Cd₂ (54×10^5 CFU g⁻¹) and Pb₁ (33×10^2 CFU g⁻¹) respectively while the least heterotrophic bacteria, actinomycetes, and fungi counts were Cd₃/Pb₃ (16.7×10^8 CFU g⁻¹), Cd₃/Pb₃ (33×10^5 CFU g⁻¹), Cd₃/Pb₃ (17×10^2 CFU g⁻¹) respectively. The most inhibitive effects of Pb, Cd, or a mixture of Pb/Cd on soil microbes, enzymes and properties were observed in week 2. The supplemented concentrations of the metals studied significantly altered the microbial communities, profiles and activities.

Paper 134

Modelling of Lead-free Perovskite Solar Cell Using SCAPS-1D

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Abstract

In this work, the effect of some parameters on tin-based perovskite ($\text{CH}_3\text{NH}_3\text{SnI}_3$) solar cell were studied through device simulation with respect to adjusting the doping concentration of the perovskite absorption layer, its thickness and the electron affinities of the electron transport medium and hole transport medium, as well as the defect density of the perovskite absorption layer and hole mobility of HTM. A device simulator; the one-dimensional Solar Cells Capacitance Simulator (SCAPS-1D) program was used for simulating the tin-based perovskite solar cells. Optimized values of the doping concentration, defect density, electron affinity of electron transport material and hole transport material were determined to be $1.0 \times 10^{16} \text{ cm}^{-3}$, $1.0 \times 10^{15} \text{ cm}^{-3}$, 3.7 eV and 2.3 eV respectively. Appreciable values of solar cell parameters were obtained with J_{sc} of 31.38 mA/cm², V_{oc} of 0.84 V, FF of 76.94% and PCE of 20.35%. The results show that the lead-free $\text{CH}_3\text{NH}_3\text{SnI}_3$ perovskite solar cell which is environmentally friendly is a potential solar cell with high theoretical efficiency of 20.35%. CuI has also shown to be a potential hole transport layer.

Paper 135

A Review on Lanthanide (III) Complexes of Schiff Bases derived from 4-aminoantipyrine and its Derivatives

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Abstract

The Schiff bases derived from 4-aminoantipyrine have been known to form complexes with transition metals, lanthanides and actinides. Lanthanide complexes comprise a vast area of coordination chemistry. Over the years, interest in the coordination chemistry of lanthanide complexes has increased because of their interesting optical, luminescence and biological applications. Schiff bases derived from 4-aminoantipyrine contain the oxygen and nitrogen donor atoms which are building blocks for the formation of numerous lanthanide coordination

compounds. This review contributes to the coordination chemistry of lanthanide complexes of 4-aminoantipyrine, its derivatives and some possible applications.

Keywords: 4-aminoantipyrine, Schiff base, lanthanide, complexes

Paper 136

Comparative study of biodegradation of sucrose-plasticised thermoplastic mango starch biofilms in water and soil

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Abstract

Plastic pollution is a global pandemic that is affecting our marine and terrestrial life and has altered our ecosystem owing to its inherent non-biodegradable properties. The need to curtail this global challenge is driving the periphery of science and technology to explore and discover sustainable route to nib the environment challenge in the bud. This study compared the biodegradation rate of thermoplastic mango starch plasticised with sucrose and reinforced with Carboxymethyl cellulose (CMC) immersed in water and buried in soil. The effect of HCl (aq) concentration, percentage of Sucrose and CMC on the rate of biodegradation were investigated. The entire derivative showed an increase in weight after the first 7 days of burial in soil and water immersion. The rate of biodegradation for derivatives when immersed in water, showed that increasing the HCl (aq) from 0.0 - 0.2 M, decreases the biodegradation rate; increase in sucrose amount from 0-180 %, decreases the rate from 2.2 – 1.4 % per day while CMC from 0-70 % increases the rate of biodegradation from 1.5 % per day to almost 2.5 % per day. Also, the rate of biodegradation when buried in soil, indicates that increase in the HCl (aq) increases the rate of biodegradation in soil from 3.0 – 4.2% per day, increase in sucrose shows a significant decrease in the rate from over 14.2 to 2.3% per day while increase in CMC remarkable increased the rate of biodegradation from 1.6 to 3.7 % per day. In conclusion, the result shows that the rate of biodegradation in soil is higher compared to water but in general the thermoplastic would be most suitable for single-use plastics application.

Keywords: Sucrose, Plasticiser, biodegradation rate, Mango starch, carboxymethyl cellulose.

Paper 137

Evaluation of tableting properties of ethylated cassava starch

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Abstract

To improve the inherent starch properties especially for pharmaceuticals, different modification technique has been employed, for which Starch ethylation is an important chemical method that has been used to enhanced pristine starch for tablet formulation. This investigation involves the evaluation of tableting properties of ethylated cassava starch. The friability, hardness, disintegration time, and assay were measured. It shows that the friability, hardness, disintegration and assays of the ethyl starch as a binder in Paracetamol tablets gave maximum values of 0.96 %, 5.81kg and 13.41minutes respectively. FTIR spectrum indicated the formation of a new bond between ethyl group and starch anhydrous glucose units (AGU) because of transmittance at 2400 cm^{-1} due to the presence of ethyl group on the ethylated starch derivatives and also the ratio between the absorption intensities of O-H stretching band ($\sim 3450\text{ cm}^{-1}$) and C-H stretching band ($\sim 2925\text{ cm}^{-1}$) in the spectra of the ethylated derivative is lower than that in the native starch spectrum. The Paracetamol tablets resulting from these ethylated starches obtained from the cassava plant were found to be without surface defects, sufficiently hard and having disintegration time within 15 minutes. The research revealed that the ethyl starch obtained from the cassava plant (*Monihot eculenta*) compares favourably with standard otherand conformed to official requirement specified in British Pharmacopoeia 2012 for ethyl starch.

Keywords: Ethylation, Cassava starch, Friability, Hardness, Disintegration time, Assay,

Paper 138

***In vitro* antimicrobial, free scavenging, and antidiabetic activities of extracts of *Senecio Abyssinicus* leaves**

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Abstract

Despite advancement in technology and healthcare delivery, infectious diseases still ravage humanity, plants-based remedies still remain our major kick back against them. The phytochemical screening, antimicrobial, antioxidant, and anti-hyperglycemic activities of n-hexane, ethyl acetate, and methanolic extracts of *Senecio abyssinicus* leaves were investigated in this study, in line with SDG 3, 9 and 12 goals, following standard methods. The *in vitro* antioxidant properties were tested using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and 2,2'-azinobis(3-ethylbenzthiazoline-6-sulphonate) (ABTS⁺) free radical scavenging assays. Agar diffusion-pour plate methods was used to evaluate the antimicrobial activities of the extracts. The phytochemical evaluation of the extracts unveiled the presence of polyphenols, steroids, terpenoids, alkaloids, and cardiac glycosides. The methanol extracts showed varying degrees of antibacterial activity against the tested bacterial: *Klebsiella pneumonia*, *Bacillus subtilis*, *Staphylococcus aureus*, *Escherichia coli*, *Pseudomonas aeruginosa*, and *Salmonella typhi* at concentrations between 6.25 – 200 mg/mL relative to Gentamycin. Furthermore, it showed significant activity on the tested fungal strains: *Rhizopus stolons*., *Aspergillus niger*, *Pneumoniae notatum*, and *Candida albicans*. between 12.5 – 200 mg/mL, with regards to Tioconazole. The methanol extract had the greatest inhibitory effect (IC₅₀, 26.59µg/mL) on α-glucosidase enzyme, with respect to Acarbose (IC₅₀ 11.31 µg/mL). Similarly, it showed low ABTS⁺ and DPPH antioxidant activity (IC₅₀ >50 µg/mL) when compared to the standard Trolox (IC₅₀ 5.91 µg/mL) and Ascorbic acid (IC₅₀ 12.24 µg/mL) respectively. These findings demonstrated that *S. abyssinicus* leaves exhibits moderate to significant antimicrobial, antioxidant, and antidiabetic activities. Thus, could be considered as a good source of antioxidant, hypoglycemic, and antimicrobial agents for good health and well-being.

Keywords: *Senecio abyssinicus*, Phytochemical constituents, Antidiabetic, Antioxidant assay, Antimicrobial activity, DPPH assay, ABTS⁺ assay, α -glucosidase inhibition,

Paper 139

Effect of Sonication Time on Dispersion of Pristine Single-Wall Carbon Nanotubes in 1,2-dichloroethane

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Abstract

Sonication method has attracted immense attention for dispersing and solubilizing single-wall carbon nanotubes (SWCNT) in appropriate solvents for most applications. In this study, the effect of sonication time on dispersion of arc-discharged SWCNT in 1,2-dichloromethane was investigated using an ultrasonic bath operating at a frequency of 37 kHz and 30% power setting. The sonication time was varied from 30 minutes to 24 hours. The resulting suspension was centrifuged at 15,000 rpm for 1 hour to remove any large aggregates or nanotube bundles. The concentration of SWCNT remaining in the supernatant was measured by UV-Vis absorption. The quality of nanotubes dispersed was checked by Raman spectroscopic measurement. The amount of nanotubes dispersed was found to increase from 30 min to 12 hours beyond which it did not change significantly. The Raman measurement also indicated that increasing sonication time creates more defects on the SWCNT.

Paper 140

Reactivity study of metal oxide supported bimetallic catalysts for upgrading of lignin derived bio-oil to hydrocarbons fuels

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Abstract

The need for effective catalysts for upgrading of lignin derived bio-oil to hydrocarbons fuels is still required. Due to high number and moderate acidity of some metal oxides as well as high cheap, stability and hydrogenating activity of some transition metals, promoted metals supported catalysts are still considered promising for hydrodeoxygenation bio-oil. In our previous research, Titanium oxides supported bimetallic (nickel-copper) catalysts showed greater activity for hydrodeoxygenation of carbohydrate-based bio-oil toward hydrocarbons fuels. To further investigate its reactivity for other types of bio-oil, the catalysts were slightly

modified and applied for upgrading of lignin derived bio-oil toward hydrocarbon fuels products. To further investigate the effectiveness and efficiency of this catalysts for upgrading of lignin derived bio-oil, the catalysts was synthesized with slight modification via co-impregnation method. The catalysts were further characterized using Raman, XRD, FESEM, EDX and TPR Technique. Its then applied for hydrodeoxygenation of this bio-oil at 270°C, 100bar, 6hours of reaction time. The initial characterization results confirmed the presence of copper-nickel catalysts as well as TiO₂. The metals were observed with good dispersion over the surface of oxides support. The catalytic activity results showed good conversion of the bio-oil model compound as well as good selectivity to fuel graded molecules. Products distribution also showed greater deoxygenation degree during hydrodeoxygenation reaction.

Keywords: Titanium oxides, Cu-Ni catalysts, reactivity, conversion and selectivity.

Paper 141

Simple ultrasound-heating process for preparation of magnetite-sulfur adsorbent for rapid uptake of phosphate solution

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Abstract

The current paper describes the results of adsorptive performance of magnetite-sulfur nanocomposite (MSNP) for the removal of phosphate which causes eutrophication; providing algae nutrients to grow at alarming rate and therefore starve other aquatic organisms of much needed oxygen. The nanocomposite was prepared by ultrasonic-heating method using sulfur and magnetite nanoparticles as starting materials in the presence of citric acid as stabilizing agent. Formation of nanocomposite was verified by FTIR, SEM, EDX, TEM, UV-Vis, XRD, TGA and pH of point of zero charge measurements. Adsorptive removal of phosphate by the nanocomposite was investigated in aqueous solution by determining the effects of catalyst dosages, contact time, phosphate initial concentrations and pH of the solution on the phosphate adsorption. The results indicated that phosphate uptake reached maximum adsorption capacity at 38.58 mg/g, corresponding to pH 4.5, suggesting that acidic conditions favor removal of phosphate ions in water. Adsorption process was consistent with both Langmuir isotherm model and pseudo-second order. The calculated parameters from Langmuir model and pseudo-second order showed that the phosphate adsorption on MSNP is a feasible process. Adsorption mechanism was attributed to bimolecular interactions involving anionic species of phosphate and cationic sites of MSNP. The spent MSNP was easily regenerated with NaOH and reused for more than four adsorption-desorption cycles. The adsorbent showed good reusability and therefore suitable for phosphate removal and other water contaminants.

Keywords: magnetite-sulfur composite; Batch adsorption method; Phosphate adsorption; Wastewater treatment; Adsorption mechanism; Adsorption isotherms.

Paper 142

Insight into the corrosion mechanism and mitigation effect of benzimidazole derivative on Cu-Ni alloys corrosion in a simulated acid cleaning environment

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Abstract

It is customary to subject a multistage desalination plant to acid cleaning operation in order to get rid of deposited inorganic scales for the purpose of enhancing the efficiency of a desalination plant. The process, if done in the absence of an effective corrosion inhibitor encourages the deterioration of plant metallic parts. The development of affordable and environmentally-compatible corrosion inhibitors for this kind of industrial application is highly advocated. In view of this, the corrosion mechanism of Cu-Ni alloys in a simulated acid cleaning solution and the extent of corrosion inhibition by 2-(2-bromophenyl)-1-methyl-1H-benzimidazole (2BB) were investigated. The classical mass loss technique complimented with the electrochemical and surface characterization measurement techniques were employed in the investigation. The contributions of temperature variation, immersion duration, and synergist addition on 2BB performance were as well studied. The results obtained disclosed that, in the unprotected acid solution, the alloys actively corroded. However, in the presence of 2BB, the corrosion process was remarkably suppressed with 1.0 g/L 2BB retarding the dissolution of Cu-Ni 70/30 and 90/10 alloys by 89% and 58%, respectively at normal atmospheric conditions. The 2BB performed better at longer immersion duration (48 – 72 h) and in combination with 1 mM KI but its performance declined minimally at 60 °C. The potentiodynamic polarization results revealed that 2BB retarded both the oxidation and reduction corrosion reactions by electrostatically interacting with the charged Cu-Ni alloys surfaces. The surface screening analysis results confirmed the adsorption of 2BB molecules on the Cu-Ni alloys surfaces. The investigated compound (2BB) could be used as an active in the development of a corrosion inhibitor cocktail for acid cleaning applications.

Paper 143

Proximate Analysis and Functional Properties of Physically Modified of Kidney Bean (*Phaseolus vulgaris. L.*) Starch

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Abstract

Starch obtained from kidney bean (*Phaseolus vulgaris*) was subjected to heat moisture treatment – HMT (at moisture levels of 18%, 21%, 24% and 27%) and annealing. Proximate analysis as well as functional properties of the modified starches were investigated. The proximate composition of the native starch is as follows: 14.82% moisture content, 0.81% crude protein, 2.16% crude fat, 0.05% ash and 82.16% carbohydrate content. However, significant reduction in all non-starch components (crude protein, ash, and crude fat) were recorded following modification. Also, swelling power increased with increasing temperature (60 to 90°C), as such the swelling capacity of the starches were temperature-dependent. In the same vein, pH influenced the swelling capacity of the starches. The solubility of all the starches was also temperature-dependent. An increase in HMT, was accompanied by a corresponding increase in water absorption capacity and HMT enhanced gel-forming capacity of the starches. X-ray pattern of modified starches showed a characteristics “C” pattern of legume starches and differed insignificantly from the native starch. Scanning electron microscopy of the native starch revealed heterogeneous sized starch granules that were round and oval with smooth surfaces. Modification altered the starch granules as cracks and fissures could be seen on their micrographs. Physical modification generally reduced non-starch components and improved the physicochemical properties of the native kidney bean starch. Similarly, improvement in the functional properties of modified starches make them a potentially promising, cheap and domestically available raw material for food and pharmaceutical applications in industries.

Keywords: *Phaseolus vulgaris*, Starch, Functional properties, Heat moisture treatment, X-ray pattern

Paper 144

Phytochemical and Antioxidant Evaluation of *Albizia zygia*, *Trema orientalis* and *Psidium guajava*: A drug discovery pathway for combating obesity

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Abstract

Obesity has attained disease state as declared by the American Medical Association and American Heart Association. It is precursory to many diseases such as type II diabetes, atherosclerosis, sleep apnea, certain cancers, high blood pressure and cardiovascular disease. Our indigenous plants are vast in potent phytochemicals that can be extracted for the treatment and management of various diseases including Obesity. The phytochemicals in *Albizia zygia*, *Psidium guajava* and *Trema Orientalis* were determined qualitatively using standard methods. The plants contain tannins, phenols, flavonoids, saponins, cardiac glycosides and alkaloids. Quantitative determination of tannins and total phenolics were done using Folin-ciocalteau colorimetric method, total flavonoids was determined using Aluminum chloride colorimetric method, while the alkaloids and saponin in plant samples were determined using gravimetry. The free radical scavenging power of the methanol and ethyl acetate extracts of the three plants was determined using DPPH method, an *in vitro* antioxidant assay. Percentage inhibition was calculated from the absorbance value at 517 nm using UV-Spectrometer over a concentration range of 4-0.125 µg/mL. The results showed IC₅₀ values of 4.76, 4.85 and 5.66 for *Albizia zygia*, *Trema orientalis* and *Psidium guajava* ethyl acetate extracts respectively. The methanol extracts had IC₅₀ values of 5.59, 4.88 and 5.73 for *Albizia zygia*, *Trema orientalis* and *Psidium guajava* respectively. These IC₅₀ values were compared with that of ascorbic acid, the standard antioxidant for the study which had IC₅₀ value of 4.88. The study revealed that the ethyl acetate extracts of *Albizia zygia* and *Trema Orientalis* showed stronger activity than the standard. The methanol extract of *Psidium guajava* has an equal free radical scavenging ability comparable to the standard. The study reports the presence of secondary metabolites such as tannins, flavonoids and phenolics in *Albizia zygia*, *Trema orientalis* and *Psidium guajava* that may be responsible for their strong antioxidant activities. The presence of saponins and flavonoids in the studied plant samples is promising as the two metabolites are reputed for anti-obesity property and lowering of cholesterol.

Keywords: Phytochemicals, Antioxidant, Anti-obesity, *Albizia zygia*, *Psidium guajava*, *Trema orientalis*

Paper 145

Preparation and advantage of adhesive (glue) from Styrofoam and gasoline in Nigeria economy

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Abstract

Adhesive is any non-metallic substance that can hold materials together in a functional manner by surface attachment that resists separation. The term “adhesive” may be used interchangeably with “glue”. It also includes cement, mucilage, and paste. Adhesives may be found naturally or produced synthetically. Preparation involves putting 50 ml of gasoline in a clean and dry glass beaker. The Styrofoam which has been cut into small pieces was added slowly to gasoline in the beaker and stirred continuously. Styrofoam dissolved in the gasoline when saturation point was reached. A thick, coagulated mass, the adhesive was formed. It can be concluded that Styrofoam and gasoline combined will create an alternative sealant. The conversion of waste Styrofoam to adhesive is an economical, eco-friendly and efficient technique. Glue made from Styrofoam and gasoline can serve as a sustainable building material for construction e.g binding of roofing sheets and bricks, thereby minimizing the use of nails and cement in construction. Styrofoam glue can serve as a means of income generation for Nigeria, Industry set up and job creation.

Keyword: Adhesive, glue, styrofoam, industry.

Paper 146

Preparation and characterization of rice husk activated carbon supported zinc oxide nanocomposite

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Abstract

Rice husk (RH-AC) activated carbon was successfully loaded with freshly prepared ZnO nanoparticles by a combination of bottom-up approach and precipitation method resulting in

formation of rice husk activated carbon supported zinc oxide nanocomposite (RH-AC/ZnO-NCs). The Rice husk was carbonized and activated using 1M H₃PO₄ (Orthophosphoric acid) for 1 hr at 400 °C. Loading of the ZnO nanoparticles onto the activated carbon was carried out using Zinc Nitrate (Zn (NO₃)₂) and Ammonium Carbonate (NH₄)₂CO₃. RH-AC/ZnO-NCs was characterized by series of physicochemical techniques and surface functional group determined by Fourier transform infrared (FTIR). The physicochemical parameters determined showed pH (6.53), bulk density (0.88), %moisture content (17.72%), %ash content (18.45%), %volatile matter (58.077%). The iodine number was carried out to estimate the surface area and Boehm titration were also carried out to determine the surface functionalities. The surface chemistry of RH-AC/ZnO-NCs and its characteristic unique physiochemical parameters vis-à-vis the surface area, low ash content and high iodine value revealed its suitability for adsorption studies and hence a promising nanocomposite.

Keywords: Nanocomposites; Rice husk, Activated carbon; Zinc Oxide, Physicochemical parameters

Paper 147

Cellulose nanocrystals prepared and characterised from underutilised sugarcane peel

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Abstract

Sugarcane peels are agricultural waste, available in abundance and are presently underutilised. This work was set out to explore the possible usage of sugarcane peel as a source of cellulose and nanocrystalline cellulose, hence, solving the problem of littering waste of sugarcane peels arbitrarily in the environment. Isolation of cellulose from sugarcane peel was prepared by using two pre-treatments methods; alkaline and acidified sodium chlorite treatment. Extraction of cellulose nanocrystals (CNCs) was performed via acid hydrolysis at 45°C for 45 mins by 64% concentration sulphuric acid. The chemical composition and physicochemical properties of the sample were studied. The resulting CNCs of the sugarcane peel was characterised using; Fourier transformed infrared (FT-IR) spectroscopy, x-ray diffraction (XRD) spectroscopy, transmission electron microscopy (TEM), differential scanning calorimetry (DSC) and zeta potential measurement. The results indicated that the hemicellulose and lignin were removed comprehensively from the extracted cellulose. Fourier transformed infrared spectroscopy and x-ray diffraction revealed free noncellulosic contents and enhanced crystallinity for CNCs, respectively. The TEM revealed 20.6±9.47 nm as average particle size in width. However, the

results of the DSC and zeta potential measurement displayed no temperature of moisture loss and availability of negative charge on the surface of the material, respectively. As a result, the CNCs from sugarcane peel residuals are valued and promising resources.

Keywords: acid hydrolysis, agricultural waste, cellulose nanocrystal, characterisation, sugarcane peel

Paper 148

Optimization of process variables for the leaching of dolomite in Hydrochloric (HCl)/Perchloric (HClO₄) acid system

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Abstract

The study of statistical optimization of dolomite leaching in HCl-HClO₄ system was investigated in order to reduce cost and reaction time by minimizing the number of experiment required to attain the optimum leaching efficiency. The optimization was carried out with Design Expert 6.0 using Box- Behnken method of surface response methodology. The effect of reaction time was varied from 20 to 60 Mins, leaching temperature was varied from 30 to 70 °C and HCl- HClO₄ concentration was varied from 0.5 to 2.5 M. Dissolution efficiency of 99.7 % was predicted by the software at temperature of 57 °C, reaction time of 20 Mins and acid concentration of 2.03 M while 98.39 % was validated experimentally. A significant model equation with $Prov > F$ of < 0.0001 was developed, the effect of temperature, acid concentration, reaction time, interactive effect of temperature and acid concentration; interactive effect of temperature and time all have significant effect on the leaching process while interactive effect of acid concentration and time has no significant effect on the dissolution process.

Paper 149

Commodity Plastics of the Future: Polyhydroxyalkanoates (Review)

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Abstract

It is becoming increasingly difficult to separate plastics from our everyday needs. And without care, the remains from these lifelong materials will force a gradual slide into a health crisis. However, unlike petroleum-derived plastics, bioplastics like polyhydroxyalkanoates (PHAs) can degrade. In this work, we will review the recent stages of bacterial PHAs as a viable alternative to the conventional plastics. We shall describe the unique features of PHAs and how it sets a pace for our sustainable future in the plastic industry. On the other hand, among the longstanding challenges—of the PHAs—are gaps between laboratories and markets. Indeed, many of the newly introduced PHAs and their variations fall-short when compared to petroleum plastics. Medium-chain-length PHAs, the most promising of the PHAs groups, are yet to match market standards. As compared to polypropylene or polyethylene, these inventions do not yet possess adequate strength against thermal, chemical, or mechanical forces. Another limitation of the PHA is production cost. Yet on the bright side, promising innovations around genetics are creating opportunities for altering bacteria cells, which will improve the quality of PHA produced. The introduction of the latest Nobel Prize CRISPR/Cas9 technology in editing cells' DNA offers a platform for multiple solutions. Another reassuring insight considered in this review is the emergence of chemical synthesis—a new route to scaling PHA production. One goal is to set the stage for many machine learning models, essential for predicting diverse PHAs with new features that can either match or outpace conventional plastics.

Paper 150

Synthesis of Faujasite zeolite X from silica extracted from rice husk ash for the removal of heavy metals from aqueous solution by batch process: Kinetic and equilibrium study

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Abstract

In this study, Faujasite Zeolite X (FZX) synthesized from silica extracted from rice husk ash via hydrothermal synthetic route was characterized and its performance as adsorbent in the removal of Cu^{2+} and Ni^{2+} from aqueous solution was assessed. Hydrothermal condition for the synthesis of pure FZX phase was optimized. The optimum conditions for the synthesis were 100 °C for 6h without stirring. Characterization of the adsorbent with XRD (X-ray Diffraction) showed particle size of ~ 65 nm of the pure FZX phase. Scanning Electron Microscope (SEM) and Transmission Electron Microscope (TEM) analyses showed that the synthesized FZX adsorbent had pyramidal octahedral morphology and d-spacing of 1.55 nm characteristic of a typical zeolite X possessing high structural integrity. Branuer Emette Teller (BET) analysis showed that the FZX have a hierarchical pore distribution with diameters ranging from 1.67-16.18 nm and a surface area of 43 $\text{m}^2\cdot\text{g}^{-1}$ while solid state ^{27}Al Nuclear Magnetic Resonance (NMR) established the complete incorporation of Al species in the synthesis gel and the absence of extra-frameworks responsible for framework defect. The adsorption study showed that the maximum adsorption capacity of synthesized FZX was 60.24 $\text{mg}\cdot\text{g}^{-1}$ and 36.90 $\text{mg}\cdot\text{g}^{-1}$ for Cu^{2+} and Ni^{2+} respectively. Results obtained from the adsorption study showed a good agreement with the Langmuir's model. The processes involved in the adsorption of Cu^{2+} and Ni^{2+} was best described by Pseudo-second order kinetic model. Thermodynamic study revealed that adsorption of metals onto the synthesized adsorbent was endothermic and spontaneous.

Keywords: zeolite, heavy metals, rice husk, silica, adsorption, kinetic, thermodynamic

Paper 151

Thermal, transparency and water sensitivity properties of bleached, cross-linked cassava starch film

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Abstract

This work investigated a novel study of the effect of bleaching and cross-linking cassava starch film. Native cassava starch was bleached with hydrogen peroxide (H₂O₂), cross-linking was carried out with oxidized sucrose while glycerol was added to enhance the plasticity of the film. Operating temperature and time of 90 °C and 10 Minutes respectively with and addition of 0.5 ml of glycerol gave the best bleached, cross-linked cassava starch film. UV-visible spectrometer analysis revealed that the cassava starch film produced at the above reaction conditions retained 88.2 % of its transparency at 96 hours water immersion. The water solubility test shows that the film experienced 52.02 % weight loss after 96 hours immersion in water. The thermo-gravimetric analysis (TGA) shows a significant improvement on the thermal stability with Temperature peak (T_p) of 420.75 °C, compared to 374.13 °C T_p of the control sample (unbleached, uncross-linked) of the cassava starch film.

Keywords: bleached, cross-linked, transparency, water solubility, thermal stability

Paper 152

The Effect of motion and pattern of diamagnetic Motion to destroy Corona Virus

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Abstract

Corona virus is referring to as a severe acute respiratory syndrome (SAR COV-2) has been transmitted through contact and respiratory droplet produced from cough and sneezing, U.S disease control and prevention. Spinoculation is a method initiated to enhance the strength of cells that enable cells to develop energy bond to grow from mini structure to a complex structure as they are being allowed to spin in their axis, also is a method used in virology research to enhance viral infection. Corona virus derived its strength of latching from spinning motion. The lipid bilayer of the SAR COV-2 is a phospholipid bilayer, is the barrier that keeps the ion, proteins and other molecules where they are needed and prevent them from area where they should not be. But the interesting point of this corona virus bilayer that gives the direction

of its function is the pattern of its movement, recent researchers has pointed it out that phospholipid bilayer transits laterally, rotate and diffuse. Phospholipid rotates on its axis to interact with its immediate neighbors to gain strength of bond. In addition, the motion and orientation of a spin-labelled lipid in a bilayer can be deduced from the ESR spectrum, these studies have also shown that individual lipid molecules rotate very rapidly about their long axis and that their hydrocarbon chains are flexible. In this paper context, there are some certain materials that reduces the life span of corona virus when deposited at their surfaces such as plastic (3 days), steel (3 days) copper (4 hrs), cardboard (1 day), alcohol (few minutes) etc. The presence of weak external forces can produce major deformations of a liposome's shape and affect the permeation of water and solutes through the liposome's bilayer membrane. Spinning motion of a particle can be destabilized when a particle can revolve around it. The particle moving around it will send a torque to the spinning particle at the center which makes it moves linearly to the direction of the external force moving around it thereby stopping the spinning motion and loose the bond of connection and compartment. Once phospholipid bilayer stops spinning the long chain bond will be broken and the compartment that bound the protein, ions and molecule will be loose making the virus to be weak and finally destroyed

Keywords: spinning, revolve, diamagnetism, diamagnetic anisotropy