Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

THE 6TH INTERNATIONAL WORKSHOP/CONFERENCE ON NANOTECHNOLOGY ORGANIZED BY NANOTECHNOLOGY RESEARCH GROUP (*NANO*+), LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY OGBOMOSO, NIGERIA

IN COLLABORATION WITH
NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA), MUSA YAR'ADUA WAY, LUGBE, ABUJA

BOOK OF ABSTRACTS OF THE HYBRID CONFERENCE

THEME: NANOTECHNOLOGY FOR SOCIO-ECONOMIC DEVELOPMENT OF AFRICA

DATE: TUESDAY 22 - THURSDAY 24 NOVEMBER, 2022

VENUE: THE CONFERENCE HALL, NASRDA, LUGBE, ABUJA & ZOOM

Chairman
Prof. Mojeed O. Liasu
Ag. Vice-Chancellor, LAUTECH, Ogbomoso, Nigeria

Co-Chairman/Chief Host
Dr. Halilu A. Shaba
Director-General/CEO, National Space Research and Development Agency (NASRDA), Abuja, Nigeria

Host/Convener
Prof. Agbaje Lateef
Head, Nanotechnology Research Group (*NANO*+), LAUTECH, Ogbomoso, Nigeria

LOC Chairperson
Dr. Benjamin G. Ayantunji
Director, Physical and Life Sciences, NASRDA, Abuja, Nigeria

Co-Host
Prof. Adepoju T. J. Ogunkunle
Dean, Faculty of Pure and Applied Sciences, LAUTECH, Ogbomoso, Nigeria

Co-LOC Chairperson
Prof. Musibau A. Azeez
Department of Pure and Applied Biology, LAUTECH, Ogbomoso, Nigeria

Special Guest of Honour
Senator Adeleke Mamora
Honourable Minister of Science, Technology and Innovation, Abuja, Nigeria

Guests of Honour
Senator Uche Ekwunife, Chairman, Senate Committee on Science, Technology and Innovation
Chief Henry Ikechukwu Ikoh, Honorable Minister of State, Science, Technology and Innovation
Senator AbdulFatai Buhari, Chairman, Senate Committee on Land Transportation
Hon. Akinlade Akinremi, Chairman, House Committee on Research Institutions
Mrs. Monilola Udoh, Permanent Secretary, Ministry of Science, Technology and Innovation
Mr. Taiye Williams, MD, LUBCON International Limited, Ilorin

KEYNOTE SPEAKER
Prof. Mohammed S. Haruna
Executive Vice-Chairman/Director-General,
National Agency for Science and Engineering Infrastructure (NASENI), Abuja

Speakers at the Conference
Prof. Omowunmi Sadik, Department of Chemistry and Environmental Sciences, New Jersey Institute of Technology, USA

Prof. Enock O. Dare, Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria

Dr. Mikael Syväjärvi, ALMINICA AB, Research Utilization and Innovation Capacity, Sweden

Prof. Ashok Vaseashta, CEO/CTO, International Clean Water Institute, VA, USA

Prof. Fabian. I. Ezema, Department of Physics, University of Nigeria, Nsukka, Nigeria

Prof. (Mrs) Esther Ikhuoria, Department of Chemistry, University of Benin, Nigeria

Prof. Chérif Dridi, Centre for Research on Microelectronics and Nanotechnology, Technopark of Sousse, Tunisia

Prof. N. Tabet, Department of Applied Physics and Astronomy, University of Sharjah, United Arab Emirates

Associate Prof. Hassan Soleimani, Department of Fundamental and Applied Sciences, Universiti Teknologi PETRONAS 32610 Seri Iskandar Perak Malaysia

Prof. Evariste B. Gueguim-Kana, Department of Microbiology, University of KwaZulu-Natal, Pietermaritzburg, South Africa

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

SCHEDULE OF ACTIVITIES (GMT +1)

DAY ONE (TUESDAY, NOVEMBER 22, 2022)
WORKSHOP ON THE SYNTHESIS, CHARACTERIZATION, AND APPLICATIONS OF NANOPARTICLES

S/N	TIME	ACTIVITIES	VENUE/ANCHOR
1.	8:00 - 9:45 am	Arrival and registration	Conference Room
2.	10:00 - 10:40 am	Overview of nanotechnology, biosynthesis of nanoparticles and applications- Prof. M.A. Azeez	Conference Room
3.	10:40 - 10:50 am	Questions and Answer	Dr. J.A. Badmus
4.	10:50 - 11:10 am	**Tea Break**	
5.	11:20 am	Courtesy visit to DG/CEO, NASRDA	
6.	11:40 - 12:30 pm	Characterization techniques in Nanotechnology- Prof. T.B. Asafa & Prof. M.O. Durowoju	Conference Room
7.	12:30 - 1:00 pm	Questions and Answer	Prof. T.A. Yekeen
8.	1:00 - 2:00 pm	**Lunch**	Conference Room
9.	2:00 -6:00 pm	Practical Session & Interaction	Prof. I.C. Oladipo, Dr. E.A. Adebayo, Dr. J.A. Badmus, & Dr. M.K. Awodele: Incubation Centre, NASRDA

DAY TWO (WEDNESDAY, NOVEMBER 23, 2022): OPENING CEREMONY

Time	Activities	Anchor/Presenter
9:00	Arrival and registration of participants	**Prof. T.B. Asafa/Dr. M.K. Awodele/NASRDA**
9:45	Arrival of dignitaries and special guests	**Protocol**
10:00	National anthem and national prayers	**NASRDA**
10:05	Introduction of guests	**NASRDA**
10:10	Covener/Host's speech	**Prof. A. Lateef** Head, Nanotechnology Research Group, LAUTECH, Ogbomoso
10:20	Co-Chairman/Chief Host's speech	**Dr. Halilu A. Shaba** DG/CEO, NASRDA, Abuja
10:30	Chairman's speech	**Prof. Mojeed O. Liasu** Acting Vice-Chancellor, LAUTECH, Ogbomoso
10:40-10:50	Goodwill messages	**NASRDA**
10:50	Minister's speech and Delacaration of the Conference Open	**Senator Adeleke Mamora** Honourable Minister of Science, Technology, and Innovation, Federal Republic of Nigeria
11:00	Citation of keynote Speaker	**Prof. T.B. Asafa**
11:05-11-45	Keynote Speech	**Prof. Mohammed S. Haruna** Executive Vice-Chairman/Director-General, National Agency for Science and Engineering Infrastructure (NASENI), Abuja
11:50	Closing Remark/Vote of thanks	**Dr. B.G. Ayantunji** Chairperson, LOC
12:00	Photograph session	**NASRDA**

12:20	**Short break**	
12:25	Citation of lead speaker	**Prof. M.A. Azeez**
12:30-1:20	**Lead paper:** The race towards African socio-economic advancement requires a sustainable nano-enabled system as game changer	**Prof. E.O. Dare** Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria
1:30-2:10	**Lunch break**	
2:10-2:50	**Invited Lecture 3**: Nanotechnology for sustainable food safety	**Prof. A.S. Abdulkareem** Nanotechnology Research Group, Africa Centre of Excellence on Mycotoxins and Food Safety, Federal University of Technology, Minna, Niger State, Nigeria
DISCUSSION/INTERACTION		
3:10	**BREAK-OUT SESSIONS (NOVEMBER 23, 2022)** **SESSION A (PHYSICAL/ENGINEERING)**	
	Moderators	**Prof. Y.K. Sanusi**
	ABSTRACT NUMBER/TITLE	**AUTHORS/PRESENTERS**
3:20	**Invited Lecture 4**: The application of nanotechnology for combating environmental and climatic issues	**Ezema, F.I** Nano Research Group, Department of Physics and Astronomy, University of Nigeria, Nsukka, Nigeria
3:50	**2022/P001:** Mathematical model on the dynamics of Covid-19 in Nigeria	Mohammed, I.A., Bello, F.M., and Gwandum, G.S
4:00	**2022/P002:** Integrating nanotechnology into undergraduate education in Nigeria	Muhammad, I.D., and Arudi. I.S
4:10	**2022/P003:** Biosynthesis of silver nanoparticles using aqueous *Phoenix dactylifera* L. extract-characterisation and study of water purification	Ibrahim, I., Hussaini, S.A., and Muhammad, A
4:20	**2022/P004:** Computational study of the effect of Fe-doping on the Young's modulus of single-walled zirconia nanotubes using finite element analysis	Muhammad, I.D., Arudi. I.S., and Arogundade, I.I
4:30	**2022/P005:** Fabrication and characterization of green synthesized graphene nanoparticles/polymer-based counter electrodes in dye-sensitized solar cells	Awodele, M.K., Oyeshola, H.O., Ajiboye, J.O., Akinrinola, O., Adedokun, O., and Sanusi, Y.K
4:40	**2022/P010:** Development of nano-based products from conception to commercialization: a case study of controlled released fertilizer in Malaysia	Muhammad, I.D., Awang, M., and KuShaari, K
4:50	**2022/P011:** Influence of Perovskite thickness on the performance of silver-doped $NaZnBr_3$ Perovskite solar cells using SCAPS software	Abdulmalik, M.O., and Danladi, E
5:00	**Participants are to move to the general room for closing**	
BREAK-OUT SESSIONS (NOVEMBER 23, 2022) **SESSION B (BIOMEDICAL)**		
	Moderators	**Prof. I.C. Oladipo**
	ABSTRACT NUMBER/TITLE	**AUTHORS/PRESENTERS**
3:10	**Invited Lecture 5**: How safe are nanoparticles: analyzing data from systemic, reproductive, and cytogenetic studies in different models	Alabi, O.M Department of Biology, Federal University of Technology, Akure, Nigeria

3:50	**2022/B006:** Antioxidant capacity and lipid peroxidation responses of broiler chickens exposed to *Euphorbia lateriflora* synthesized silver nanoparticles	Badmus, J.A., Alabi, T.D., Olayeni, T.B., Azeez, M.A., Akeredolu, B.R., Owoade, S.A., Okesola, P.E., Adebayo, Z.O., Ishola, O.Q., and Adebayo, E.A
4:00	**2022/B007:** Impact of silver nanoparticles synthesized using *Euphorbia lateriflora* on Broiler chicks (*Gallus gallus domesticus*) growth performance and biochemical indices	Badmus, J.A., Olayeni, T.B., Yekeen, T.A., Ojewale, B.A., Ogunsola, D.T., Issa, B.F., Jokotade, A.O., Febian, H.C., and Aderinola, M.D
4:10	**2022/B008:** Phytotoxic and biomedical activities of synthesized silver nanoparticles using the seed extract of *Morinda citrifolia* (Noni)	Ibikunle, G.J., Akintola, A.O., Ayoola, P.B., Awotoye, A.J., Oguejiofor, C., and Ogunsona, S.B
4:20	**2022/B009:** Fungi and their derivatives: versatile tools in nanotechnology	Adebayo, E.A., and Oke, M.A
4:30	**2022/B012:** *In-vitro* anti-hypertensive, anti-oxidant and antifungal properties of synthesized gold nanoarticles from *Strophanthus hispidus* leaf aqueous extract	Oladipo, I.C., Lateef, A., Azeez, M.A., Asafa, T.B., Yekeen, T.A., and Ogunsona, S.B
4:40	**2022/B013:** Characterization and biomedical applications of titanium dioxide nanoparticles synthesized from *Lecaniodiscus cupanioides* leaf extract	Oladipo, I.C., Lateef, A., Azeez, M.A., Asafa, T.B., Yekeen, T.A., and Ogunsona, S.B
4:50	**2022/B014:** Characterization and biomedical applications of titanium dioxide nanoparticles synthesized from *Datura stramonium* seed extract	Oladipo, I.C., Lateef, A., Azeez, M.A., Asafa, T.B., Yekeen, T.A., Ogunsona, S.B., and Adewoyin, A.G
5:00	**Participants are to move to the general room for closing**	
DAY THREE (THURSDAY, NOVEMBER 24, 2022): GENERAL		
9:00	**Invited Lecture 6: Nano-innovative materials for food security and socio-economic development** **Adewuyi, S** Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria	
9:40	**Invited Lecture 7**: **SMART sustainable nanotechnology based strategies for nano/micro systems development for good health and well-being** **Dridi, C** NANOMISENE R&D Laboratory LR16CRMN01, Center of Research on Microelectronics and Nanotechnology (CRMN) of Sousse, Technopole of Sousse, B.P334, 4054 Sahloul Sousse, TUNISIE	
BREAK-OUT SESSIONS (DAY THREE – NOVEMBER 24, 2022) **SESSION A1 (PHYSICAL/ENGINEERING)**		
	Moderators	**Prof. M.O. Durowoju**
	ABSTRACT NUMBER/TITLE	**AUTHORS/PRESENTERS**
10:20	**Invited Lecture 8:** Impact of graphene nanofluid on ionic polarization in reservoir sandstone under electric double layer	**H. Soleimani** Department of Geoscience, Universiti Teknologi Petronas, Perak, Malaysia
10:50	**Invited Lecture 9**: Hierarchical integration of electrospinning and 3D/4D printing process for rapid prototyping	**Vaseashta, A** CEO/CTO, International Clean Water Institute, VA, USA; Professor, Transylvania University of Brasov, Brasov, ROMANIA, IEEN Chaired Professor of Nanotechnology, Academy of Sciences of Moldova
11:20	**Comments, Questions, and Answers**	
11:30	**Tea Break**	
12:00	**2022/P015:** An analysis of buoyancy-driven flow and heat exchange in a cylindrical channel filled with a water–Cu nanofluid	Sangotayo, E.O., and Ogidiga, J.O
12:10	**2022/P016:** Fabrication, characterization and	Adewumi, H.K., Ayodele, A.J., Oyeshola,

	applications of multiwall-carbon nanotubes-Al_2O_3 ceramic composites	H.O., Adewumi, A.S., Sanusi, Y.K., and Fajinmi, G.R
12:20	**2022/P058:** Efficiency of carbon nanotubes from environmental waste as cement admixture	Gado, N., Yahaya, I.M., and Izuagie, T
12:30	**2022/P059:** Evaluation of chemical and antimicrobial activities of silver nanoparticles synthesised from *Calotropis procera* leaf extract	Sulaiman, H., Yahaya, I.M., and Izuagie, T
12:40	**2022/P022:** Development of copper polymer based grown nanocomposite thin film for photovoltaic application	Oyeshola, H.O., Atere, D.A., Ojeniyi, F.A., Lawal, M.A., Atanda, O.S., Adejumo, B.K., Raheem, K.K., Alamu, Q.A., Adewumi, H.K., and Sanusi, Y.K
12:50	**2022/P023:** Green synthesised silver nanoparticles and their potential as cement admixtures	Yahaya, M.I., and Tambari, M.S
1:00	**2022/P025:** Comparative study of inhibition potentials of gold-silver alloy nanoparticles on mild steel in 3.5% NaCl and 1.0 M HCl solutions	Asafa, T.B., Odusote, J.K., Ogbesanya, V.O., Opatola, E.A., Lateef, A., Durowoju, M.O., Azeez, M.A., Yekeen, T.A., Oladipo, I.C., Adebayo, E.A., Badmus, J.A., Sanusi, Y.K., and Adedokun, O
1:10	**Lunch Break**	
2:10	**2022/P027:** Preparation and pigmentation of carbon nanotubes for biomedical application	Uselegh, L.Y., Tijani, J.O., Alex Ikechukwu Ajai, A.I., and Abdulkareem, A.S
2:20	**2022/P028:** Effects of beryllium on the stability, electronic and optical properties of graphene: a first principles approach	Agbolade, L.O., Tijjani, A., Adewale, A.A., Oyeshola, H.O., Sanusi, Y.K., and U. Hashim, M.N.A
2:30	**2022/P029:** Synthesis and characterization of carbon quantum dots/titanium dioxide hybridized photoanode for improved quantum dots sensitized solar cell	Oyeshola, H.O., Lawal, A.M., Balogun, S.W., Adewale, A.A., Murithador, F.A., Ojeniyi, F.A., and Sanusi, Y.K
2:40	**2022/P031:** Electromagnetic adsorption and polarization mechanism on reservoir sandstone with nanofluid interaction for oil mobility	Sikiru, S., Soleimani, H., Abiodun, A.J., and Sanusi, Y.K
2:50	**2022/P038:** Synthesis of cellulosic nanocrystal encapsulated limonene and its application as an insect pest repellent	Badmus, O.K., Awujola, A.O., Adegoke, A.K., and Alayande, S.O
3:00	**2022/P039**: Pectin-template derived from *Parkia biglobosa* as a novel route for the synthesis of silver nanoparticles	Ibraheem, S.A., Audu, E.A., Jaafar, M., Atabat, A.J., Tanimu, B.F., Yahaya, J.Y., and Barminas, J.T
3:10	**2022/P041:** Synthesis and application green silver nanoparticles on cotton fabric	Lawal, O.M., Salisu, Z.M., Barminas, J.T., Umar, S.M., Ukpong, M.K., Suleiman, A.M., Ilyasu, A., Suleiman, I.A., Iroegbu, U., and Oneli, I.C
3:20	**2022/P072:** Synthesis, characterization and application of a composite adsorbent in remediation of bitumen-polluted water	Ayelabola, J.A., Abiola,, B.E*., Olabemiwo, O.M and Esan, A.O
3:30	**Invited Lecture 10**: Nanotoxicity: are our allayed fears about toxicity of nanomaterials correct?	Elias Emeka Elemike Department of Chemistry, Federal University of Petroleum Resources, Effurun, Nigeria
4:00	**Invited Lecture 11:** Semiconductor nanostructures: Nanoelectrodes and nanowires recent advances in biosensors technology	Uda Hashim Institute of Nano Electronic Engineering, Universiti Malaysia Perlis, Malaysia

4:30	**Participants are to move to the general room for Polling and Closing of the conference**	
SESSION A2 (PHYSICAL/ENGINEERING) 24 NOVEMBER, 2022		
12:00	**2022/P042:** Development of functional cotton fabric via chemically synthesized silver-nano coating	Ukpong, M.K., Salisu, Z.M., Barminas, J.T., Umar, S.M., Lawal, O.M., Suleiman, A.M., Ilyasu, A., Sulaiman, I.A., Iroegbu, U., and Oneli, I.C
12:10	**2022/P046:** Effect of nanoparticles on biogas yield of cocoa pod co-digested with chicken manure at mesophilic temperature	Adebayo, A.O., Olaniran, J.A., and Omoyeni, O.D
12:20	**2022/P047:** Process optimization of furfural production from algae	Abdulbaqi, A
12:30	**2022/P050:** Electromagnetic pigging using superparamagnetic nanomaterials: a review	Wansah, J.F., Akpan, J.J., Achimugu, A., Ocheje, J.A., Akeredolu, B.J., and Iyen, C
12:40	**2022/P051:** Recovery of oil from drilling waste using nanomaterials: a review	Achimugu, A
12:50	**2022/P052:** Photoresponsive performance of MoS_2-based photodetector using improved liquid phase exfoliation method	Akeredolu, B.J., Ahemen, A., Amah, N., Onojah A.D., Shakya, J., Gayathri, H.N., and Ghosh, A
1:00	**2022/P053:** Distribution Rare Earth Elements in sediment cores from Lagos Lagoon, Nigeria	Shelle, R.O.D., and Oyatola, O.O
1:10	**Lunch Break**	
2:10	**2022/P056:** The availability of critical minerals for Nigeria's renewable energy and economic development: an assessment of the role of nanotechnology	Aliu, H.O
2:20	**2022/P057:** Microstructural and nanomechanical properties of AlCoCuFeSi high entropy alloys for renewable energy applications	Dada, M., and Popoola, P
2:30	**2022/P060:** Green synthesized carbon nanotubes as adsorbent of environmental toxic metals	Isha, A., Yahaya, I.M., and Izuagie, T
2:40	**2022/P061:** Effect of TiB_2 addition on the microstructure evolution of FeCrV15+TiB_2 deposit fabricated via laser cladding technique	Jamiru, T., Popoola A.P.I., Sadiku E.R., and Aramide B.P
2:50	**2022/P062:** Experimental study of the electrical conductivity and thermal conductivity property of micro-based Al-Cu-Nb-Mo alloy	Uwa, C.A., Jamiru, T., and Sadiku, E.R
3:00	**2022/P066:** Fabrication of a facile β-cyclodextrin based nano-composite towards 2,4-dinitrophenol removal	Mamman, S., Shuaibu, B.S., Isah, J., Mohammed, J., and Osuegba, O.S
3:10	**2022/P069:** Production of graphene using local contents	Elemo, E., Adegbe, A., and Obarolo, A
3:30	**Invited Lecture 10**: Nanotoxicity: are our allayed fears about toxicity of nanomaterials correct?	Elias Emeka Elemike Department of Chemistry, College of Science, Federal University of Petroleum Resources, Effurun, Nigeria
4:00	**Invited Lecture 11:** Semiconductor nanostructures: Nanoelectrodes and nanowires recent advances in biosensors technology	Uda Hashim Institute of Nano Electronic Engineering, Universiti Malaysia Perlis, Malaysia
4:30	**Participants are to move to the general room for Polling and Closing of the conference**	
BREAK-OUT SESSIONS (DAY THREE – NOVEMBER 24, 2022) SESSION B1 (BIOMEDICAL)		
	Moderators	**Dr. J.A. Badmus**

9:30	**ABSTRACT NUMBER/TITLE**	**AUTHORS/PRESENTERS**
10:00	**Invited Lecture 12:** Drug delivery and nanoparticles: recent advances and prospects	**Bakre, L.G** Department of Pharmaceutics and Pharmaceutical Technology, Olabisi Onabanjo University, Sagamu, Nigeria
11:00	**Comments. Questions and Answers**	
11:20	**2022/B019:** Development and stability studies of diosgenin-integrated *oil-in-water* nanoemulsified system for its potential drug delivery application	Akinsipo, O.B., Dare, E.O., Oladoyinbo, F.O., Katare, D.P., and Sanni, L.O
11:30	**Tea Break**	
12:00	**2022/B020:** Recent advances of biotechnological approaches in nanotechnology: applications and limitations	Alabi, T.D., and Badmus, J.A
12:10	**2022/B016:** Biosynthesis of silver nanoparticles from agro-waste (corncob) and its antibacterial effect in water treatment	Mohammed, M.O., Suleiman, M.M., Yusuf, T.B., Aderinkola, T.A., Abubakar, A.A., Oladuntoye, M.T., and Ola-Williams, I
12:20	**2022/B018:** Bio-fabrication of silver nanoparticles from *Azanza garckeana* seed extract: A promising alternative to conventional antibiotic therapy against Vancomycin-resistant *Enterococci*	Yusuf-Omoloye, N.A., Azeez, L.A., Adeyemi, F.M., Sule, W.F., Ajigbewu, H.O., and Adegbite-Badmus, M.K
12:30	**2022/B021:** Antimicrobial susceptibility pattern of *Enterococcus* isolated from oral and rectal cavity of *Sus scrofa domestica* (domestic pig)	Ngwu, M.I ., Ozota, G.O ., Emencheta, S., and Ozioko, C.A
12:40	**2022/B024:** Green synthesis of silver nanoparticles using *Sarcocephalus latifolius* root aqueous extract for biomedical application	Adewoyin, A.G., Oladipo, I.C., Akintola, A.O., Oyeniyi, O.D., Oke J.V., and Afolabi, S.T
12:50	**2022/B026:** Synthesis and effects of sunflower-mediated calcium phosphate nanoparticles on physical and sensory properties of broiler chicken	Ola, A.K., Ojebiyi, O.O., Akinwumi, A.O., Lateef, A., Sanu D.O., Oladeji H.O., and Fajimolu, O.M
1:10	**Lunch Break**	
2:10	**2022/B033:** Applications of nanotechnology in animal nutrition: a review	Idowu, A.O., Ojebiyi, O.O., Lateef, A., Odunsi, A.A., Ola, A.K., and Akinola, A.O
2:20	**2022/B034:** Green synthesis of gold nanoparticles from *Terminalia mollis M.A.* Lawson (Combretaceae)	Usman, A.B, Dozie-Nwachukwu, S.O., Falayi, M.A., Onodugo, C.D., Onwuazor, O.P., and Odusanya, O.S
2:30	**2022/B035:** Optimization of green synthesis of gold nanoparticles from *Combretum glutinosum*	Onwuazor, O.P., Dozie-Nwachukwu, S.O., Falayi, M.A., Onodugo, C.D., Usman, A.B., and Odusanya, O.S
2:40	**2022/B036:** Phytosynthesis of gold nanoparticles from an ethnomedicinal plant, *Khaya ivorensis* A. Chev. (Meliaceae)	Usman, A.B., Dozie-Nwachukwu, S.O., Onwuazor, O.P., Onodugo, C.D., Falayi, M.A., and Odusanya, O.S
2:50	**2022/B037:** Biosynthesis, characterization and biomedical applications of gold nanoparticles from cassava (*Manihot esculenta*) leaf extract	Onodugo, C.D., Dozie-Nwachukwu, S.O., Onwuazor, O.P., Usman, A.B., Falayi, M.A., and Odusanya, O.S
3:00	**2022/B043:** Biosynthesis, characterization and antibacterial activities of cerium oxide and zinc oxide nanoparticles on fish pathogens - *Vibrio cholerae* RC3 and *Escherichia coli* C214 – a comparative study	Olugbojo, J.A., Akinyemi, A.A., Obasa, S.O., and Dare, E.O
3:10	**2022/B044:** Synthesis and characterization of maggot-based chitosan–Silver nanocomposites for antimicrobial application in fisheries and aquaculture	Olugbojo, J.A., Akinyemi, A.A., Obasa, S.O., and Dare, E.O

3:20	**2022/B073**: Nanoparticles in the soil environment and potential for agricultural improvement	Azeez, M.A., Durodola, F.A., Adubi, A.O., Lateef, A., Yekeen, T.A., and Adebayo, E.A
4:20	**Participants are to move to the general room for Polling and Closing of the conference**	
	SESSION B2 (BIOMEDICAL) **24 NOVEMBER, 2022**	
11:20	**2022/B030:** Green synthesis of silver nanoparticles using *Mangifera indica* stem bark extract and formulation of its pharmaceutical gel for antimicrobial and antioxidant applications	Adeyemi, O.E., Omoteso, O.A., and Ajala. T.O
11:30	**Tea break**	
12:00	**2022/B032:** Characterization and antimicrobial evaluation of biomimetically synthesized silver nanoparticles using aqueous leaf extract of *Morinda lucida* Benth (Rubiaceae)	Egonu, S.N., and Udengwu, O.S
12:10	**2022/B045**: Biogenic silver nanoparticles from two species of Malvaceae: Synthesis, antimalarial, antitrypanosomal, antimicrobial efficacies and their potential towards HeLa cell line	Ogunmola, O.O., Larayetan, R., Ayeni, G[5,6]., Majolagbe, O.N., and Adedosu, T.A
12:20	**2022/B048:** GC-MS analysis and antibacterial activities of silver-mediated nanoparticles using ethanol extract of *Cassia sieberiana* DC	Amodu, S, Aina, D.A., Ezeamagu, C.O., Oyewole, T.E., Adewunmi, G.A., Animashaun, R.O., and Adaramola, F.B
12:30	**2022/B049:** Biogenic synthesis and antibacterial activities of silver-mediated nanoparticles using pulp extract of *Dacryodes edulis*	Amodu, S., Aina, D.A., Ezeamagu, C.O., Oyewole, T.E., Adewunmi, G.A., Animashaun, R.O., and Ogunwenmo, K.O
12:40	**2022/B054:** Synthesis, characterization and antifungal efficacy of copper-chitosan nanoparticles	Atanda, S.A., Shaibu, O.R., and Agunbiade, F.O
12:50	**2022/B055:** Biosynthesis of silver nanoparticles using bacterial feather hydrolysates for the enhancement of growth and nutraceutical properties of leafy vegetables	Adelere, I.A., and Lateef A
1:00	**2022/B063:** Green synthesis, characterization, antimicrobial activity and *in vivo* cytotoxicity test of silver nanoparticles for biomedical applications	Raimi, O.R., Lateef, A., Raimi, M.A., Azeez, Z.M., Afolabi, F., and Afolabi, O
1:10	**Lunch Break**	
2:10	**2022/B064:** Influence of valerate complexation and bromelain encapsulation on morphological characteristics of polyhydroxybutyrate micronized particles	Nasir-Naeem, K.O., and Shittu, O.K
2:20	**NANO/B065:** Optimization of crosslinked starch/graphene oxide nanocomposite films for fruits and vegetable packaging	Kalu, A.O., Egwim, E.C., Jigam, A.A., and Muhammed, H.L8
2:30	**NANO/B067:** Mycelia and lipase inhibitory properties of *Cassia fistula*-mediated gold nanoparticles	Ajayi, V.A., and Lateef, A
2:40	**NANO/B068:** Eco-friendly synthesis of silver nanoparticles using stem bark of *Jatropha tanjorensis* and evaluation of anti-trypanosomal activity	Abedo, A.J., and Abutu, S.R
2:50	**NANO/B070:** Biofabricated Ti-AgNPs in functionalized nanotextiles inhibited MDR bacterial strains and fung	Aguda, O.N., and Lateef, A
3:00	**NANO/B071:** Exploration of vertebrate animal wastes for the green synthesis of nanoparticles: A review	Abodunrin, A.E., Yekeen, T.A., Azeez, M.A., Lateef, A., Badmus, J.A., and Adebayo, E.A
4:20	**Participants are to move to the general room for Polling and Closing of the conference**	

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

WELCOME ADDRESSES

Prof. A. Lateef
Host and Head, Nanotechnology Research Group (NANO⁺), LAUTECH, Ogbomoso, Nigeria

I am delighted to welcome you to the 6th international conference on nanotechnology of our research group, LAUTECH Nanotechnology Research Group (*NANO⁺*) in collaboration with the National Space Research and Development Agency (NASRDA), with the theme 'Nanotechnology for Socio-economic Development of Africa'.

This is the first time that our conference will be held outside our University, LAUTECH which is a milestone in our quest to partner with stakeholders to deepen nanotechnology discourse in the country and beyond. I thank the Director-General of NASRDA, Dr. Halilu A. Shaba and his worthy team for the partnership. At this conference, we will listen to 12 invited lecturers and 73 abstracts will be presented.

The impact of nanotechnology on economic development is huge; with estimated worth of $3 trillion in 2020, provision of about 6 million jobs and it has been predicted to account for 10% of the world's GDP by 2030. Africa must not watch in the unfolding scenario that nanotechnology presents, and the time to act is now.

Nanomaterials are exploited in all facet of human endeavours, and the applications increase daily - food and agriculture, health, industries, engineering, environment, security and defence, water, energy, sport, and consumer products/services. They represent potent tools that can be used to deliver on the SDGs of UN.

In the quest to place Nigeria among comity of players in nanotechnology, our multidisciplinary research group, which was formed in 2014, has made contributions to promote nanotechnology R&D in Nigeria. They can be summarized as follows:

1. Organization of workshops/conferences on nanotechnology in 2017, 2018, 2019, 2020, 2021 and publications of conference papers in Nigeria (*Science Focus; Nano Plus: Science and Technology of Nanomaterials*) and United Kingdom (*IOP Conference Series: Materials Science and Engineering*).
2. Mentoring of students and academics in more than twenty universities and other institutions in Nigeria and beyond, as well as expanding the outreach of nanotechnology discourse to students of primary and secondary schools.
3. We have deepened nanotechnology discourse in several electronic and print media in culminating in more than 40 press releases/interviews. Our website (www.lautechnanotech.com) is robust, informative, and regularly updated. Since its launch in 2016, it has received more than 124,600 visitors.

4. Members of *NANO*+ remain the most prolific in nanotechnology R&D in Nigeria having published more than 150 articles in various areas of nanotechnology since 2015. Five members of the group emerged among the top 12 nanotechnology researchers in Nigeria as indexed in Scopus (2010-2020).
5. Development of nano-based products: nanopaints, nanotextiles, nanopesticides, nanobiocides, nanofertilizers, nanoadsorbents, nanofilters and DSSCs.
6. Establishment of the first specialized journal on nanotechnology in sub-Saharan Africa, '*Nano Plus: Science and Technology of Nanomaterials*'.

It our fervent hope that these efforts and those from other sister research groups on nanotechnology and scholars in this field will be complemented by the government at providing us with policy guidelines on nanotechnology R&D in Nigeria and dedicated capital to develop nanotechnology infrastructure.

South Africa that we started the nanotechnology journey together in 2006 has dedicated more resources in this area, and has now moved to translational research. It has developed nano-based products, standards and has commendable number of patents. It has succeeded in completing a 10-year development plan on nanotechnology (2010-2019). For us, as a nation, we need to move faster to benefit from the fruits of nanotechnology. Iran, despite all manners of sanctions realized $550 million from nanotechnology enterprise in 2020, with projection of $1 billion by 2025.

I therefore call on the federal government of Nigeria to finalize the passage of nanotechnology policy on nanotechnology, establish an agency to drive nanotechnology agenda for the country, and dedicate funds for its promotion and R&D. Establishment of centres of excellence in nanotechnology is germane to realize the lofty potentials of the country in this field, and with the leadership that we have offered, LAUTECH deserves to host such centre. This challenge should be taken up FMSTI, TETFund, NASENI, NASRDA and angel investors.

On behalf of my group, I appreciate the honourable minister, STI, the permanent secretary, the Director of Chemical Technology in the ministry for the various supports offered to the group since 2018. I appreciate the leadership of LAUTECH (past and present) for believing in us and support for our cause. We appreciate the recognition that was given to our group during the 14th combined convocation ceremonies of the University in April, 2022. I equally thank all our colleagues in academia, our guest lecturers, LAUTECH community, collaborators, enthusiasts, industrialists, sponsors, students, pressmen and family members for supporting our activities over the years.

Once again, I welcome you to LAUTECH-NASRDA NANO 2022 and wish us fruitful deliberations and a rewarding experience at the conference.

Thank you and God bless.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

SPEECH PRESENTED BY DIRECTOR-GENERAL AND CHIEF EXECUTIVE OFFICER, NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA), DR. HALILU A. SHABA AT THE OPENING CEREMONY OF THE 6TH INTERNATIONAL WORKSHOP/CONFERENCE ON NANOTECHNOLOGY

Protocols:

I welcome you all to our beautiful campus for this very important workshop/conference. Our objective at NASRDA is always to work with all stakeholders in promoting the frontiers of new and emerging technology in order to provide solutions to problems that are peculiar to us as a Nation using Space Science and Technology for socioeconomic development.

I want to use this occasion to congratulate the LAUTECH Nanotechnology Research Group (*NANO*$^{+}$) for its tenacity and commitment to the expansion of the frontiers of knowledge in the area of Nanotechnology. The 6th annual workshop/conference is the testament of your commitment. At a time when most organizations and associations are finding it difficult to organize a conference, you have kept the flag flying even during Covid-19 pandemic.

Nanotechnology is the manipulation of matter on a near-atomic scale to produce new structures, materials and devices. The technology promises scientific advancement in many sectors such as medicine, consumer products, energy, materials and manufacturing. Nanotechnology refers to engineered structures, devices, and systems. Nanomaterials have a length scale between 1 and 100 nanometers. At this size, materials begin to exhibit unique properties that affect physical, chemical, and biological behavior. Researching, developing, and utilizing these properties is at the heart of new technology.

Space Science and Technology is the ultimate frontier of technological innovation, hence, NASRDA cannot take a back seat in the area of innovation. It is consequent upon this that the collaboration with the LAUTECH Nanotechnology Research Group is of optimum importance. We will do all that is expected within our ability to ensure that this relationship yields a result that is beneficial to Nigeria in particular and the world in general.

I welcome you once more to Obasanjo Space Centre, the campus of the premiere Space Agency in Africa. Have a wonderful deliberation.

Thank you

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

WELCOME SPEECH DELIVERED BY THE ACTING VICE-CHANCELLOR OF THE LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY (LAUTECH), OGBOMOSO, PROFESSOR MOJEED OLAIDE LIASU AT THE 6th INTERNATIONAL CONFERENCE ON NANOTECHNOLOGY ORGANIZED BY THE NANOTECHNOLOGY RESEARCH GROUP (*NANO*+) OF LADOKE AKINTOLA UNIVERSITY OF TECHNOLOGY, OGBOMOSO IN COLLABORATION WITH THE NATIONAL SPACE RESEARCH AND DEVELOPMENT AGENCY (NASRDA) HELD ON NOVEMBER 22-25, 2022

The Honourable Minister, Science, Technology and Innovation, Federal Republic of Nigeria, Senator Adeleke Mamora,
Permanent Secretary, Federal Ministry of Science, Technology and Innovation,
Director-General of NASRDA, Dr. Halilu A. Shaba,
Principal Officers, Ladoke Akintola University of Technology, Ogbomoso
Directors-General of Agencies and Institutes,
The Lead Speaker,
Invited Lecturers and all other attendees from across the globe,
Ladies and gentlemen,

I am glad to be here today to welcome you to the 6th International Conference on Nanotechnology with the theme 'Nanotechnology for Socio-economic Development of Africa'. This year's conference is organized by our illustrious Nanotechnology Research Group (*NANO*+), in collaboration with the prestigious National Space Research and Development Agency (NASRDA) to forge a common front at promoting nanotechnology R&D in Nigeria and beyond.

Going down the memory lane, *NANO*+ started advocacy on nanotechnology in 2017 by exposing scholars to rudiments of synthesis of nanoparticles and their applications. By 2018, activities of the group attracted the attention of the Federal ministry of science, technology and innovation, with their participation in their conferences. So, we are happy at the current milestone, that an agency of federal government has partnered with the group to organize LAUTECH-NASRDA NANO 2022. This is highly commendable.

Ladoke Akintola University of Technology, Ogbomoso, the best state University in Nigeria has come of age, and is currently well-ranked among her peers. This year, the University was ranked as the 10th in Nigeria by the Times Higher Education (THE). These feats would not have been possible without excellent researches and dedicated staff of the University. In April this year, the University recognized some of our outstanding scholars of which two members of *NANO*+ were among; Prof. A. Lateef

and Prof. M.A. Azeez. The contributions of the research group to the growth of the University were also acknowledged in my speech at the 14th combined convocation ceremonies.

The Honourable minister Sir, LAUTECH has established itself as a leader in nanotechnology enterprise in Nigeria, and should be supported for greater achievements. Five of our scholars are among the top 20 scholars of nanotechnology in Nigeria going by papers indexed in Scopus in a decade (2010-2020). I therefore call on you to use your good office to mobilize supports for the establishment of a centre of excellence on nanoscience and nanotechnology at LAUTECH, Ogbomoso. Our *NANO*+ has demonstrated competence in cutting-edge research, publications, training, and mentoring towards creation of critical mass of experts in nanotechnology. The group also established the first journal of nanotechnology (*Nano Plus: Science and Technology of Nanomaterials*) in the sub-Saharan Africa.

Nanotechnology is an enviable catalyst for national development, because of its cosmopolitan applications. It can be deployed to solve myriads of problems that confront us as a nation- environmental degradation, lack of clean water, energy crisis, food insecurity, physical insecurity, infrastructural deficit and burden of diseases among others. Creatively, nanotechnology exploits lead to innovation and development of new processes and products, with great impacts on job creation and stimulation of economy. Thus, Nigeria must act fast to imbibe nanotechnology for growth and development.

Once again, I applaud the Director-General of NASRDA and his team for this partnership. It is a step in the right direction, and I do hope that the partnership will wax stronger for us to have more meaningful deliverables in the nearest future. I thank our keynote speaker, guest speaker, other invited speakers, guests and participants for honouring us with your presence. I also congratulate *NANO*+, for this milestone, and state that the University is proud of your activities on nanotechnology. I invite your group to make use of the new opportunity in the University through the recently established Intellectual Property and Technology Transfer Office (IPPTO) to register and protect your innovations, and enhance their commercialization.

I thank you and I wish you a rewarding conference.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

GOODWILL MESSAGES

Prof. Beatrice I.O. Ade-Omowaye
Dean, Faculty of Food and Consumer Sciences and Chairperson, Committee of Provosts and Deans, LAUTECH, Ogbomoso, Nigeria

It is with great honour and utmost pleasure that I am giving a goodwill message as the 6th International Conference on Nanotechnology (HYBRID) kicks off. The Nanotechnology Research Group (*NANO*$^{+}$) is headed by a seasoned Scientist (**Prof. Agbaje Lateef**) who recently emerged as one of the top Scientists in his institution. Let me quickly add that members of the group are strikingly heading towards attaining the 75th percentile of the Scientists in their respective fields. Since the beginning of the research group about six years ago, the tenacity of the group in driving positive change within the country and across Africa has remained visible and undeniable. The theme: **"Nanotechnology for Socio-economic Development of Africa"** cannot be more pertinent at another time than now, considering the incumbent economic crisis bedevilling most African countries. A truth that must be told is that when African challenges are tackled by African Scientists or those living on the continent, sustainable solutions are bound to emerge. Let me commend the organizers for the wisdom displayed in the course of planning to make this conference a hybrid format. No doubt, the arrangement promises to grant a significant number of participants the privilege to participate in the conference.

Nanotechnology is an emerging technology with lots of prospects which include the development of novel products and the creation of job opportunities. A market value of about US$1.6 trillion for goods utilising nanotechnology was reported in 2014. It was also projected that by 2030, the sector might provide 6 million employment and 10% of the global GDP. This projection shows that nanotechnology will play a critical role in the revitalization of socio-economic development in Africa. The research group has made a tremendous effort in laying a strong foundation via organization of workshops and conferences where Scientists showcase discoveries in nanoworld particularly using available nanoparticles. As we all know that a tree can not make a forest, the recent collaboration of Ladoke Akintola University of Technology (LAUTECH) Nanotechnology Research Group with the National Space Research and Development Agency (NASRDA) is a step in the right direction and I know the synergy of these two groups will yield positive and lasting results that will aid socio-economic development in the country with its ripple effects in Africa.

Although there are scores of publications in nanotechnology currently in Nigeria, the research is still at the toothing stage and I expect that this conference will define the pathways to birth products that can be patented and commercialized. I want to charge

both the Nanotechnology Research Group and NARSDA to go beyond the walls of laboratories and seek partnerships with both Small and Medium Enterprises and existing industries to harness nanotechnology-enabled products. I wish to encourage the organizer to produce a communique from this conference which should be sent to the Federal Ministry of Science, Technology and Innovation and other appropriate quarters including policymakers that will drive the visions of maximizing the potential of nanotechnology in the African continent.

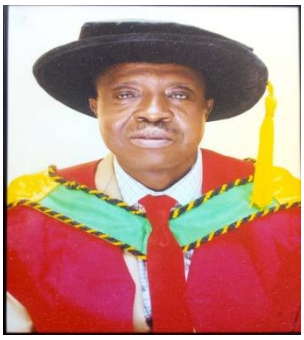
I admonish the earlier entrants into nanotechnology to utilize their wealth of experience to provide the needed platforms for the tutelage of the upcoming ones so that our dear country can stand shoulder-high in the comity of African countries in nanotechnology. A privilege of attending scientific conferences that should be explored by young Scientists is finding potential collaborators and mentors. Since no one is an island of wisdom, it is expedient that all presenters of scientific papers should utilize the post-presentation comments to improve on their future conception, design and execution of research. Another prospect that this conference promises to offer is interdisciplinary research collaborations. I call upon the organizers to provide the platforms that will enable the participants to explore several opportunities for research collaborations and funding.

An outstanding feature of the Nanotechnology Research Group in the past conferences is that pertinent sub-themes and keynote addresses were assigned to experienced speakers who did justice to the topics. I am optimistic that this will not be an exception. Hence, the conference promises to be highly educative from its inception to the end. As an ardent follower of nanotechnology research at my university, the fundamentals started with biology, chemistry and physics and have now extended to other areas such as engineering and medicine. I wish to call on nanotechnology researchers to the necessity of increasing their spectrum of applications. It is my opinion that such will enlarge the application of nanotechnology and its potential in the socio-economic development of African countries. Available statistics show that China, USA and India were the three leading countries in nanotechnology publications without any African country in the top 20 in 2016. The three countries maintained their positions in 2019 with Egypt being the 19th country and the only African country that made the top 20 list. I wish to charge Nigerian Scientists to intensify their efforts to elevate the country's ranking in nanotechnology; since we have the expertise and manpower.

In conclusion, I appreciate the organizers for giving me the privilege to present this Goodwill Message and wish every conference attendee a fruitful moment at this 6th International Conference on Nanotechnology (HYBRID). I wish you all journey mercies to your respective destinations.

Thank you.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001



Prof. A.T.J. Ogunkunle
Dean, Faculty of Pure and Applied Sciences, LAUTECH, Ogbomoso, Nigeria

On this auspicious occasion of the 6th international conference of Nanotechnology Research Group (*NANO*+) of Ladoke Akintola University of Technology, Ogbomoso, Nigeria, I offer fraternal greetings and a congratulatory message from Faculty of Pure and Applied Sciences of the University. The faculty is aware and exceedingly proud of the plethora of achievements that LAUTECH *NANO*+, a multidisciplinary research group has recorded within the past eight years of its birth. We are particularly pleased by your leadership role in advancing the knowledge of nanotechnology, being the most prolific outfit in nanotechnology research and development in Nigeria with a turnout of more than 150 published articles within a short period of 2015 till date. Your exemplary role in promoting multi-sectoral application of nanotechnology is also noted with an array of nano-based products that have been developed by members of your group. These include but not limited to nanopaints, nanotextiles, nanopesticides, nanobiocides, nanofertilizers, nanoadsorbents, and nanofilters.

The laudable achievements enumerated above, coupled with your mentoring of students and academics in more than twenty universities and other institutions within and outside Nigeria, as well as your 'catch them young' approach of expanding the outreach of nanotechnology discourse to students of primary and secondary schools are sure ingredients to ingrain nanoscience in Nigeria sustainable development efforts. Added to our satisfaction with your attainments thus far is the gratification that this year's edition of the conference themed "Nanotechnology for Socio-economic Development of Africa" is holding outside the shores of LAUTECH, Ogbomoso, being co-hosted by the University and the National Space Research and Development Agency (NASRDA) in Abuja. This groundbreaking move is highly commendable.

While congratulating the Head and members of *LAUTECH NANO*+on this unique and solemn occasion, I am urging you to keep the flag flying in order to ensure further growth and development of your group; then, the sky will not be the limit. By the same token, I wish to salute and congratulate NASRDA for partnering with the best state University in Nigeria to promote nanotechnology in Africa.

I thank you very profoundly for your patience and wish you happy and fruitful deliberations.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Prof. A.W. Ogunsola
Dean, Postgraduate School, LAUTECH, Ogbomoso, Nigeria

It is my great pleasure, and I feel highly honoured as the Dean, Postgraduate school, Ladoke Akintola University of Technology, Ogbomoso to congratulate the *NANO*+ for another great conference of your group this year. The entire Board, staff and students of the Postgraduate school of the Ladoke Akintola University of Technology, Ogbomoso, rejoice you for your continuous efforts, giant strides and the great accomplishments so far made in a rapidly evolving world of technological advancements.

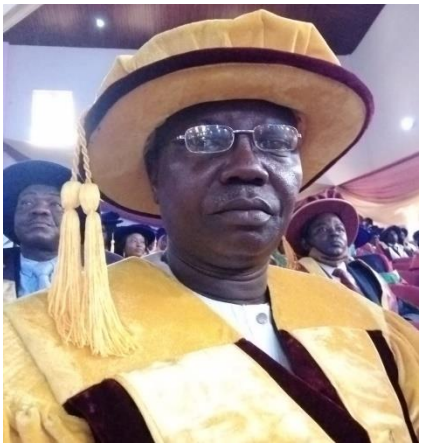
I want to particularly commend the efforts of the conference planning committee for putting together this world-class event with the array of speakers, panelists, moderators, coordinators and discussants of the various topics, programmes and sessions of the conference. I am particularly elated by the fact that this conference brings together all the stakeholders in the Nanotechnology research field namely students, researchers, scholars, professionals, industrialists and end-users of products of Nanotechnology outputs, to share experiences, results, innovations and accomplishments, trends as well and practical challenges encountered in some situations and the solutions adopted in the field of Nanotechnology.

The theme of this year's conference: **Nanotechnology for socio-economic development in Africa** is very crucial. Indeed, it is coming at a time when our nation is going through a lot of socio-economics challenges which are begging for answers. This conference particularly will affords great minds in the field of Nanotechnology, the opportunity to exchange ideas on the challenges and issues affecting Nanotechnology development, explore higher frontiers and also come up with practical solutions to issues of health, food and nutrition security, poverty and inequality, energy crisis, insurgency, climate change towards a better earth for all of God's creations..

Arising from this great conference this year, I strongly belief we will have outputs that will constitute giant steps towards accomplishing the scientific contents of the Sustainable Developments Goals and issues that will be of great help to humanity at large in order to chart a course that will benefit Nanotechnology development, human existence and wellbeing in Nigeria and all across the globe.

In conclusion, I wish you all a fruitful deliberations, findings and recommendations that will propel the necessary innovation adoption which will positively reposition the course of human existence and the global community as you progress in the various sessions of this conference.

Thank you all and God bless you.



Prof. A.A. Akingbade
Dean, Faculty of Agricultural Sciences, LAUTECH, Ogbomoso

Nanotechnology has become a vital area of study, leading evolving innovative developments in life and material sciences to answer growing human needs. Interestingly, the Nanotechnology Research Group (*NANO*⁺) of Ladoke Akintola University of Technology (LAUTECH) has made a significant contribution since its inception, with remarkable achievements in a few years of the group's existence. Therefore, on behalf of the Faculty of Agricultural Sciences, LAUTECH, I congratulate you on this 6th international conference in conjunction with the National Space Research and Development Agency (NARSDA) titled "Nanotechnology for Socio-Economic Development for Africa". We hope that this year's conference will deliver new solutions that are safe, highly productive and affordable to further the cause of development, especially in the Agricultural sector in terms of production, processing, packaging and storing of agricultural products.

I, therefore, wish you more fruitful deliberations and continued success. Thank you.

Prof. A.I. Olugbenga-Bello
Dean, Faculty of Clinical Sciences, LAUTECH, Ogbomoso

I felicitate with the Nanotechnology Research Group (*NANO*⁺), LAUTECH, Ogbomoso and NASADA on this 6th International Conference, tagged, "LAUTECH-NASRDA NANO 2022". The theme, "NANOTECHNOLOGY for Socio-Economic Development of Africa" cannot be more appropriate at this time that it is pertinent for us as a continent to grow our economy and improve the living standard of our people, thus responsive to the reality in Africa.

The conference being a scientific gathering of various experts with rich background in agriculture, life sciences, humanities, engineering and medical fields, shows that Africa is poised for greater exploits in advancing and promoting humanity beyond the known frontiers and Nigeria remained the pivot for the anticipated socio-economic development of our continent.

The application of nanotechnology in medicine draws on the natural scale of biological phenomena to produce precise solutions for disease prevention, screening, diagnosis

and treatment. 'Nanomedicine' is a young science, first used in the year 1990, which has a huge potential, to revolutionize medical care, widening the medical tools, knowledge and therapies currently available to clinicians. It will offer several benefits from improving the accuracy and efficacy of disease diagnostics and screening procedures to targeted drug delivery; consistent mornitoring of patients' physiological health status; regenerative medicine as well as vaccine development. Being a relatively young science however, more research is needed to consider the ethical impact of medical nanotechnology and what societal behavior might be affected by them.

NANOTECHNOLOGY will place Africa at the center point of medical tourism, and will redirect the channel of "braindrain" to "brain harvest".

I believe that every participants will gain tremendously from this year's conference and its effect shall reverberate globally.

Once again, I congratulate the organizers and wish you a fruitful deliberations.

Thank you all.

Prof. A. Adetutu
Dean, Faculty of Basic Medical Sciences, College of Health Sciences, LAUTECH, Ogbomoso

Nanotechnology provides a diverse approach to increase productivity and innovation in Basic Medical and Life Sciences. Research into Nanomedicine has created a good target for drug delivery, diagnosis and treatments.

In the light of this, LAUTECH Nanotechnology Research Group (*NANO*$^+$) has been playing a strategic and key role in scientific Research and Development since her inception. Therefore, it is expected that the LAUTECH-NASRDA NANO 2022 Conference will showcase modern and new applications of Nanotechnology for national growth.

On behalf of staff and students of the Faculty of Basic Medical Sciences, I wish to extend our felicitations on the occasion of LAUTECH- NASRDA NANO 2022 Conference to be hosted in Abuja. We wish *NANO*$^+$ group success in the 2022 Conference.

Thank you and God bless you all.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Prof. T. Ebijuwa
Acting Dean, Faculty of Arts and Social Sciences,
LAUTECH, Ogbomoso, Nigeria

I feel honoured and delighted for the invitation extended to me by LAUTECH NANOTECHNONOLOGY RESEARCH GROUP (*NANO*$^{+}$) in partnership with NASRDA as a Special Guest at its conference scheduled for 22-25 November, 2022, in Abuja. First and foremost, I want to sincerely commend the concerted efforts of the organizers of this laudable international conference with the theme: "Nanotechnology for socio-economic Development of Africa". I have no doubt that the conference whose participants have been drawn from different fields of human endeavours such as agriculture, physical sciences, environmental sciences, humanities, engineering and medicine will in no small measure focus on discussions on how Nigeria can explore nanotechnology for national development through innovative research.

Furthermore, I am of the view that the conference would afford the participants the opportunity of acquiring various techniques in nanotechnology research. In addition, it will expose them to current trends in nanotechnology research. Consequently, I wish to admonish all the participants to make judicious use of the opportunity to take part in this conference. It is my belief that we will all benefit immensely from the wealth of experience of the seasoned scholars who are to serve as resource persons at the conference. Our gathering will also afford us the opportunity of rubbing minds and exchanging ideas on the various papers relating to the theme of the conference that will be presented during the programme.

Finally, I want to use this opportunity to congratulate the organizers and wish them well as they employ nanotechnology for socio-economic development in Africa.
Thank you and God bless.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

PLENARY LECTURES

The race towards African socio-economic advancement requires a sustainable nano-enabled system as game changer

Dare, E.O
Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria
dare3160@hotmail.com

Sustainable socio-economic development would never be possible without having a strong scientific and technological basis. Nanotechnology concept has been considered as the core of the next boundless technological revolution that would stimulate national transformation through a knowledge-based economy. **Sustainable nanotechnology is the development of science and technology within the 1 – 100 nanometer scale, with considerations to the long-term economic viability and a sensible use of natural resources, while minimizing negative effects to human health and the environment. Sustainable nanotechnology remains a** green pathway for clean environment, poverty reduction, adequate clean water provision, e.t.c leading to socio-economic development (Figure 1). Therefore, this presentation hopes to express the possible underlining research concepts [1-4] revolving around sustainable nanotechnology vis-à-vis circular economic program for adoption towards Nigeria socio-economic development agenda.

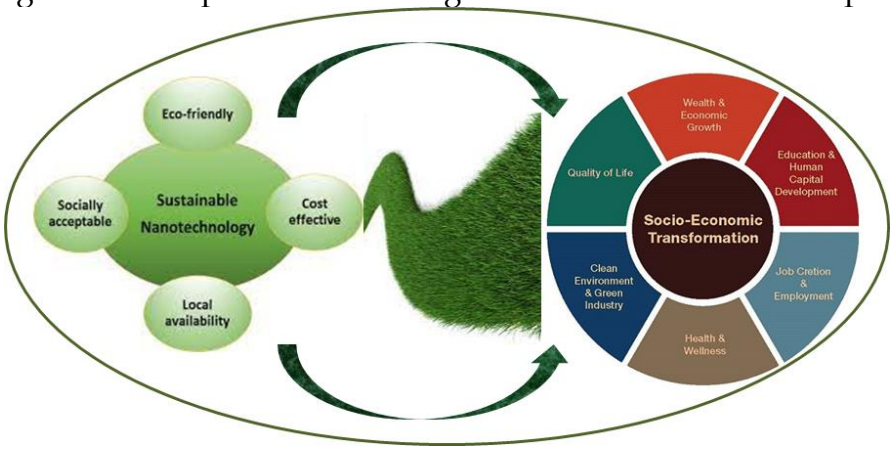


Figure 1: Roadmap to socio-economic transformation via sustainable nanotechnology

References

1. Alayande, S.; Akinlabi, A.K., Ayedun, P., Msagati, T. Dare, E.O: (2021) Recovery of crude oil from a crude oil adsorbent and simultaneous regeneraton of the adsorbent.:. Registration Date: 29-03-2018. Patent Cooperation Treaty. **WO 2018/055566 A1** (**US Patent: 11,065,602 B2)**.

2. Dare E. O. et al (2020): A nanoemulsified system of Phytodrug for a novel transdermal treatment of type II Diabetes Mellitus. **NOTAP Patent: RP-NG/P/2020/155. Cert: 004844**
3. Enock O. Dare et al (2020): Novel Fluorescent Labeled Octasilsesquioxanes Nanohybrids as Potential Materials for Latent Fingerprinting Detection. **Chemistry - A European Journal**. https://doi.org/10.1002/chem.202001908
4. Enock O. Dare et al (2021): Latent Fingerprint Detection by Two Novel Nanohybrids based on Eight-Dansyl-Functionalized Octasilsesquioxane. **Dyes and Pigment**, Volume 184, 108841. https://doi.org/10.1016/j.dyepig.2020.108841

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano-innovative materials for food security and socio-economic development

Adewuyi, S
Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria

Tremendous growth in the design of new functional materials with small particle sizes and intriguing physical and chemical properties has been recorded with the advent of nanoscience. It has also elicited numerous prospects for various applications of socio-economic impacts, vis-à-vis, environmental application, catalysis, biology and most importantly in agriculture leading to food security. Generally, pathogens are responsible for crop diseases that lead to enormous losses in crop production. Interestingly, studies have shown that the combination of nanochitosan (or other polymer) templated metal nanoparticles renders a synergetic effect against broad spectrum microorganisms/pathogens with little or no toxicity issues. The polycationic nature of chitosan in acidic medium favors its antimicrobial and antifungal properties, which makes it possible to interact with the negative charges of the microbial cell membrane thereby, opening new avenues for the development of nanoformulations with improved activities. By employing green synthesis routes, our group has prepared chitosan stabilized metal nanoparticles which have been investigated against pathogens affecting post harvested fruits as well as preservations of vegetables. These new nanoagro-innovative materials can be used to preserve post harvested fruits and vegetables against pathogenic attack.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Hierarchical integration of electrospinning and 3D/4D printing process for rapid prototyping

Vaseashta, A
CEO/CTO, International Clean Water Institute, VA, USA
Academician: Euro Mediterranean Academy of Arts and Sciences;
Professor, Transylvania University of Brasov, Brasov, Romania, IEEN Chaired Professor of Nanotechnology, Academy of Sciences of Moldova, Chisinau, Moldova

Electrospinning is an effective and versatile technique used to produce porous structures ranging from submicron to nanometer diameters. Using a variety of high-performance polymers and blends, several porous structure configurations have become possible for applications in tactile sensing, energy harvesting, filtration, and biomedical applications, however, the structures lack mechanical complexity, conformity, and desired three-dimensional single/multi-material constructs necessary to mimic desired structures. A simple, yet versatile, strategy is through employing digitally-controlled fabrication of shape-morphing by combining two promising technologies, viz., electrospinning and 3D printing/additive manufacturing process. Using hierarchical integration of configurations, elaborate shapes and patterns are printed on mesostructured stimuli-responsive electrospun membranes, modulating in-plane and interlayer internal stresses induced by swelling/shrinkage mismatch, and thus guiding morphing behaviors of electrospun membranes to adapt to changes of the environment. Recent progress in 3D/4D printing/additive manufacturing processes includes materials and scaffold constructs for tactile and wearable sensors, filtration structures, sensors for structural health monitoring, biomedical scaffolds, tissue engineering, and optical patterning, among many other applications to support the vision of synthetically prepared material systems that mimic many of the structural aspects with digital precision. A novel technology called 3D jet writing was recently reported that catapults electrospinning to adaptive technologies for the manufacturing of scaffolds according to user-defined specifications of the shape and size of both the pores and the overall geometric footprint. This chapter reviews the hierarchical synergy between electrospinning and 3D printing as part of precision micromanufacturing for rapid prototyping of structures that are likely to evolve next-generation structures into reality.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

SMART sustainable nanotechnology based strategies for nano/micro systems development for good health and well-being

Dridi, C
NANOMISENE R&D Laboratory LR16CRMN01, Center of Research on Microelectronics and Nanotechnology (CRMN) of Sousse, Technopole of Sousse, B.P334, 4054 Sahloul Sousse, TUNISIE

In our group, we have been interested on the united nations (UN) *Sustainable Development Goal*s (*SDG*s) particularly the SDG3: *Good Health and wellbeing* with a focus on emerging diseases by:

1/ their prevention, based on the monitoring of emerging contaminants potentially cancerogenic ones including *nanoplastics* (Bisphenol A (BPA), phenol (Phe), hydroquinone (HQ), catechol (CC), and resorcinol (RC)), *antibiotics* (Daptomycin, Meropenem, sulfadiazine), *heavy metals* (Cu, Cr(VI),…), and *dyes* which can have severe and health chronic effects. Our strategy is based on the development of simple, cost-effective, eco-friendly and portable nanoplatforms for fast analysis of food and drinking (tap and mineral) water using nanomaterials based bio/chemical *nano/micro sensors* of these ECs;

2/ their *Prediction* & early stage diagnosis, as considered essential and highly valued by global health organizations. In this context, we present our recent achievements in the development of nanomaterials-based nano/micro sensors and biosensors for diagnosis and monitoring of emerging diseases such as,

(i) *Cancer ones* by their early-stage warning through the detection of their *biomarkers* for example serotonin and dopamine (for breast cancer); microRNA-10b and Cr (VI) (for lung cancer) using a green synthesized AgNPs-rGO nanocomposite, graphene oxide and and µPAD strategies respectively;

(ii) *Neurodegenerative diseases* by the detection of *Tryptophan* through an ecological and low-cost approach based on carbon black/ZnO nanocomposite;

(iii) *Viral diseases* like *Covid-19* by developing a strategy for a new antigenic test using lateral flow immunochromatographic assay (LFIA)[3] for the detection of SARS-CoV-2 as a rapid and inexpensive population screening tool.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

The application of nanotechnology for combating environmental and climatic issues

Ezema, F.I
Nano Research Group, Department of Physics and Astronomy, University of Nigeria, Nsukka, Nigeria

As the globe's population and energy consumption continue to rise, the world faces tremendous difficulties. Fossil fuels and other raw resources, which are currently the primary sources of energy generation, are depleting at an alarming rate, posing serious environmental and climatic issues. To overcome the problems posed to the environment by using green design and analysis, new research, new concepts, and creative developments in the use of new technologies are required. Innovative research and fresh innovations in the application of new instruments to address the difficulties should be pursued. This is clearly a research-based, thorough, and practical study that focuses on the use of applied concepts to increase productivity and sustainability. As a result, substantial research is provided that reports on new approaches and vital applications in the disciplines of chemical and physical sciences to cope with and protect our corroding environment, as well as providing cleaner and fresher air through nanotechnology. We discuss the synthesis and characterization of perovskite and dye sensitized solar cells with a view to developing clean and cheap energy. Over 60% of the light in the visible region transmitted through the Electron transporting layer and absorption edge of PbI_2 and $MAPbI_3$ with optical band gap of 2.49 eV and 1.63 eV respectively. For perovskite layers deposited by spin coating and CVD, the efficiencies were calculated to be 3.61% and 12.89% respectively.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nanotechnology for sustainable food safety

Abdulkareem, A.S
Nanotechnology Research Group, Africa Centre of Excellence on Mycotoxins and Food Safety, Federal University of Technology, Minna, Niger State, Nigeria

According to the UN, about 759 million people worldwide are malnourished, of which 30% are in sub-Saharan African region. This region ranks the second largest among the hunger region across the globe. The region also faces serious environmental challenges, such as rivers and land contaminations by crude oil spillages. Consequences of these problems are the reduction in food, fish and agricultural products and increased levels of poverty and hunger. It has been for instance reported that the presence of multiple mycotoxins in food or animal feeds as a result of chemistry of diversity of mycotoxins has led to a growing concern over the health risk stemming from mycotoxicosis and economic development. Meanwhile, numerous strategies, such as thermal inactivation, microbial degradation, irradiation, treatment with a variety of chemicals and physical separation (adsorption) have been proposed to detoxify the mycotoxin-contaminated feedstuffs. However, these materials have some limitations which include; unspecific binding property, efficacy limited to few mycotoxins, high cost of some binding materials, adsorption of micronutrients, and high inclusion rate for vitamins and minerals. Therefore, there is need to have binders that can address some of the limitation of the present binders. To also meet up with the food requirements for the teaming population, urban agriculture is being introduced around the world, and has put severe pressure on available water resources for agricultural purposes. The indiscriminate discharge of wastewater into the environment from domestic and industries has contributed to the rise in salinity, sodicity and toxicity of irrigation water. These three parameters are considered as a major problem to irrigation water that affects the soil physical condition, soil fertility and crop yields. It is therefore important to treat the irrigation water before use. Another challenge in food industry is the correct identification of microbes and contaminated food samples for quality control and prevention of diseases. For sustainable agriculture, nanotechnology offers novel techniques that promise high-quality food, by checking food products at various levels such as food manufacturing, processing, and packaging (Fig.1). Nanoparticles have been developed with many associated benefits especially in biological systems with special focus on the antibacterial activities against pathogenic and spoilage bacteria, viruses and fungi. Nanoparticles devote several properties to food materials such as antibacterial, antiviral and antifungal properties, which have led to significant developments in food sector. This presentation will discuss the applications of nanotechnology in feed binders, effective irrigation water treatment, and development of nanofertilizer, nano food packaging and nano sensor for sustainable food safety.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Impact of graphene nanofluid on ionic polarization in reservoir sandstone under electric double layer

H. Soleimani
Department of Geoscience, Universiti Teknologi Petronas
32610 Tronoh, Perak, Malaysia

The improve oil recovery (IOR) is a way of enhancing the reservoir properties with the use of nanomaterials to detach the oil molecule from the trapped zone. The polarization effect on reservoir sandstone under electric double layer is one of the major research interests. The nanoparticles agglomeration such as graphene nanofluid due to poor dispersion in reservoir zone can be a major challenge that can lead to low reservoir permeability are well elucidated. This study investigated the influence of graphene nanofluid on the ionic polarization in under electric double layer in reservoir sandstone. Saturated Berea sandstone were used to investigate the interaction of ionic species on reservoir sandstone with the aid of Field-emission microscopy (FESEM), Energy dispersive X-ray mapping (EDX), Fourier transform infrared spectroscopy (FTIR), Raman spectral analysis and Core flooding experiment. This research gives information on the adsorption of ions within electric double layer and its polarization mechanisms. It was revealed from the experimental result that ionic polarization occurs at 10.97 GHz with 5.8 nm wavelength shift which improve the mobility of the reservoir and in turn increase oil recovery factors. Graphene nanoparticles shows a positive effect on both reservoir oil viscosity and stabilization characteristics of drilling fluids, wettability alteration, interfacial tension, and improving the emulsion.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Semiconductor nanostructures: Nanoelectrodes and nanowires recent advances in biosensors technology

Uda Hashim
Institute of Nano Electronic Engineering, Universiti Malaysia Perlis, Malaysia

Semiconductor nanoelectrodes and nanowires represent powerful building blocks for next generation bioelectronics given their attractive properties, including nanometre-scale footprint comparable to subcellular structures and biomolecules, configurable in nonstandard device geometries readily interfaced with biological systems, high surface-to-volume ratios, fast signal responses, and minimum energy consumption. This presentation will summarise recent progress in the fields of nanowire and nanoelectronics, with a primary focus primarily on silicon nanowire field-effect transistors and interdigitated electrode biosensors. First, the fabrication and integration of these devices will include the basics of nanowire FETs and IDE, which are crucial to their configuration as biosensors. Second, the presentation will focus on recent results in nanowire and IDE bioelectronics for biomedical applications ranging from label-free sensing of biomolecules to identifying specific viruses related to SARS-CoV-2 virus, *Escherichia coli*, and Parkinson Disease.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

How safe are nanoparticles: analyzing data from systemic, reproductive, and cytogenetic studies in different models

Alabi, O.M
Department of Biology, Federal University of Technology, Akure, Nigeria

Nanomaterials exist naturally in the environment such as dust storms, volcanic ash, and soot from forest fires or are the incidental byproducts of combustion processes (e.g., diesel engines, welding, etc.). Thus, human beings are exposed to naturally occurring nanomaterials. The last decade has witnessed a continuous increase in the use of nanotechnology. Thousands of products varying from food, cosmetics, clothes, military equipment, and personal care products are now available with nanoparticle contents. Recently, experimental and clinical usage of nanoparticles has risen exponentially because of their diverse range of biomedical applications such as in drug delivery, cell tracking, and imaging. Due to the numerous applications of nanoparticles in consumer products, the chances of human exposure through ingestion, inhalation, and dermal contact are significantly increased. There is a growing concern about the possible adverse health effects of nanoparticles on the environment and humans. Some nanomaterials are relatively safe as compared to other nanomaterials, which are harmful. Nanoparticles may aggregate and interact in the environment in water, solids, or sediments, leading to co-exposure either *via* the food chain or drinkable water, which could bio-accumulate and magnify in the 'food chain cycle'. Exposure to nanoparticles may elicit novel distribution, immune responses, absorption at physiological barriers, and interaction/impairment of DNA repair processes. In general, smaller particles are thought to interact more strongly with biological systems compared to larger particles. Interestingly, some materials which are known to be inert in large quantities are in fact toxic at the nanoscale, such as gold. Nanoparticles have been shown to be mutagenic, carcinogenic, teratogenic, immunotoxic, hematotoxic, and cytotoxic in different biological systems and *in vitro* studies. Toxicological data have shown that nanoparticles are toxic to both somatic and germ cells. Also, it has been shown that co-exposure to nanoparticles is more toxic than individual nanoparticles. The ability of nanoparticles to damage the DNA has been suggested to be through systemic alterations. *In vivo* and *in vitro* genetic and reproductive toxicity studies of nanoparticles are very limited and the data so far reported is insufficient, hence, more experimental data are needed. Furthermore, despite the fact that humans can be exposed to a variety of nanoparticles at the same time, most studies have been limited to the toxicity of individual nanoparticles. Since the environment and humans are subjected to a complex mixture of nanoparticles, there is an urgent need for toxicological studies of co-exposure to nanoparticles, which is presently scanty in the literature. This is necessary to have a wholistic data on the biocompatibility of numerous nanoparticles in consumer products.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Drug delivery and nanoparticles: recent advances and prospects

Bakre, L.G
Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, Olabisi Onabanjo University, Ogun state

Drug delivery is an essential part of pharmaceutical sciences that should be taken into account early in the drug discovery and development process. A drug that cannot be delivered to its site of action is essentially useless. In drug delivery applications, nanotechnology typically involves the creation of nanoparticles (5 ~ 800 nm) that are then used to package drug molecules and genes. A number of diverse nano-sized structures have been investigated for drug formulation and delivery, including small molecule and polymeric micelles, solid lipid nanoparticles, nano-sized crystalline drug and drug-antibody conjugates, dendrimers, liposomes, lipid emulsions, and solid drug-polymer nanoparticle dispersions. Engineering of these particles has produced nanomedicines that target drugs and genes to tumors and improve the brain delivery of peptides and other molecules. These particles are also capable of promoting oral drug absorption and drug transport across other biological barriers such as the cornea and the skin. Nanomaterials provide a high degree of biocompatibility before and after conjugation to biomolecules for specific function so as to translate into nanomedicines and clinical practice. Nanomaterials provide for a favorable blood half-life and physiologic behavior with minimal off-target effects, effective clearance from the human organism, and minimal or no toxicity to healthy tissues in living organisms. Nanomaterials have been used for strategic development of new drug delivery systems and reformulation of existing drugs to enhance the effectiveness, patent protection, patient-compliance, safety of drugs and decreasing the cost of health care. Recent advances in nanodrug delivery suggest that the forthcoming generations of nano products will have target specificity, may carry multiple drugs and could potentially serve as carriers for the treatment and management of chronic diseases such as cancer, asthma, hypertension, HIV and diabetes. Currently, only a few of these nanodrugs are commercially available such as liposomes (e.g., Doxil®), low molecular weight micelles (e.g., fungizone®), and polymer–drug conjugates (Oncaspar®); but the therapeutic benefits being observed in both preclinical studies and early clinical testing suggest that more of these technologies will emerge into the patient arena in the future. A dynamic collaboration is needed within the researchers, government, pharmaceutical - biomedical companies and educational institutions all over the world in developing the nanotechnology applications in advanced medicine and patient care. Its role in the convergence of knowledge, technology and society for achieving sustainable socio-economic development cannot be overemphasized.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nanotoxicity: are our allayed fears about toxicity of nanomaterials correct?

Elias Emeka Elemike
Department of Chemistry, College of Science, Federal University of Petroleum Resources, Effurun, Nigeria

Research in nanotechnology is expanding as different materials ranging from nanopolymers, nanometals, nanoceramics, nanodrugs, and nanoelectronics are created and used in recent times. These materials are made from different synthetic routes including physical, chemical and biological methods. They serve great purposes as they have made life easier in modern times exhibiting fascinating properties different from microscopic materials. There are possibilities that these nanomaterials could be toxic over time resulting from the release of their constituents in nano range. Nano products made through the chemical route tend to be toxic due the nature and chemical properties of the starting materials. The biosynthesised nanoproducts may be less toxic due to the utilization of green materials in producing them. The verification of the toxicity of nanomaterials is as important as the characterization and application of these nanomaterials in order to guarantee safety and general acceptability. It is therefore pertinent to study the toxicity of nanomaterials whether it is applied in biomedicine, electronics, environmental remediation, water purification, energy and food.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

ABSTRACTS OF ORAL PRESENTATIONS

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Mathematical model on the dynamics of Covid-19 in Nigeria

Mohammed, I.A[1]., Bello, F.M[2]., and Gwandum, G.S[1]
[1]Department of Mathematics and Computer, Gombe State College of Education, Billiri, Gombe State, Nigeria
[2]Department of General Studies, Gombe State College of Education, Billiri, Gombe State, Nigeria

*E-mail: alhajiibrahim0011@gmail.com

NANO2022/P001

Abstract

Keywords
Covid-19
Equilibrium points
Local stability
Reproduction number

A mathematical model for the transmission dynamics of Coronavirus otherwise known as Covid-19 was developed and analysed in this work. The model was developed using a set of six ordinary differential equations: Susceptible individuals, U(t), Suspected individuals, V(t), Asymptomatic individuals, W(t), Acutely infected individuals, X(t), Quarantined individuals, Y(t) and Recovered individuals, Z(t). The aim of the study was to study the dynamics of coronavirus. The methodology employed in obtaining Covid-19 free equilibrium was linearization and stability analysis have been carried out. Basic reproduction number, R_0 was obtained which can be used to control the transmission dynamics of Covid-19. The results revealed that, Covid-19 can be eradicated by ensuring R_0 is less than one. The results of the study indicate also that when measures of curtailing the disease (as given by professionals) are strictly adhered to, Covid-19 will be wiped out.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Integrating nanotechnology into undergraduate education in Nigeria

Muhammad, I.D*., and Arudi. I.S
[1]Department of Mechanical Engineering, University of Abuja, Abuja, Nigeria

*E-mail: d.ibrahim@uniabuja.edu.ng

NANO2022/P002

Keywords
Nanotechnology
Nanoeducation
Curriculum
NUC
BMAS

Abstract

Based on global advancements made in nanotechnology, Nigeria can be classified in the group of those demonstrating interests where activities related to nanotechnology are mainly on selective individual/group research efforts and limited conferences. One of the most significant factors for growth in the fields of nanoscience and nanotechnology is education across levels from secondary to postgraduate. In order to ascertain specific teaching level of nanotechnology in Nigerian undergraduate education, a review was conducted on 40 programmes related to pure and applied sciences as specified by the National Universities Commission (NUC) on Benchmark Minimum Academic Standards (BMAS) for undergraduate education. Results obtained from the review showed that no University in Nigeria is offering any undergraduate programme as major or minor option in Nanotechnology. Also, the only relevant full courses in the BMAS are Nanomedicine and Micro/Nano Processing Technology in Bioengineering and Mechatronics programmes respectively. In addition, it was discovered that only one specialized and a third generation university added a full course in nanotechnology in her Metallurgical and Materials Engineering programme. Thus, nanotechnology in syllabus of relevant courses is not significantly covered in majority of undergraduate programmes studied. Therefore, in order for Nigeria to move to the next level of development in nanotechnology, there is the need to develop relevant interdisciplinary engineering and science curricula for undergraduate programmes.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biosynthesis of silver nanoparticles using aqueous *Phoenix dactylifera* L. extract-characterisation and study of water purification

Ibrahim, I[1*]., Hussaini, S.A[2]., and Muhammad, A[3]
[1]Chemistry Unit, [2]Biology Unit, Department of Natural Sciences, Gombe State College of Education, Billiri, Gombe State, Nigeria
[3]School of Science Education, Federal University, Kashere, Gombe State, Nigeria

*E-mail: isaibindo12@gmail.com

NANO2022/P003

Keywords
Phoenix dactylifera
Silver nanoparticles
Green synthesis
Water purification

Abstract

The emerging microbial resistance and increased water pollution are of serious concerns around the globe. In order to cope with these problems, new strategies are needed to develop less toxic and more effective nanomaterials that could arrest the microbial growth and eliminate unwanted organic pollutants from water samples. In the present contribution, we report the green synthesis of silver nanoparticles using the aqueous extract of *Phoenix dactylifera* leaf. Vegetable mediated synthesis of nanoparticles is a green chemistry approach that connects nanotechnology and biotechnology. In the present investigation, we have used a fast convenient environmental friendly method for the synthesis of silver nanoparticles by biologically reducing silver ions with aqueous extract of date palm under optimum conditions (pH 10). The formation of silver nanoparticles was indicated by the colour change from colourless to brown. Biosynthesized nanoparticles were characterized by UV-Vis and FTIR analysis. The AgNPs absorbed between 350-450 nm with maximum peak occurring at 430 nm. FTIR analysis was carried out to identify the biomolecules responsible for the bioreduction which was found to be phenolic group. The synthesized AgNPs was used to purify water which showed significant changes in the boiling point, turbidity and temperature of the water when AgNPs were added.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Computational study of the effect of Fe-doping on the Young's modulus of single-walled zirconia nanotubes using finite element analysis

Muhammad, I.D*., Arudi. I.S., and Arogundade, I.I
[1]Department of Mechanical Engineering, University of Abuja, Abuja, Nigeria

*E-mail: d.ibrahim@uniabuja.edu.ng

NANO2022/P004

Keywords
Zirconia nanotubes
Fe-doping
Young's modulus Finite element analysis

Abstract

The effect of Fe-doping on the Young's modulus (**E**) of single-walled zirconia nanotubes (SWZNTs) with varying compositions were investigated using numerical simulations based on the concept of Finite element analysis (FEA). After simulations on generated models, it was found out that there is decrease in the intensity of **E** as the % content of Fe increases, with the intensity of change dependent on the type and geometry of SWZNTs. The zigzag-type SWZNTs showed relatively higher Young's modulus with comparatively constant rate. The armchair-type displayed lower **E** in addition to irregular reduction depending on the quantity of dopant available. The zigzag SWZNT have higher values for ***E*** at a constant reduction rate of about 12% as the content of Fe increases from 1 to 8%; while the armchair type have lower values for E with irregular reduction between 12 to 21%. Therefore, the theoretical results obtained indicates that minimal amount of Fe nanoparticles should be added to SWZNTs during doping in order to obtain required Young's modulus for applications, such as a photo catalyst for treatment of organic pollutants.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Fabrication and characterization of green synthesized graphene nanoparticles/polymer-based counter electrodes in dye-sensitized solar cells

Awodele, M.K[1,2]*., Oyeshola, H.O[1]*., Ajiboye, J.O[1]., Akinrinola, O[1]., Adedokun, O[1,2]., and Sanusi, Y.K[1,2]

[1]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

[2]Nanotechnology Research Group (*NANO*[+]), Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: mkawodele@lautech.edu.ng; hooyeshola@lautech.edu.ng

NANO2022/P005

Keywords
Dye-sensitized
Solar Cells
Graphene
Counter electrode
Synthesis

Abstract

Dye-sensitized solar cells (DSSCs) are alternatives to the more expensive silicon solar cells since it is very cheap, and have high mechanical flexibility with excellent thermal stability. Nevertheless, current densities of Counter Electrode (CE) play a vital role to lower the internal energy loss in DSSCs, but the most common material on CE in DSSC is platinum (Pt) However, the high cost associated with Pt is a hurdle to its commercialization. Therefore, this research focuses on alternative electrode materials with efficacy to replace Pt-based DSSCs. The sample was synthesized from the precursor of graphite powder with fresh castor oil (*Ricinus communis*) leaf as a reducing agent. The prepared sample was analyzed and blended with polyaniline (PANI) and the nanocomposite of GNPs/PANI was deposited onto a cleaned fluorine-doped tin oxide using spin-coating techniques. SEM images of the nanocomposite were spherical and granular in nature and the stretching and vibrational studies were recorded by FTIR. XRD pattern showed a wurtzite structure with an average grain size of 14.36 nm. The intensive absorption peak occured within 200-400 nm and absorbance of 1.08 a.u was recorded from UV-spectroscopy. The short circuit current (Isc = 1.675 $mA^{-1}cm^2$), open-circuit voltage (Voc = 26.30V), fill factor (FF = 50.7), percentage efficient conversion (PCE = 12.08%), resistivity (ρ = 0.135 Ωm), sheet resistance (R = 0.248 Ω) and conductivity (σ = 7.41 S/m) were obtained for graphene/polymer-based counter electrode during electrical characterization. The modified graphene/polymer-based CE layer gives high performance compared to polymer or graphene nanoparticles alone. Therefore, the device can be used in DSSCs for improved efficiency.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Antioxidant capacity and lipid peroxidation responses of broiler chickens exposed to *Euphorbia lateriflora* synthesized silver nanoparticles

Badmus, J.A[1*]., Alabi, T.D[2]., Olayeni, T.B[3]., Azeez, M.A[4]., Akeredolu, B.R[1]., Owoade, S.A[1]., Okesola, P.E[1]., Adebayo, Z.O[1]., Ishola, O.Q[1]., and Adebayo, E.A[4]

[1]Department of Biochemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[2]Department of Biochemistry, Baze University, Abuja, FCT, Nigeria
[3]Department of Animal Production and Health, Ladoke Akintola University of Technology, Ogbomoso, Nigeria
[4]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: jabadmus@lautech.edu.ng

NANO2022/B006

Keywords
Silver nanoparticles
Euphorbia lateriflora
Antioxidant activity
Lipid peroxidation
Broiler

Abstract

Redox balance has been shown to be critical to the wellbeing of aerobic organisms, which when upset causes oxidative stress and eventual tissue damage. This study evaluated the influence of silver nanoparticles synthesized using *Euphorbia lateriflora* (AgNPs-EL) on broiler chicken redox status. A total of 100 day-old Broiler chicks (*Gallus gallus domesticus*) were randomly assigned to 5 treatment groups with two replicates of 10 chicks. The first group was unvaccinated control, while second control group was vaccinated.. The 3rd, 4th, and 5th groups were unvaccinated, placed on basal diet and 1%, 5% and 10% AgNPs-EL. respectively. The nanoparticles were added to the drinking water of the broiler chickens for 4 and 8 weeks as starter and finisher stages respectively. GSH, GPx, GST, SOD and lipid peroxidation were evaluated in the serum, liver and kidney. The results showed that there were no significant changes in all the parameters evaluated in the starter phase except significant reduction of liver SOD and GST in the groups exposed to 1% and 10% AgNPs-EL when compared with control-1 and -2, respectively. No significant changes were observed in GSH, GPx, GST and lipid peroxidation in finisher stage of entire tissues. However, the serum SOD activity of finisher phase was significantly up-regulated across all the groups treated with AgNPs-EL. The study showed that AgNPs-EL did not elevate levels of lipid peroxidation in all the tissues, a reflection of the mildness of the nanoparticles on the chicken redox status. The nanoparticles can therefore be explored for improved poultry production.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Impact of silver nanoparticles synthesized using *Euphorbia lateriflora* on Broiler chicks (*Gallus gallus domesticus*) growth performance and biochemical indices

Badmus, J.A[1]., Olayeni, T.B[2*]., Yekeen, T.A[3]., Ojewale, B.A[1]., Ogunsola, D.T[1]., Issa, B.F[1]., Jokotade, A.O[1]., Febian, H.C[1]., and Aderinola, M.D[1]

[1]Department of Biochemistry, [2]Department of Animal Production and Health, [3]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: tbolayeni@lautech.edu.ng

NANO2022/B007

Keywords
Silver nanoparticles
Euphorbia lateriflora
Broiler
Bird growth
Haematology

Abstract

The effects of silver nanoparticles synthesized using an aqueous extract of *Euphorbia lateriflora* (AgNPs-EL) on growth performance and biochemical indices of broiler were evaluated in this study. A total of 100 broiler chicks were randomly allotted into 5 treatments of two replicates of 10 chicks each. The treatments 1 and 2 served as unvaccinated and vaccinated groups, respectively given basal diets and drinking water *ad libitum*. Treatments 3, 4 and 5 were administered at 1, 5 and 10% AgNPs-EL in drinking water for 4 weeks (starter phase) and 8 weeks (finisher phase). The final live weight, eviscerated, bled weight, dressing percentage, carcass hematological indices, serum ALT, AST, creatinine urea, total protein, albumin, globulin, total cholesterol, HDL-c and triglycerides were determined. AgNPs-EL (1 and 5%) significantly ($p<0.05$) increased carcass weight compared with control-2 of starter phase. At finisher stage; carcass, eviscerated and final live weights of 10% AgNPs-EL were significantly ($p<0.05$) heavier compared with control-2. AgNPs-EL (10%) significantly ($p<0.05$) elevated blood platelets of both phases. No significant changes due to the treatments were observed in serum urea, globulin, albumin and cholesterol of both phases. The AgNPs at 1%, significantly ($p<0.05$) lowered triglyceride level while significantly ($p<0.05$) reduced creatinine level was observed in groups treated with 5% and 10%. AgNPs-EL at 10%, significantly lowered AST level compared with other groups at starter phase. It can be concluded that AgNPs-EL has potential to improve chicken growth performance without distressing biochemical indices.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Phytotoxic and biomedical activities of synthesized silver nanoparticles using the seed extract of *Morinda citrifolia* (Noni)

Ibikunle, G.J[1]., Akintola, A.O[1]., Ayoola, P.B[1*]., Awotoye, A.J[2]., Oguejiofor, C[1]., and Ogunsona, S.B[1]

[1]Department of Science Laboratory Technology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

[2]Department of Science Laboratory Technology, The Polytechnic, Ibadan, Nigeria

*E-mail: pbayoola@lautech.edu.ng

NANO2022/B008

Abstract

The synthesis of silver nanoparticles (AgNPs) using aqueous extract of noni (*Morinda citrifolia*) seed as the reducing/capping agent was investigated for its anticoagulant, thrombolytic and phytotoxic activities. The AgNPs synthesis was monitored through the colour change which turned out to be light brown in colour, and then further characterized using UV-Vis spectroscopy, Fourier transform infrared spectroscopy (FTIR), EDX and scanning electron microscopy (SEM). The UV-visible spectrum of the AgNPs displayed clear peak at 440 nm, the prominent peaks of AgNPs in FTIR spectrum were 3456.55, 2360.95, 2000.25 and 1637.62 cm^{-1} which show that proteins and phenolic compounds were involved in the forming and capping of the AgNPs. Energy dispersive X-ray (EDX) analysis showed that silver was prominent. The AgNPs at 15 µgml showed anticoagulant activities of 49%, and thrombolytic activities of 46%. The biomedical and phytotoxic properties of the AgNPs have established the medical, agricultural and economic importance of the AgNPs.

Keywords
Silver nanoparticles
Morinda citrifolia
Phytoxicity
Anticoagulant
Thrombolysis

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Fungi and their derivatives: versatile tools in nanotechnology

Adebayo, E.A[1,2*]., and Oke, M.A[1]
[1]Microbiology and Nanobiotechnology Laboratory, Department of Pure and Applied Biology, [2]Nanotechnology Research Group (*NANO*[+]), Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: eaadebayo@lautech.edu.ng

NANO2022/B009

Keywords
Silver nanoparticles
Morinda citrifolia
Phytoxicity
Anticoagulant
Thrombolysis

Abstract

Fungal nanotechnology has great promise and potential for developing new products with distinct diverse applications in different fields ranging from drug development to the food industry and agricultural biotechnology. The ecological friendly state of their metabolites, their safety, secretion of both intracellular and extracellular, clean and non-toxic agents have made fungi unique in nanotechnology. The diversity of several macromolecules coupled with ease of scaling up and downstream processing with the existence of fungal mycelia which sustain an increased surface area provides a leading benefit as a veritable tool for nanoparticle synthesis. Fungal nanotechnology is applied in agriculture, medical and industrial sectors for goods and services improvement and delivery to mankind. In medical sciences which remain the major area of research, fungal nanotechnology has found its application in diagnosis and treatment of diverse bacterial, fungal, protozoal, and viral diseases with efficacious vaccine development. Agriculturally, it has been applied for disease management in plants and the production of effective insecticides, and fungicides which are environmental friendly, and non-toxic in other to enhance agricultural production generally. The current study therefore explored fungal nanobiotechnology; mechanism of synthesis, characterization and potential applications in various fields of human endeavours for goods and services delivery.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Development of nano-based products from conception to commercialization: a case study of controlled released fertilizer in Malaysia

Muhammad, I.D[1*]., Awang, M[2]., and KuShaari, K[3]
[1]Department of Mechanical Engineering, University of Abuja, Abuja, Nigeria
[2]Department of Mechanical Engineering, [3]Department of Chemical Engineering, Universiti Teknologi, PETRONAS, Malaysia

*E-mail: d.ibrahim@uniabuja.edu.ng

NANO2022/P010

Keywords
Urea
Controlled release fertilizer
Nanomaterial
Nanomanufacturing

Abstract

More than 90% of urea produced globally is intended for use as a nitrogen-release fertilizer. Urea contains the highest nitrogen content (46%) of all solid nitrogenous fertilizers. Upon application to the soil, urea undergoes a series of biological, chemical and physical transformations to produce required nutrients to plants. There are some problems associated with the use of conventional urea fertilizers, such as wasteful dissolution, volatilizing to air as ammonia gas and absorption of nutrients by soil microbes instead of plants. Nanofertilizers are one of the options for solving problems associated to the use of urea on crops. This study summarizes all the processes used for development of a brand of nanofertilizer in Malaysia comprising of conception; modelling and simulation of materials and processes; laboratory synthesis of nanomaterials; patenting; scaling up, manufacturing and product assessment. The nanofertilizer was conceived based on the concept of controlled release. It uses a distinct nano-based coating and binding technology to integrate diverse concentrations of nutrients required by plants at various phases of growth. Findings showed that nanomanufacturing is viable for many products, as the nanofertilizer developed and marketed have 30% higher efficiency on *Padi* rice when compared to conventional fertilizers and is also environmental-friendly. But there are several challenges such as high investment in research and development; highly skilled personnel from several fields; scalability; government policies among others.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Influence of Perovskite thickness on the performance of silver-doped $NaZnBr_3$ Perovskite solar cells using SCAPS software

Abdulmalik, M.O[1*]., and Danladi, E[2]
[1]Department of Physics, Confluence University of Science and Technology, Osara, Nigeria
[2]Department of Physics, Federal University of Health Sciences, Otukpo, Nigeria

*E-mail: abdulmalikmo@custech.edu.ng

NANO2022/P011

Keywords
SCAPS 1-D
Perovskite solar cells
Absorbing layer
Power conversion efficiency (PCE)
Current density

Abstract

The absorbing layer thickness is a crucial parameter that significantly impacts the performance of perovskite solar cells (PSCs). In this study, we investigated the influence of the thickness of the absorbing layer on the performance of silver-doped $NaZnBr_3$ perovskite solar cells using the one-dimensional Solar Cell Capacitance Simulator (SCAPS-1D) software. The absorbing layer was varied in the range of 100 nm to 1300 nm of thickness. The initial solar cell parameters of the device upon simulation were a 1.174 V, 14.012 $mAcm^{-2}$, 79.649%, 13.101% values for open circuit voltage (Voc), short circuit current density (Jsc), Fill Factor (FF), and Power Conversion Efficiency (PCE) respectively. Implementing the optimised perovskite layer thickness value of 1000 nm, appreciable values of solar cell parameters were obtained with a Voc of 1.197 V, Jsc of 18.184 $mAcm^{-2}$, FF of 79.110%, and PCE of 17.215%. A 31% and 30% increase were observed in PCE and Jsc respectively when the optimised and initial results of the device were compared. This confirms the premise of excellent photon management and enhanced PSCs performance when selecting the thickness of the absorbing layer.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

In-vitro anti-hypertensive, anti-oxidant and antifungal properties of synthesized gold nanoarticles from *Strophanthus hispidus* leaf aqueous extract

Oladipo, I.C[1*]., Lateef, A[2]., Azeez, M.A[2]., Asafa, T.B[3]., Yekeen, T.A[2]., and Ogunsona, S.B[1]

[1]Department of Science Laboratory Technology, [2]Department of Pure and Applied Biology, [3]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: icoladipo@lautech.edu.ng

NANO2022/B012

Keywords
AuNPs
Strophantus hispidus
Antioxidant
Antifungal
Anti-hypertensive
Lipid peroxidation

Abstract

This dispensation has recorded lot of sudden deaths and health complications resulting from high blood pressure and oxidative stress than necessary. This study describes the green synthesis, characterization and some biomedical application of gold nanoparticles synthesized using aqueous leaf extract of *Strophantus hispidus*. The phytosynthesized AuNPs showed an irregular morphology with smooth outer surface on the SEM micrograph. Gold was the most occurring metal noted on EDX analysis. The UV-visible spectrum of the AuNPs synthesized displayed clear peak at 552 nm. The FTIR showed prominent peaks at 3417.98, 2359.02, 1622.19 and 1384.94 cm^{-1} attributed to the involvement of proteins in the AuNPs biofabrication and capping. The AuNPs showed potent antifungal activity through inhibitions of mycelia by 72.5, 82.7, 70.1, 87.6 and 51.8 % against *Fusarium solani, Fusarium poae, Aspergillus niger, Aspergillus flavus* and *Penicillium avetonatum* respectively at 150µl/ml. The AuNPs synthesized showed free radical scavenging properties of 80.75-89.34% at 50-200 µl/ml against DPPH. Furthermore, gold nanoparticles inhibited rat liver mitochondria lipid peroxidation by 44.37-96.84% at 50-200 µl/ml. The AuNPs showed a significant Angiotensin converting enzyme (ACE) inhibitory activities. Gold nanoparticles showed ACE inhibitory activities of 60.88±3.1000, 42.98±0.4755, 37.80±0.1077 and 36.66±0.444% at 50, 100, 150, and 200µg/ml respectively. It has been established in this research work that the green synthesis of AuNPs from *Strophantus hispidus* leaf possess anti-hypertensive, free radical scavenging and mycelial inhibitory activities; feats that could be exploited deeply in fixing bio-medical and agro-based challenges in this dispensation.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Characterization and biomedical applications of titanium dioxide nanoparticles synthesized from *Lecaniodiscus cupanioides* leaf extract

Oladipo, I.C[1*]., Lateef, A[2]., Azeez, M.A[2]., Asafa, T.B[3]., Yekeen, T.A[2]., and Ogunsona, S.B[1]

[1]Department of Science Laboratory Technology, [2]Department of Pure and Applied Biology, [3]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: icoladipo@lautech.edu.ng

NANO2022/B013

Keywords
TiO_2NPs
Lecaniodiscus cupanioides
Antioxidant
Antifungal
Anticoagulant
Thrombolytic

Abstract

The phyto-fabrication of titanium dioxide nanoparticles (TiO_2NPs) using the leaf aqueous extract of a folk medicinal plant *Lecaniodiscus cupanioides* was investigated in this work. The TiO_2NPs was evaluated for its antifungal, antioxidant, anticoagulant and thrombolytic activities. The characterization showed that the UV-visible spectrum of the TiO_2NPs synthesized displayed clear peak at 374.0 nm, also the FTIR spectrum peaks were obtained at 3849, 3468, 3376, 2904, 2643, 2414, 1895, 1896, 1602, 1369, 1091and 696 cm^{-1}. The SEM micrograph showed that the shapes of TiO_2NPs were nearly spherical, and agglomerated in nature with sizes range of 21.74-57.0 nm. Energy dispersive X-ray (EDX) analysis showed that titanium was the prominent metal present, while the selected area electron diffraction pattern conformed to the face-centred crystalline nature of TiO_2NPs. The TiO_2NPs showed potent mycelial inhibititory activities against *Aspergillus niger, Aspergillus flavus, Aspergillus fumigatus* and *Fusarium solani* by 60.0, 43.0, 58.9, 70.4 and 55.7% respectively at 250µg/ml. The TiO_2NPs also scavenged DPPH by 81.56-90.96%. Furthermore, the synthesized TiO_2NPs inhibited lipid peroxidation at 10µl/ml by 52.27-95.85% at 20-60µl/ml. The TiO_2NPs showed anticoagulant activity of 97.6% at 75µg/ml and thrombolytic activities of 35.2-89.3% at 30-75µg/ml. Conclusively, this study has presented a green approach to the synthesis of TiO_2NPs from the leaf of *Lecaniodiscus cupanioides* and its biomedical feats that could be employed in drug formulations that include free radical scavenging, surgical, and hematological processes to mention a few.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Characterization and biomedical applications of titanium dioxide nanoparticles synthesized from *Datura stramonium* seed extract

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

[1]Department of Science Laboratory Technology, [2]Department of Pure and Applied Biology, [3]Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: icoladipo@lautech.edu.ng

NANO2022/B014

Keywords
TiO_2NPs
Datura stramonium
Antioxidant
Antifungal
Anticoagulant
Thrombolysis
Lipid peroxidation

Abstract

The biosynthesis of titanium dioxide nanoparticles (TiO_2NPs) using extract of *Datura stramonium* seed was investigated in this work. The TiO_2NPs were nearly spherical, and agglomerated in nature with size of 75.88-155.52 nm. Energy dispersive X-ray (EDX) analysis showed that titanium (Ti) was the prominent metal present, while the selected area electron diffraction pattern conformed to the face-centred crystalline nature of TiO_2. The UV-visible spectrum of the TiO_2NPs synthesized displayed clear peak at 454.0 nm. The prominent FTIR peaks obtained at 3636, 3400, 3235, 2902, 2357, 1640, 1421, and 1062 cm^{-1} alluded to the fact that proteins were involved in the biofabrication and capping of TiO_2. The TiO_2NPs synthesized showed potent antifungal activities through mycelial inhibitions of 77.5, 62.5, 79.0 and 52.5% against *F. solani, A. niger A. flavus* and *A. fumigatus* at 250µg/ml respectively. The TiO_2NPs synthesized showed great free radical scavenging properties of 59.27, 57.92, 61.95, 70.99% against 2,2-diphenyl-1-picrylhydrazyl at 10, 20, 40 and 60 µl/ml respectively. Furthermore, the synthesized TiO_2NPs also inhibited lipid peroxidation at 10 µl/ml (29.94%), 20 µl/ml (32.91%), 40 µl/ml (47.63%) and 60 µl/ml (84.88%). The TiO_2NPs prevented coagulation of blood at 30 µg/ml by 53.4%, 45 µg/ml by 58.7%, 60 µg/ml by 76.3% and 75 µg/ml by 97.3% and lysis of blood clot at 30 µg/ml by 48.3%, 45 µg/ml by 68.5%, 60 µg/ml by 80.4% and 75 µg/ml by 94.9%, thus, showing potential biomedical applications. This study has presented an eco-friendly and economical synthesis of TiO_2NPs from *Datura stramonium* husk for various nanobiotechnological applications.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

An analysis of buoyancy-driven flow and heat exchange in a cylindrical channel filled with a water–Cu nanofluid

Sangotayo, E.O*., and Ogidiga, J.O
Department of Mechanical Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: eosangotayo@lautech.edu.ng

NANO2022/P015

Keywords
Natural convection
Nanofluid
Finite difference method
Cylindrical cavity
Buoyancy parameter

Abstract

Fluid stream and heat exchange qualities by natural convection within an enclosure have gained a lot of attention because of the numerous manufacturing applications. The density-buoyancy analysis is crucial in the technical design of floating vessels. This study explores quantitatively the effect of buoyancy factors on natural convection in a heated Cu nanofluid-filled cylinder. The governing equations were discretized using the finite difference method, and continuity and Navier Stoke fields were integrated using the C++ computer language. The particle sizes of the Cu nanoparticles investigated in this study ranged from 1% to 10%, and buoyancy parameters were in the range of 2.6 – 2.8×10^3. The results are presented as Nusselt number, temperature gradient, vorticity, and stream function curves utilizing Cu nanofluids as working fluids. The results showed that increasing the volume fraction of nanoparticles to 0.04 increases the buoyancy parameters to a maximum of 2.76×10^3, resulting in a significant increase in the convective heat transmission rate. Furthermore, when the buoyancy factor grows, the temperature gradient, vorticity, and stream function of the nanofluid improve while the local drag coefficient drops. This research enhances the understanding of buoyancy-driven convective flow and heat behavior of boundary layer problems; for safety and effectiveness, as engineers examine the response of floating vessels like ships and oil rigs to increasing weight.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biosynthesis of silver nanoparticles from agro-waste (corncob) and its antibacterial effect in water treatment

Mohammed, M.O., Suleiman, M.M., Yusuf, T.B*., Aderinkola, T.A., Abubakar, A.A., Oladuntoye, M.T., and Ola-Williams, I
Department of Biological Sciences, Summit University, Offa, Nigeria

*E-mail: yusuftoyyib5@gmail.com

NANO2022/B016

Keywords
Silver nanoparticles
Corncob
Green synthesis
Water treatment
Polyurethane

Abstract

As the reoccurrence of water pollution emerges worldwide, the use of conventional treatment method of polluted water is proven to be less effective. However, the use of nanoparticles due to their large surface area and particle size is said to have a wide variety of application in which water treatment is one of them. Nanoparticle synthesis using agrowastes is not only cost effective and ecofriendly but also indirectly reduces the menace of environmental pollution. In this study, the green synthesis of silver nanoparticles using agro-waste (corncob) extract was carried out and evaluated for antibacterial activity towards water treatment. The synthesis of silver nanoparticles was monitored using UV-vis spectrophotometer. The synthesized nanoparticles were embedded on Polyurethane foams for 5 h, washed with distilled water and air dried. A loop-full of *Escherichia coli* and *Shigella* spp isolated from Afelele river was inoculated and homogenized in a distilled water before inserting the embedded PU-foams. One ml from the setup was taken and incubated at several intervals (0 min, 30 min, 1 h, 8 h and 24 h) to observe antibacterial activity. Results (cfu/ml) obtained after the incubation period shows little effect at 0 min (8.0×10^6), 30 min (7.0×10^6) and 1 h (6.0×10^6) after plating out while at 8 h and 24 h, no growth was noticed on the plates indicating the complete inhibition of the isolates. In conclusion, this study reveals the applicability of agro-waste in nano-synthesis and the efficacy the embedded PU-foams in water treatment as evident in the inhibition of the selected microorganisms.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Fabrication, characterization and applications of multiwall-carbon nanotubes-Al_2O_3 ceramic composites

Adewumi, H.K*., Ayodele, A.J., Oyeshola, H.O*., Adewumi, A.S., Sanusi, Y.K., and Fajinmi, G.R
Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: hkadewumi@lautech.edu.ng, hooyeshola@lautech.edu.ng

NANO2022/P017

Keywords
MWCNTs
Al_2O_3
Ceramic composite
Bulk conductivity
Electronic devices

Abstract

Dielectric substrate materials with light weight, electromagnetic compatibility, frequency-dependent permittivity and permeability, good microwave absorptiveness, extremely low dielectric and magnetic losses, and broad bandwidth have become essential requirements in today's world due to advancements in electronic and wireless communication technology. Hence, the extraordinary characteristics, specific properties and potentials of carbon nanotubes (CNTs) in formation of composite substrate materials which are useful in the design of broadband absorbing or functional materials at higher microwave frequency has been underutilized. Therefore, this paper presents the results and suitable area of applications of multiwall carbon nanotubes -Al_2O_3 ceramic composites (MWCNTs-Al_2O_3) that were fabricated synthetically. The multiwall carbon nanotube was synthesized at different temperatures using chemical vapor deposition techniques and then used to doped five different samples of Al_2O_3 to form composite samples. The composites samples obtained were further characterized to realize some properties such as relative permittivity, relative permeability, microwave absorptiveness, bulk conductivity, dielectric loss tangent and magnetic loss tangent. The properties obtained show that the composite materials formed can be suitably used as microwave absorber, electromagnetic compatibility devices, insulator, ferromagnetic devices, capacitor and patch antenna substrate which are essential components of solid state electronic devices.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Bio-fabrication of silver nanoparticles from *Azanza garckeana* seed extract: A promising alternative to conventional antibiotic therapy against Vancomycin-resistant *Enterococci*

Yusuf-Omoloye, N.A[1]., Azeez, L.A[2]., Adeyemi, F.M[1]., Sule, W.F[1]., Ajigbewu, H.O[1]., and Adegbite-Badmus, M.K[1]

[1]Department of Microbiology, [2]Department of Pure and Applied Chemistry, Osun State University, Osogbo, Nigeria

*E-mail: nana.yusuf@pgc.uniosun.edu.ng

NANO2022/B018

Keywords
Silver nanoparticles
Green synthesis
Azanza garckeana
Vancomycin-resistant Enterococci
Antibacterial activity

Abstract

Globally, Vancomycin-resistant Enterococci (VRE) has become a major concern and a primary cause of nosocomial infections. Their multiple resistance to various antibiotics particularly vancomycin has become a major clinical and epidemiological issue. *Azanza garckeana,* also known as the African Snot Apple is widely known for its medicinal properties but is one of the least-exploited indigenous wild fruit of interest in Africa. The present study aimed to synthesize silver nanoparticles (AgNPs) from the seed extracts of *Azanza garckeana,* and screen for possible antibacterial activity against VRE isolates. AgNPs were synthesized using the eco-friendly biological method by mixing the *Azanza garckeana* seed extract in a silver nitrate solution. The particles were then later characterized using UV-Vis spectroscopy and FTIR. The antimicrobial activity of the AgNPs was evaluated for their inhibitory potential against VRE isolates from clinical, food, and water sources using the Kirby-Bauer well diffusion method**.** The results obtained from UV spectroscopy showed a clear parabolic shape at 435 nm, and FTIR analysis showed various peaks implying that *A. garckeana* had polyphenolic compounds responsible for the capping and stabilizing of the silver nanoparticles. The synthesized AgNPs also exhibited antibacterial activity against the VRE isolates with inhibition zones between 10-16 mm. The green synthesized AgNPs revealed potent antimicrobial activity; thus, the antibacterial activity of the synthesized AgNPs from *Azanza garckeana* seed extract could be explored further and employed in several biomedical applications.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Development and stability studies of diosgenin-integrated *oil-in-water* nanoemulsified system for its potential drug delivery application

Akinsipo, O.B[1*]., Dare, E.O[2]., Oladoyinbo, F.O[2]., Katare, D.P[3]., and Sanni, L.O[4]
[1]Department of Chemical Sciences, Tai Solarin University of Education, Ijagun, Nigeria
[2]Department of Chemistry, Federal University of Agriculture, Abeokuta, Nigeria
[3]Centre for Medical Biotechnology, Amity University, Noida, India
[4]Department of Food Science and Technology, Federal University of Agriculture, Abeokuta, Nigeria

*E-mail: solape2010@gmail.com

NANO2022/B019

Keywords
Diosgenin
Nanoemulsion
Drug delivery
Stability

Abstract

Bioavailability and protection of poorly water-soluble phyto-drugs can be enhanced when encompassed in a nanoemulsion system, hence, impelling its drug delivery application. This study aims at uniquely incorporating diosgenin (DG) into an oil-in-water (O/W) sub-micron-sized nanoemulsion (NE) capable of enhancing its stability for therapeutic drug delivery purposes. The low-energy phase inversion composition method was used in formulating diosgenin-incorporated O/W nanoemulsion (DGNe). The characteristic surface morphology of DGNe was determined using Scanning Electron Microscope (SEM) and Field Emission Scanning Electron Microscope. Differential Light Scanning Calorimeter (DLS) was employed in investigating the particle size, zeta potential, and polydispersity index (PDI) of DGNe. The functional stability of the formulated DGNe was characterized using Fourier Transform Infrared (FTIR), DLS techniques including physical and thermodynamic studies. SEM revealed an almost spherical nanoemulsion matrix of the dispersed diosgenin. The DLS indicated particles of 92–265 nm with a PDI of 0.01-0.40. Meanwhile, the FTIR showed a stable DGNe formulation at days 0 and 90. DGNe were also found to be thermodynamically stable at 4 and 25 °C after 4 weeks. The viscosity of DGNe revealed a decrease with increasing water content. *In-vitro* drug release studies indicated a slow, continuous, and sustained release of drug from 0.5 to 15 h period.
.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Recent advances of biotechnological approaches in nanotechnology: applications and limitations

Alabi, T.D[1*]., and Badmus, J.A[2]
[1]Department of Biochemistry, Baze University, Abuja, Nigeria
[2]Department of Biochemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: toyudoc@yahoo.com

NANO2022/B020

Keywords
Nanotechnology
Biotechnology
Nanobiotechnology
Nanoparticles
Biomedical

Abstract

Nanotechnology have been extensively researched and its applications introduced in almost all fields and disciplines. Of much interest is its utmost use and applications in biomedical and biochemical sciences that includes bio-detection, drug delivery and diagnoses for disease management and prevention. However, there is a growing interest towards the expansion of nanobiotechnological tools. Besides the immense contribution of organic chemistry to nanotechnology, biotechnology now provides interesting tools for the synthesis of new polymeric nanoparticles. In this review, we discuss the emerging uses of biotechnology techniques and tools in nanotechnology. The significance of biotechnological tools such as genetic engineering of microorganisms for wound healing, drug delivery and overcoming multi-drug resistant infections will be discussed. This review presents an overview of the recent advances of biotechnological approaches in nanotechnology, alongside the respective limitations observed in the investigations and studies analyzed. For that purpose, we have compiled a list of selected articles from an extensive search in main scientific databases such as PubMed, Science Direct© (Elsevier) Web of Science™, and SCOPUS® using a combination of different keywords, such as "nanoparticles", "nanotechnology", "biotechnology", "antimicrobial", "resistant", "bacteria", "polymers" and complementary terms that might be useful to the study.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Antimicrobial susceptibility pattern of *Enterococcus* isolated from oral and rectal cavity of *Sus scrofa domestica* (domestic pig)

Ngwu, M.I*., Ozota, G.O., Emencheta, S., and Ozioko, C.A
Department of Pharmaceutical Microbiology, University of Nigeria, Nsukka, Nigeria

*E-mail: maria.ngwu@unn.edu.ng

NANO2022/B021

Keywords
Enterococci
Vancomycin-resistance
Domestic pig
Susceptibility testing

Abstract

Among food animals, there has been frequent occurrences of resistant enterococci and they may be reservoirs of resistant enterococci that can be transferred to humans through the food chain. The aim of this study was to isolate and determine the antimicrobial susceptibility pattern of *Enterococcus* isolated from the oral and rectal cavity of pig obtained from farm in Nsukka. Oral and rectal samples of domestic pig were collected using swab stick. The specimens were inoculated onto the sterile nutrient broth containing 6.5% normal saline, these were then incubated for 24 h. After the incubation they were sub-cultured aseptically onto a sterile Slanetz and Bartley agar. This was incubated for 24 h. After purification, the organisms were cultured on Bile-Esculin agar for confirmation of the *Enterococcus*. Antibiotic susceptibility profile was performed using disc diffusion method according to Clinical Laboratory Standard Institute (CLSI), using Mueller-Hinton agar. A total of 304 oral and rectal samples were obtained and 116 organisms were isolated. The susceptibility result showed that 66.4% were resistant to vancomycin, 41.1% to erythromycin, 51.7% to linezolid and 23.3% to teicoplanin. There was high level of vancomycin resistant enterococcus (VRE) strain in pigs in this study which calls for effective environmental and antimicrobial monitoring. We advanced that nanoparticles can be exploited to curtail the emerging antibiotic resistance in enterococci.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Development of copper polymer based grown nanocomposite thin film for photovoltaic application

Oyeshola, H.O[1]*., Atere, D.A[1]., Ojeniyi, F.A[1]., Lawal, M.A[1]., Atanda, O.S[1]., Adejumo, B.K[1]., Raheem, K.K[1]., Alamu, Q.A[1]., Adewumi, H.K[1]., and Sanusi, Y.K[1,2]

[1]Department of Pure and Applied Physics, [2]Nanotechnology Research Group (*NANO*[+]), Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: hooyeshola@lautech.edu.ng

NANO2022/P022

Keywords
CuNPs
Organic solar cells
Photovoltaic efficiency
Nanocomposite
Thin film

Abstract

Today, there is an increase in the level of material in organic-based solar cells (OSCs) as an alternative energy source. The polymer such as P3HT:PCBM and polyaniline (PANI) layers exhibit excellent photovoltaic properties yet their power conversion efficiency are still low compared to that of convectional silicon photovoltaic cells. Therefore, there is need to improve the photovoltaic efficiency of this polymer by incorporation of high metal as a hole collector buffer layer. This research focused on incorporation of green copper nanoparticles (CuNPs) into polymer (PANI) to form a composite for active layer device to improve the overall efficiency of OSCs. Green synthesized CuNPs were obtained from precursor of copper-sulphate. Copper-polymer nanocomposite thin film was deposited onto a cleaned glass substrate (ITO) using spin coating techniques to form composite active layer device. Optical and electrical properties of the developed copper-polymer composite-based active layer device were investigated using UV-VIS spectrophotometer, AFM and four-probe technique. There was tendency of agglomeration due to incorporation of copper metal in the polymer matrix as observed from SEM. FTIR revealed that carboxyl (C=O), hydroxyl (-OH) and amine (NH) groups and XRD shows diffraction pattern which confirms the standard peak of CuNPs. AFM shows interaction between Cu and polymer and the absorption spectrum show shift in the absorption peak. The photovoltaic properties of the copper-polymer composite-based active layer gives better performance compared to the polymer only active layer; composite active layer gives Isc of 1.565 $mAcm^{-2}$, Voc of 26.30 V, Fill Factor of 29.36%, Efficiency of 12.991%. The developed nanocomposite device provides conduction pathways for an improved charge transferability which might be a good candidate as whole collector electrode in thin film OSCs.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Green synthesised silver nanoparticles and their potential as cement admixtures

Yahaya, M.I., and Tambari, M.S
Department of Pure and Industrial Chemistry, Sokoto State University, Sokoto, Nigeria

*E-mail: ymansur64@gmail.com

NANO2022/P023

Keywords
Cement
Silver nanoparticles
Cement admixture
Compressive strength
Construction industry

Abstract

The construction industry is faced with alarming cement scarcity and poor alternate cement admixture coupled with the current market lack of long term application and cheaper admixture that would promote cement production. In order to overcome these issues, a suitable synthesis that can serve a better function is needed. The green synthesis of nanoparticles provides a convenient, simple and environment friendly way which minimizes the side effects of chemical and physical methods by preventing the use of toxic chemicals and formation of harmful by-products and at the same time enhance the durability, workability, or strength characteristics of concrete and a better cement production. This have become a very promising research in the field of nanoscience in recent years. As such, silver nanoparticle produced from plant extracts can be considered as one of the prominent agents which will be able to perform a wide spectrum potential as cement admixture. In this research, silver nanoparticles synthesized from plant extract were characterized and their potential as cement admixture investigated. An increase in UV-Vis absorbance in the region 340 to 450 nm with time indicated the synthesis of silver nanobio conjugates. The FTIR peak at approximately 3200 cm^{-1} indicated the reduction of Ag+ into silver nanoparticles. The SEM morphology of the silver nanoparticles is pre-dominantly spherical. There was an increase in the setting time when the mixture of cement and silver nanoparticles was above 3.0wt%. The sample mixture shows an increase in compressive strength after 48 h. The results indicate the possibility of using silver nanoparticles as cement admixture.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Green synthesis of silver nanoparticles using *Sarcocephalus latifolius* root aqueous extract for biomedical application

Adewoyin, A.G*., Oladipo, I.C., Akintola, A.O., Oyeniyi, O.D., Oke J.V., and Afolabi, S.T
Department of Science Laboratory Technology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: agadewoyin@lautech.edu.ng

NANO2022/B024

Keywords
Silver nanoparticles
Sarcocephalus latifolius
Antioxidant activity
Malondialdehyde activity
Angiotensin-converting enzyme (ACE) inhibiting activity

Abstract

Silver nanoparticles were synthesized by using aqueous root extract of *Sarcocephalus latifolius* in this study. The nanoparticles were characterized by UV-Visible spectroscopy, Fourier transform infrared (FTIR) spectroscopy, Scanning electron microscopy (SEM) and Energy dispersive X-ray (EDX). The antioxidant activity of the biosynthesized nanoparticles was determined using 2,2-diphenyl-1-picrylhydrazyl (DPPH) and nitric oxide radical scavenging assays. The malondialdehyde activity and angiotensin-converting enzyme (ACE) inhibiting activity of the synthesized nanoparticles were also determined. The surface plasmon resonance found at 450 nm confirmed the formation of AgNPs and FTIR spectra obtained confirmed the involvement of biological molecules, while SEM analysis confirmed the formation of distinct spherical silver nanoparticles. The biosynthesized nanoparticles showed increase in radical scavenging activity with increase in concentration in comparison to the standard used. Effective inhibition of ACE was observed which was dose dependent. This study suggested that AgNPs synthesized from aqueous *Sarcocephalus latifolius* root extract have the potential of being exploited in the treatment of stress related issues.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Comparative study of inhibition potentials of gold-silver alloy nanoparticles on mild steel in 3.5% NaCl and 1.0 M HCl solutions

Asafa, T.B[1*]., Odusote, J.K[2]., Ogbesanya, V.O., Opatola, E.A[2]., Lateef, A[1]., Durowoju, M.O[1]., Azeez, M.A[1]., Yekeen, T.A[1]., Oladipo, I.C[1]., Adebayo, E.A[1]., Badmus, J.A[1]., Sanusi, Y.K[1]., and Adedokun, O[1]

[1]Nanotechnology Research Group (*NANO*[+]), Ladoke Akintola University of Technology, Ogbomoso, Nigeria

[2]Department of Materials and Metallurgical Engineering, University of Ilorin, Ilorin, Nigeria

*E-mail: tbasafa@lautech.edu.ng

NANO2022/P025

Abstract

Monolithic metallic nanoparticles have been deployed to minimize corrosion of metals in marine and other corrosive environments. However, the inhibition efficiency is usually below 55% for mild steel immersed in 3.5% NaCl and 1.0M HCl solutions. One way of raising the efficiency is to make use of alloy nanoparticles, a hybrid of two metallic nanoparticles, which are known to perform better in other applications. In this study, a comparative analysis of the inhibition potential of gold-silver nanoparticles (Au-AgNPs) on mild steel immersed in two corrosive media (3.5% NaCl and 1.0 M HCl) was conducted. Au-AgNPs were obtained from Laboratory of Industrial Microbiology and Nanobiotechnology, LAUTECH Ogbomoso while the corrosive media were prepared as required. The selection of the media was premised on their diverse use as operating media and cleaning agents in petrochemical industries. Five concentrations of Au-AgNPs solution (0, 5, 10, 15, and 20 µg/ml) were added to each of 3.5% NaCl and 1.0 M HCl solutions. Two approaches (gravimetric and potentiodynamic polarization) were deployed to evaluate the corrosion inhibition effects of Au-AgNPs solution on the mild steel samples. The gravimetric study was conducted for 360 h of exposure in NaCl and 240 h in HCl. Results showed that weight loss increased with exposure time but decreased with increased concentration of Au-AgNPs solution for both corrosion media. In addition, inhibition efficiency was enhanced by 75% for NaCl and 70% for HCl which are both higher than 52% obtained when AgNPs were used. The potentiodynamic polarization results showed that Au-AgNPs modified the mechanism of anodic dissolution and cathodic hydrogen gas evolution. SEM images confirmed uniform corrosion on the surfaces of the samples.

Keywords
Gold-silver alloy nanoparticles
Mild steel
Corossion inhibition
Gravimetry
Potentiodynamic polarization

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis and effects of sunflower-mediated calcium phosphate nanoparticles on physical and sensory properties of broiler chicken

Ola, A.K[1*]., Ojebiyi, O.O[1]., Akinwumi, A.O[1]., Lateef, A[2]., Sanu D.O[1]., Oladeji H.O[1]., and Fajimolu, O.M[1]

[1]Department of Animal Nutrition and Biotechnology, [2]Laboratory of Industrial Microbiology and Nanobiotechnology, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: akola@student.lautech.edu.ng

NANO2022/B026

Keywords
Calcium phosphate nanoparticles
Sunflower
Broiler
Sensory properties
Physical properties,
Hedonic scale

Abstract

The need for maintaining a balance in the use of calcium and phosphorus in animal feed cannot be overemphasized sequel to greater requirement for chicken in relation to food products. This experiment was conducted to synthesize and evaluate the effect of sunflower-mediated calcium phosphate nanoparticles (CaP-NPs) on physical and sensory properties of broiler chickens. Harvested sunflower leaves were washed, dried and ground into powder form and then extracted with water at 60 °C for 1 h. The leaf extract was used to reduce calcium phosphate (Ca_3 $(PO_4)_2$) to CaP-NPs which was fed to 200 day old Arbor acres strains of broiler chicken at 0, 0.01, 0.03, 0.05 and 0.07% inclusion level for seven weeks. At the end of the feeding trial, four birds per treatment were slaughtered and dressed for physical and sensory properties evaluation. The chilling and cooking losses were significantly ($p<0.05$) influenced across all treatments showing improved values with birds fed 0.07% CaP-NPs. Cold shortening, drip loss, pH and thermal loss were not significantly ($p>00.5$) influenced across all treatments. Though, lowest numerical values were recorded for the birds fed 0.01% and 0.07% CaP-NPs showing positive influence of the diet. Colour, flavour and overall acceptability were not significantly ($p>0.05$) influenced across all treatments while juiciness and tenderness were significantly ($p<0.05$) influenced across all treatments. Birds fed 0.03, 0.05 and 0.07% CaP-NPs had highest values in line with hedonic scale used. Birds fed 0.01 and 0.07% CaP-NPs had lowest values for cold shortening, drip loss, pH and chilling loss, cooking loss, thermal loss. Therefore, inclusion of CaP-NPs in broiler diet can improve its meat quality.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Preparation and pigmentation of carbon nanotubes for biomedical application

Uselegh, L.Y[1,3*]., Tijani, J.O[1,3]., Alex Ikechukwu Ajai, A.I[2,3]., and Abdulkareem, A.S[2,3]
[1]Department of Chemistry, [2]Department of Chemical Engineering, [3]Nanotechnology Research Group, African Centre of Excellence on Mycotoxin and Food Safety, Federal University of Technology, Bosso Campus, Minna, Nigeria

*E-mail: useleghlynd@gmail.com

NANO2022/P027

Keywords
Pigmentation
Carbon nanotube
Red oxide
Yellow oxide
Polymeric prosthetic feet

Abstract

In this study, the produced bimetallic catalyst (Fe-Ni supported on kaolin) was used to synthesis carbon nanotubes (CNTs) via chemical vapour deposition method. The produced CNTs was purified using acid mixtures (H_2SO_4/HNO_3) while the pigmentation of purified CNTs was carried out by Red oxide (RO) and Yellow oxide (YO) respectively at different proportions with the CNTs. The pigmented CNTs were characterized using Ultra Violet-visible spectroscopy, High-resolution transmission electron microscopy (HRTEM), high-resolution scanning electron microscopy (HRSEM) coupled with energy dispersive spectroscopy (EDS), and X-ray diffraction spectroscopy (XRD). The UV-visible spectrum of 0.5 g CNTs/RO(6cm^3/YO(20cm^3) sample show the highest decolouration efficiency of 36.28%, indicating bleaching effects of RO and YO in the decorated CNTs. The HRTEM image show the tubular network structure of the carbon nanotube irrespective of the colorant mixing ratio, and the EDS also confirmed that the samples consist of carbon, oxygen, and iron at different atomic percentages. The HRSEM images of decorated CNTs show that the topographical properties of CNTs were intact and not affected by the addition of RO and YO. XRD results confirmed the formation of highly graphitic carbon in the pigmented CNTS. This study demonstrated that the decolourised CNTs can act as reinforcing materials for the development of prosthetic feet for different skin types.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Effects of beryllium on the stability, electronic and optical properties of graphene: a first principles approach

Agbolade, L.O[1,2,3*]., Tijjani, A[1,2,4]., Adewale, A.A[3,4]., Oyeshola, H.O[3]., Sanusi, Y.K[3]., and U. Hashim, M.N.A[2]

[1]Faculty of Electronic Engineering & Technology, Universiti Malaysia Perlis, 02600 Arau, Perlis, Malaysia, [2]Institute of Nano Electronic Engineering, Universiti Malaysia Perlis, Perlis, Malaysia, [3]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria, [4]Centre for Frontier Materials Materials Research Universiti Malaysia Perlis, 0100, Kangar, Perlis, Malaysia

*E-mail: olatomiwaagbolade@gmail.com

NANO2022/P028

Keywords
Graphene
Beryllium
Stability
Band gap
Absorption
Reflectivity
Optoelectronics

Abstract

First-principles calculations using Density Functional theory were used to determine the stability, and electronic and optical properties of graphene doped at the edges with Beryllium at 12.5% using the *WIEN2K* code. The effects of the concentration of the impurity on the crystal structure and the electronic and optical properties were determined using the generalized gradient approximation in Perdew-Burke Ernzehof (PBE) for the exchange-correlation potential. The results show that the Beryllium doped graphene is stable due to the negative value of the adsorption energy and the symmetry of graphene was preserved by doping at the edges of graphene. The transition of Pristine graphene from a semimetal to a semiconducting material due to the introduction of the Beryllium atom in the crystal structure of graphene was reported. The band gap created was found to be 0.9 eV for Beryllium-doped graphene and exhibit a P-type behaviour in this study. Furthermore, the reflectivity of pure and Beryllium doped graphene is seen to have the least penetrating power at the interval of 8.6 – 10 eV which corresponds to the interval of maximum absorption in both systems. The results also indicate that the Beryllium doped graphene is more conductive than pure graphene. Lastly, the results reveal that beryllium is energetically stable, and can engineer a wide band gap in graphene which can be manipulated to meet the specific applications in energy storage devices and optoelectronics.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis and characterization of carbon quantum dots/titanium dioxide hybridized photoanode for improved quantum dots sensitized solar cell

Oyeshola, H.O[1*]., Lawal, A.M[1*]., Balogun, S.W[2]., Adewale, A.A[1]., Murithador, F.A[1]., Ojeniyi, F.A[1]., and Sanusi, Y.K[1,3]

[1]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

[2]Department of Materials Science and Engineering, Kwara State University, Malete, Nigeria

[3]Nanotechnology Research Group (*NANO*[+]), Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: hooyeshola@lautech.edu.ng, lawalam@gmail.com

NANO2022/P029

Abstract

The leading promising renewable and clean source of energy is solar energy due to its free, non-polluting nature, and it is limitless from source. The global energy crisis evokes an unprecedented interest for the development of equipment for efficient light-to-electricity conversion. Dye-sensitized solar cell (DSSCs) is considered as energy harvesting devices. There is an enthusiasm for improving the light harvesting materials in DSSCs, to give birth to Quantum Dots Sensitized Solar Cells (QDSSC). However, the main challenge causing the unsatisfactory power conversion of carbon quantum dots-sensitized solar cells is the low affinity between titanium dioxide (TiO_2) and carbon quantum dot (CQDs) leading to a poor adsorption of the CQDs on the TiO_2-coated photoanode. Therefore, this research focused on green synthesis of CQDs grown onto the TiO_2 surface for high performance QDSSC. The prepared TiO_2 paste was deposited onto a cleaned FTO glass using doctor blade technique. *In situ* method was used to grow CQDs on TiO_2photoanode surface. The optical and morphological characterizations were investigated using UV-Vis spectroscopy and scanning electron microscope while four point probes was done for the electrical properties. The carbon dots have peak absorption of 1.392 au at 370 nm wavelength as recorded from the UV analysis. SEM and TEM micrograph show regularly arranged particles that are not completely stacked. The fabricated thin film device has a sheet resistance of 227.48 Ω/cm^2 and power output of 14.59 mW using four point probe. The results obtained show that an *in situ* growth method has greater benefits when it comes to enhancing the functionality of CQDSCs.

Keywords
Synthesis
TiO_2 nanoparticle
Carbon dot
Dye-sensitized solar cell
Renewable energy

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Green synthesis of silver nanoparticles using *Mangifera indica* stem bark extract and formulation of its pharmaceutical gel for antimicrobial and antioxidant applications

Adeyemi, O.E[1]., Omoteso, O.A[2]., and Ajala. T.O[1]*
[1]Department of Pharmaceutics and Industrial Pharmacy, University of Ibadan, Ibadan Nigeria
[2]School of Pharmacy, University of the Western Cape, Bellville, Cape Town, 7530, South Africa

*E-mail: tolulola1721@gmail.com; to.ajala@mail1.ui.edu.ng

NANO2022/B030

Keywords
Mangifera india
AgNPs
Green synthesis
Antimicrobial
Antioxidant
Pharmaceutical gel

Abstract

This study reports the production of silver nanoparticles using aqueous and methanol *Mangifera indica* stem bark extracts as capping agents and formulation of pharmaceutical gel loaded with the nanoparticles. The extracts were prepared using standard procedures and utilized in biosynthesizing silver nanoparticles. Biosynthesis was ascertained through colour changes, UV-Visible and FTIR spectroscopy. Antioxidant activity of the extracts and biosynthesized nanoparticles were examined by DPPH method. The antimicrobial evaluation was carried out on *Pseudomonas aeruginosa* and *Staphylococcus aureus*. Pharmaceutical gels were produced (F1-F5), and loaded with the nanoparticles. Nanoparticles exhibited maximum absorption under UV-visible spectroscopy between 315-320 nm. FTIR spectrum showed that alkene and ester functional groups were conferred on the silver nanoparticles by the extracts used. The nanoparticles demonstrated antimicrobial activity against the organisms, which was significantly higher ($p<0.05$) than for extracts and reference drug. The antioxidant capacity was in a concentration-dependent manner but significantly lower ($p<0.05$) than that of the reference drug. Formulated gels had acceptable organoleptic profiles, pH range of 6.8-7.1, high viscosity and pseudoplastic flow patterns. The *in-vitro* release profiles of the gels showed was gradual, with t_{90} higher than 2 h. The release seemed to be influenced by the viscosity of the gel systems. In addition, the release kinetics of the nanoparticle loaded gel systems followed Higuchi model with r^2 ranging from 0.9958-0.9980. Thus, this study showed that *Mangifera indica* extracts were successfully used as bio-reducing agents in the synthesis of silver nanoparticles. The gel formulations had acceptable physical properties and release profiles.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Electromagnetic adsorption and polarization mechanism on reservoir sandstone with nanofluid interaction for oil mobility

Sikiru, S[1*]., Soleimani, H[2]., Abiodun, A.J[3]., and Sanusi, Y.K[4]

[1]Centre for Subsurface Imaging, Universiti Teknologi PETRONAS 32610 Seri Iskandar Perak, Malaysia
[2]Department of Geoscience, Universiti Teknologi PETRONAS 32610 Seri Iskandar Perak, Malaysia
[3] Department of Physcis and Physical Science, Lead City University, Ibadan, Nigeria
[4]Department of Pure and Applied Physics, Ladoke Akintola University of Technology, Ogbomoso Nigeria

*E-mail: surajudeen86@gmail.com

NANO2022/P031

Keywords
Oil Mobility
Electromagnetic field
Graphene
Decane
Hexadecane
Adsorption

Abstract

Using present approaches, improving oil mobility from reservoirs with high temperatures and pressures is unfeasible. As a result, injection of dielectric nanofluid driven by an electric field has been proposed to increase oil mobility in terms of diffusion coefficient and assessment of interfacial tension. When exposed to a direct electric field, nanoparticles are activated, allowing them to travel more effectively and affect oil characteristics. The electronic characteristics of four nanoparticles were simulated and characterised in terms of band structures and partial density of state: zinc oxide, copper oxide, graphene, and magnetite. In the preliminary adsorption investigation, oil was represented by Decane and Hexadecene. According to the findings, nanoparticles have a high influence on heavy molecular chains (Hexadecene) and a low impact on low molecular chains (Decane). Magnetite's contact with the rock-oil interface lowered adsorption energy from 23.99Kcal/mol to 21.63Kcal/mol (for Decane) and from 28.53Kcal/mol to 18.81Kcal/mol (for Hexadecene). Because Decane had a limited impact, it was employed as an oil candidate in following investigations. In addition, the influence of salinity on the performance of nanoparticles was studied in adsorption research. Salinity increases from 0 ppm to 11000 ppm causes additive decrease with a more obvious influence on graphene. Following this, the diffusion coefficient of Decane via a simulated Angsi field sandstone structure was calculated at 120 ^{o}C after verifying the simulation methods and before and after exposure to the action of nanoparticles and an electromagnetic field. There is a trend in the concentration effect of nanoparticles on Decane diffusivity for Graphene (from 0.01wt percent to 0.05wt percent and 0.1wt percent). Magnetite performed best at 0.05wt percent.

	The addition of an externally provided electric potential of 2V/cm and 0.05wt percent nanofluid concentration at 11000 ppm salinity resulted in increases of 1088.89% and 644.44% for graphene and magnetite, respectively. Because interfacial tension is another component that influences the effectiveness of oil mobilisation by nanoparticles, the activation of nanoparticles at the interface of oil and water by an electric field was also explored experimentally. The experimental Interfacial Tension findings proved the effectiveness of applied electromagnetic potential in activating nanofluid performance. The application of 2V/cm lowered interfacial tension by 99.49 percent for graphene and 15.66 percent for magnetite at the measurement equipment's highest practicable operational heat state of 100 °C. Graphene's greater effect can be ascribed to its hydrophobicity and strong dielectric properties.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Characterization and antimicrobial evaluation of biomimetically synthesized silver nanoparticles using aqueous leaf extract of *Morinda lucida* Benth. (Rubiaceae)

Egonu, S.N*., and Udengwu, O.S
Department of Plant Science and Biotechnology, University of Nigeria, Nsukka, Nigeria

*E-mail: sheily.egonu@unn.edu.ng

NANO2022/B032

Keywords
Morinda lucida
Silver nanoparticles
Green synthesis
Antimicrobial activity

Abstract

In this sudy, the medicinal plant *Morinda lucida* was employed in the synthesis of silver nanoparticles (AgNPs). For the synthesis, 10 ml of aqueous *M. lucida* leaf extract was added to 90 ml of freshly prepared 3 mM silver nitrate ($AgNO_3$) solution in a flask. The mixture was allowed to stand at ambient temperature, in a dark cupboard for 48 hours. Positive AgNPs synthesis, indicated by a colour change from red to brown was further validated by UV-vis spectroscopy wherein an absorption peak at 460.51 nm was recorded. The utilitarian aspects of the particles were further characterized using scanning electron microscopy (SEM), Fourier transform infrared (FTIR) spectroscopy, dynamic light scattering (DLS), X-ray diffraction (XRD) and energy dispersive X-ray spectroscopy (EDX). The SEM images showed that particles were round to amorphous in shape. Amide, amine, alkene and alkynes were the most occurring functional groups from the FTIR spectra. The XRD diffractogram of AgNPs showed two peaks at 45.53° and 77.17° that correspond to miller indices of (200) and (311) respectively and an average crystalline size of 62.60 nm obtained using the Debye-Scherrer's formula. The DLS result indicated a Z–average size of 235.1 nm and a polydispersity index (PDI) of 0.4. EDX analysis showed that elemental silver (Ag) had the highest atomic concentration of 64.50 %. Using the agar well diffusion assay, the nanoparticles exhibited antimicrobial activity against *Pseudomonas aeruginosa* and *Aspergillus flavus*. It can be concluded that *M. lucida* is capable of synthesizing stable, small-sized AgNPs with antimicrobial potential.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Applications of nanotechnology in animal nutrition: a review

Idowu, A.O[1*]., Ojebiyi, O.O[1]., Lateef, A[2]., Odunsi, A.A[1]., Ola, A.K[1]., and Akinola, A.O[1]

[1]Department of Animal Nutrition and Biotechnology, [2]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: oyeyemiidowu11@gmail.com

NANO2022/B033

Keywords
Nanotechnology
Nanoparticles
Animal nutrition
Synthetic antibiotics
Additives

Abstract

Nanotechnology deals with the development of materials on the nanometer scale to form nanomaterials which exhibit specific properties that are determined majorly by their size, shape, and crystal structure. Among nanomaterials, nanoparticles are commonly used in human medicine but their application in agriculture, animal nutrition and veterinary medicine is quite new. In order to meet the increasing demand on livestock industry, synthetic antibiotics are the major substances that are used as growth promoters. However, the use of antibiotics as feed additives is risky due to cross-resistance among bacterial strains and residues in tissues of the animal. Thus, the use of most synthetic antibiotic has been banned in many countries in the world, leading to reduction in usage and the search for alternative growth promoters with minimal or no residual effect has been intense in recent times. Many reports have suggested that nanoparticles may be good substances for animal growth promotion and antimicrobials due to the fact that some nanomaterials can remove toxins and pathogens. For instance, silver nanoparticles exhibit a strong antimicrobial effect. Also, nano-selenium, nano-chromium and nano-zinc supplemented in the diets of livestock improve their performance parameters, healthiness, and the quality of products obtained from them. Studies have shown that micro and macroelements in the form of nanoparticles can be better absorbed by animals thereby improving the quality of products obtained. Nanotechnology has the potential to transform the agriculture and livestock sector because of better bioavailability, small dose rate, and stable interaction of the nanomaterials with other components. Therefore, the use of nanoparticles is a good alternate approach that is safe and cost-effective for the control of pathogenic microbes and production improvement in livestock.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Green synthesis of gold nanoparticles from *Terminalia mollis M.A.* Lawson (Combretaceae)

Usman, A.B[1]., Dozie-Nwachukwu, S.O[1*]., Falayi, M.A[1]., Onodugo, C.D[1]., Onwuazor, O.P[1]., and Odusanya, O.S[1,2]

[1]Medical Biotechnology Department, Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria

[2]Pan African Materials Institute, African University of Science and Technology, Galadimawa, Abuja, Nigeria.

*E-mail: stella_doz@yahoo.com

NANO2022/B034

Keywords
Gold nanoparticles
Terminalia mollis
Aqueous extract
Phytosynthesis
FTIR
UV-Vis spectroscopy
TEM

Abstract

Biosynthesis of gold nanoparticles (AuNPs) using plant extract is considered a simple, low-cost, and eco-friendly approach. This research work was aimed at synthesizing and characterizing AuNPs from *Terminalia mollis* leaf aqueous extract and also to investigate the effect of period of storage of aqueous extract prior to characterization. The synthesis of gold nanoparticles was confirmed by the colour change and further characterized using (UV-Vis) spectroscopy, FTIR, to further characterize the various functional groups in the organic layer that stabilized the particles. The morphology of the AuNPs was visualized using the Transmission Electron Microscope (TEM), while the energy-dispersive X-ray spectroscopy (EDX) confirmed the peaks of gold in the solution. The dynamic light scattering (DLS) showed that the nanoparticles were polydispersed. It was then concluded that *Terminalia mollis* is a potential candidate plant for use as source of green AuNPs for various applications especially medical applications including drug delivery. However, it was revealed that time of storage of extract had some proportional negative effect on AuNPs synthesized.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Optimization of green synthesis of gold nanoparticles from *Combretum glutinosum*

Onwuazor, O.P[1]., Dozie-Nwachukwu, S.O[1*]., Falayi, M.A[1]., Onodugo, C.D[1]., Usman, A.B[1]., and Odusanya, O.S[1,2]

[1]Medical Biotechnology Department, Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria

[2]Pan African Materials Institute, African University of Science and Technology, Galadimawa, Abuja, Nigeria.

*E-mail: stella_doz@yahoo.com

NANO2022/B035

Abstract

This study investigated the effect of varying the ratio of gold chloride to leaf extract required for the synthesis of gold nanoparticles (AuNPs) using *Combretum glutinosum*. Different ratios of 2.5 mM gold chloride to 5% (w/v) aqueous extract of *C. glutinosum* (3:1, 2.5:1, 2:1, 1.5:1 and 1:1) were used to synthesize AuNPs. The preliminary indication for the formation of AuNPs was seen in the colour change of the leaf extract from greenish yellow to ruby-red coloration. A characteristic absorbance peak at 530 nm was recorded by UV-Vis spectroscopy. The biosynthesized AuNPs were further characterized using Fourier transform infrared spectroscopy (FTIR), Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), and Energy Dispersive X-ray (EDX) microanalysis. The finest spherical shaped and most stable AuNPs were observed in ratios 1.5:1 and 1:1, with particle size range of 20-50 nm and 20-70 nm respectively. These ratios can therefore be applied for subsequent production of AuNPs for targeted drug delivery.

Keywords
Gold nanoparticles
Combretum glutinosum
Optimization
Phytosynthesis
FTIR
UV-Vis spectroscopy
TEM

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Phytosynthesis of gold nanoparticles from an ethnomedicinal plant, *Khaya ivorensis* A. Chev. (Meliaceae)

Usman, A.B[1]., Dozie-Nwachukwu, S.O[1*]., Onwuazor, O.P[1]., Onodugo, C.D[1]., Falayi, M.A[1]., and Odusanya, O.S[1,2]

[1]Medical Biotechnology Department, Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria

[2]Pan African Materials Institute, African University of Science and Technology, Galadimawa, Abuja, Nigeria.

*E-mail: stella_doz@yahoo.com

NANO2022/B036

Keywords
Gold nanoparticles
Khaya ivorensis
Phytosynthesis
Leaf extract
Biocompatibility

Abstract

Khaya ivorensis is an evergreen tree that attains a height of 40 - 50 meters. Its medicinal values include the bitter-tasting bark being used to treat cough, fever and anaemia. It can also be applied externally to wounds, ulcers, tumors, and as an anodyne to treat rheumatic pains and lumbago. The root pulp is applied as an enema to treat dysentery. Additional value has been found in the ability to be used to synthesize of gold nanoparticles (AuNPs). Aqueous leaf extract of *Khaya ivorensis* was employed in the cold synthesis of AuNPs and the reaction was instant, evidenced by the colour change of the leaf extracts from green to ruby red. The AuNPs were characterized using the UV-Vis spectroscopy, Transmission electron microscopy (TEM), Fourier Transformed Infra Red (FTIR) and Dynamic Light Scattering (DLS). The results revealed the nanoparticles to be spherical, polydispersed and the sizes within the range of 30 nm - 60 nm. The nanoparticles were then used to study the route of entry of nanoparticles within the cells.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biosynthesis, characterization and biomedical applications of gold nanoparticles from cassava (*Manihot esculenta*) leaf extract

Onodugo, C.D[1]., Dozie-Nwachukwu, S.O[1*]., Onwuazor, O.P[1]., Usman, A.B[1]., Falayi, M.A[1]., and Odusanya, O.S[1,2]

[1]Medical Biotechnology Department, Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria

[2]Pan African Materials Institute, African University of Science and Technology, Galadimawa, Abuja, Nigeria.

*E-mail: stella_doz@yahoo.com

NANO2022/B037

Keywords
Gold nanoparticles
Manihot esculenta
Biosynthesis
Leaf extract
Characterization

Abstract

Biosynthesized gold nanoparticles (AuNPs) are widely used in the field of health as biosensors, in cancer therapy, and as antimicrobial agents, as well as in drug delivery systems. The wide acceptance and various applications of biosynthesized AuNPs are based on their being biocompatible, eco-friendly, low cost and faster method of synthesis. In this study AuNPs were synthesized using cassava (*Manihot esculenta*) leaf extract as a reducing and stabilizing agent. A color change of gold chloride from pale yellow to red indicted the synthesis of AuNPs. The nanoparticles were then characterized by UV-Vis Spectroscopy, TEM, DLS, EDX and FTIR. The optimum plasmon resonance occurred at 530 nm. The sizes of the AuNPs ranged from 10 to 40nm. The FTIR measurements indicated that the AuNPs have coating of phenolic compounds with O-H stretch at the wave number of 3413 cm^{-1}, carbonyls stretch (C=O) at 1759 cm^{-1} and C-N stretch at 1251 cm^{-1}. These biomolecules might be responsible for capping and efficient stabilization of AuNPs. This study indicates that these AuNPs could be effectively used in different biomedical applications.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis of cellulosic nanocrystal encapsulated limonene and its application as an insect pest repellent

Badmus, O.K*., Awujola, A.O., Adegoke, A.K., and Alayande, S.O
[1]Department of Industrial Chemistry, First Technical University, Ibadan, Nigeria

*E-mail: kassim.badmus@tech-u.edu.ng

NANO2022/P038

Keywords
Cellulose nanocrystal
Sweet orange peel
Limonene
Insect repellancy
Controlled release

Abstract

About one-third of the world's grain crop is lost each year during storage due to insect pest infestation. The application of chemical insecticides as pesticides can lead to food toxicity and environmental pollution. Besides, the high treatment cost and pest resistance are the other major setbacks associated with chemical pesticides application. The valorisation of sweet orange peels through the extraction of limonene and its formulation into efficient insect pest repellent will ensure an improved food quality and better waste management. Limonene is an established natural pest repellent with problem of stability, liability and uncontrolled release. A novel strategies and innovative technologies for stable, efficient, targeted and precision delivery can achieved a better insect pest repellent property in the limonene. In the current investigations, Limonene and cellulose nanoparticle were extracted from citrus peel through reflux (ethanol) and acid hydrolysis respectively. The incorporation of the oil into the porous structure of nano-cellulose was done via solutions casting method. The resulting nanoparticles were characterized according to their size, morphology, encapsulation efficiency as well as their thermal stability. The bioassay studies as well as characterization showed the synthesis of an efficient, stable and controlled released limonene, impregnated in mesoporus crystalline cellulose nanoparticle.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Pectin-template derived from *Parkia biglobosa* as a novel route for the synthesis of silver nanoparticles

Ibraheem, S.A[1]., Audu, E.A[2]*., Jaafar, M[1]., Atabat, A.J[2]., Tanimu, B.F[2]., Yahaya, J.Y[2]., and Barminas, J.T[1]

[1]Organic and Natural Products Division, [2]Inorganic and Analytical Division, Scientific and Industrial Research Department, National Research Institute for Chemical Technology (NARICT), Zaria, Nigeria

*E-mail: akuadenaudu@gmail.com; ephraim.audu@narict.gov.ng

NANO2022/P039

Keywords
AgNPs
Parkia biglobosa
Pectin
Surface plasmonic resonance
Antibacterial activity

Abstract

The present study reports a simple and rapid synthesis of silver nanoparticles (AgNPs) via a one-step green approach using pectin obtained from the pulp of *P. biglobosa* as reducing agent. The synthesized nanoparticles were characterized usingTransmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), UV-Visible Spectrophotometer, Fourier Transform Infra-Red (FTIR) and Energy Dispersive X-ray Fluorescence (EDXRF) Spectroscopy. Different factors affecting AgNPs synthesis were studied by varying the volume of pectin solution, concentration of silver nitrate ($AgNO_3$) and pH of the reaction. Optimum conditions for synthesis of AgNPs were found to be at a pH of 12, 10 mM $AgNO_3$ concentration and 3 ml pectin solution. Photoluminescence study showed that AgNPs formation began within 5 min of the reaction time under sunlight. UV-spectra of all samples showed surface plasmonic resonance (SPR) typical of silver nanoparticles between 423 – 438 nm while results from FTIR revealed the presence of functional groups in pectin which could have assisted in the synthesis. Findings from EDXRF confirmed the presence of silver in the synthesized sample. Analysis of SEM and TEM confirmed the formation of well dispersed silver nanoparticles with average particle size within 20 – 30 nm. AgNPs showed antibacterial activities against *Escherichia coli*. The Minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC) were found to be 50 and 100 µg/ml respectively. Results showed that AgNPs synthesized using pectin from *P. biglobosa* exhibits great potentials for applications in biomedicine, catalysis, bioremediation and food preservation.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Mushroom-mediated metallic nanoparticles: potential applications in the production of indigenous fermented foods

Asemota. U.K
Sheda Science and Technology Complex, Abuja, Nigeria

*E-mail: peaceaka2011@yahoo.com

NANO2022/B040

Keywords
Antimicrobials
Food safety
Fermented foods
Mushroom
Metallic nanoparticles

Abstract

This article focuses on the application of mushroom-mediated metallic nanoparticles to improve the organoleptic properties and preservation of indigenous fermented foods. The use of mushrooms such as *Pleurotus florida, Pleurotus ostreatus*, *Pleurotus pulmonarius*, *Pleurotus eryngii*, *Pleurotus tuber-regium, Auricularia polytricha*, *Agaricus bisporus,* and *Lentinus* spp. for the fabrication of metallic nanoparticles has been documented. Excellent *in vitro* antimicrobial activities of mushroom-mediated metallic (Zinc Oxide, Zinc Sulfide, Silver, Gold, Cadmium Sulfide, Titanium Dioxide, Iron, Selenium, and Copper) nanoparticles against food-borne pathogens such as *Salmonella typhimurium, Pseudomonas fluorescens, Corynebacterium diphtheria, Clostridium perfrigens, Staphylococcus aureus, Escherichia coli, Streptococcus faecalis, Bacillus subtilis, Micrococcus luteus, Listeria innocua, Listeria monocytogens, Pseudomonas aeruginosa, Vibrio parahemolysis, Shigella* sp, and *Klebsiella pneumoniae* have been validated by various researchers. In this review, the mechanism of microbial cell death induced by metallic nanoparticles synthesized using mushroom broth is detailed. The role of metallic nanoparticles as nanosensors to detect food pathogens for improved quality assurance and control systems is also summarized. More so, other applications such as the use of edible mushroom-based films and coatings impregnated with metallic nanoparticles as packaging platforms for indigenous fermented foods are highlighted.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Synthesis and application green silver nanoparticles on cotton fabric

Lawal, O.M*., Salisu, Z.M., Barminas, J.T., Umar, S.M., Ukpong, M.K., Suleiman, A.M., Ilyasu, A., Suleiman, I.A., Iroegbu, U., and Oneli, I.C
National Research Institute for Chemical Technology, (NARICT), Zaria, Nigeria

*E-mail: olamilekanlawal17@yahoo.com

NANO2022/P041

Keywords
Green synthesis
Neem
Silver nanoparticles
Coating
Antibacterial activities
Textile industry

Abstract

Multifunctional silver nanoparticles-coated cotton fabrics are gaining attention as a next generation wearable fabric. The current study focuses on preparation of multifunctional cotton fabric through green synthesis approach of silver nanoparticles (AgNPs) using dip and sonication techniques. The AgNPs were produced by reacting silver nitrate with neem leaf extract (as a reducing and capping agent). The synthesized AgNPs were characterized using Ultraviolent-Visible spectrophotometer. The silver nanoparticles coated on the cotton fabric were characterized using FTIR, SEM, XRF and XRD. The antibacterial activities of the silver nanoparticle coated fabric were investigated against *Escherichia coli* and *Staphylococcus aureus*. This study has a potential of providing green and simple method of manufacturing Ag-based antibacterial cotton fabric for application in medical and textile industries.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Development of functional cotton fabric via chemically synthesized silver-nano coating

Ukpong, M.K*., Salisu, Z.M., Barminas, J.T., Umar, S.M., Lawal, O.M., Suleiman, A.M., Ilyasu, A., Sulaiman, I.A., Iroegbu, U., and Oneli, I.C
National Research Institute for Chemical Technology, (NARICT), Zaria, Nigeria

*E-mail: kokomartins@yahoo.com

NANO2022/P042

Keywords
Silver nanoparticles
Cotton fabric
Antibacterial activity
Ultrasonication
UV-Vis spectra

Abstract

High performance cotton fabric is gaining increasing awareness as a wearable fabric due to their attractive physical, chemical and antimicrobial properties. The current study elucidates a facile approach for the development of functional cotton fabric. Silver nanoparticles (AgNPs) were synthesized via chemical reduction method and coated on cotton fabric using dip and sonication technique. UV-visible spectra analysis was used to identify the formation of the silver nanoparticles. The successful deposition, chemical composition and morphology of Ag NPs on cotton fabric were verified using FTIR, SEM, and XRD respectively. The antibacterial activity of the functional Ag-cotton fabric was also investigated. This study may provide a simple strategy to manufacture Ag-based antibacterial cotton fabric for potential applications in medical and textile industry.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biosynthesis, characterization and antibacterial activities of cerium oxide and zinc oxide nanoparticles on fish pathogens - *Vibrio cholerae* RC3 and *Escherichia coli* C214 – a comparative study

Olugbojo, J.A[1,2*]., Akinyemi, A.A[2]., Obasa, S.O[2]., and Dare, E.O[3]
[1]Department of Biological Sciences, Bells University of Technology, Ota, Ogun State, Nigeria
[2]Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria
[3]Department of Chemistry, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

*E-mail: josephgbojo2012@gmail.com

NANO2022/B043

Keywords
Carica papaya leaf extract
Cerium oxide nanoparticles
Zinc oxide nanoparticles
Antibacterial agent
Phytochemicals
Scanning electron microscopy

Abstract

In recent times, plant-mediated synthesis of nanoparticles has gained much attentions due to its eco-friendliness, non-toxic, ease of preparation and biocompatibility compared with physical and chemical approach. Phytochemicals present in plants has been adjudged to be very useful as bio-reductants, stabilizers, and capping agents in the formation of nanoparticles. The aim of this study is to compare the antibacterial activities of biosynthesized Cerium oxide and Zinc oxide nanoparticles (CeO_2NPs and ZnONPs) against bacteria fish pathogens (*Vibrio cholerae* strain RC3 and *Escherichia coli* strain C214). Qualitative analysis of *Carica papaya* leaf extract was performed to examine the type of biomolecules present, then biosynthesis was carried out. CeO_2NP and ZnONP formed were characterized through UV-visible spectrophotometry, scanning electron microscopy, energy dispersive X-ray analysis, X-ray diffraction, and Fourier transformed infrared spectroscopy to confirm the particles formation, morphology, elemental composition, shape, size, and functional group present in the samples. The result revealed monodispersed, spherical shaped CeO_2NPs of average size 46.34 nm, while ZnONP revealed cylindrical shaped nanoparticles with average size of 43.77 nm. Antibacterial sensitivity test also showed that CeO_2NP has a higher antibacterial potential than ZnONPs on *Vibrio cholera* (13.00±1.41 and 10.00±1.41) and *E. coli* strain (8.00±1.41 and 0.00±0.00). In view of this outcome, it is therefore suggested that CeO_2NP could be used effectively against *Vibrio cholerae* strain and *E. coli* than ZnONP with highly significant impact.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis and characterization of maggot-based chitosan–Silver nanocomposites for antimicrobial application in fisheries and aquaculture

Olugbojo, J.A[1,2*]., Akinyemi, A.A[2]., Obasa, S.O[2]., and Dare, E.O[3]

[1]Department of Biological Sciences, Bells University of Technology, Ota, Ogun State, Nigeria
[2]Department of Aquaculture and Fisheries Management, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria
[3]Department of Chemistry, Federal University of Agriculture, Abeokuta, Ogun State, Nigeria

*E-mail: josephgbojo2012@gmail.com

NANO2022/B044

Keywords
Maggot-based chitosan nanocomposites
Fish feed inclusion
Antimicrobial
Packaging material
X-ray diffraction

Abstract

Chitosan is an important carbohydrate oligosaccharide extracted from chitin and has application in aquaculture and fisheries as antimicrobial agent. It can be easily hybridized with silver to form a composite because of its flexibility and easy scale up. The objective of this work is to synthesize maggot-based chitosan-silver nanocomposite which can be used to improve fish packaging materials, pond water treatment, as inclusion in fish feed for both therapeutic and prophylactic treatment and so on. House fly (*Musca domestica*) maggot was cultured using poultry waste. Chitin was extracted with 2M HCl and 1.25M NaOH, for decalcification and deprotonation respectively, and then deacetylate into chitosan with 45-50% NaOH. The polymer composite was synthesized using *ex-situ* and co-mixing of chitosan and phyto-synthesized silver nanoparticles, and then air dried. The nanocomposite was characterized by UV-Visible spectroscopy, FTIR, XRD, and FESEM with EDX. The result revealed Plasmon resonance band of the composite at 420 nm for silver and 240 nm for chitosan respectively with distinct peaks. FTIR analysis depicts the functional group present with strong absorption peak at 2851, 2921, 1544, 1410, 1473, and 1022 cm^{-1}. XRD confirmed the order of formation and crystalline peaks were located at 2θ values of 20.31^0, 26.34^0 and 44.86^0 respectively. The FESEM analysis shows a nose-shaped morphology with average size of 62.45 nm. EDX analysis also revealed the elemental composition of the composite showing chitosan (0.0-0.5 kev) and silver (2.5-3.0 kev) which confirmed the purity of the polymer composites. This result shows that chitosan-silver nanocomposites were truly formed with high percentage purity.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biogenic silver nanoparticles from two species of Malvaceae: Synthesis, antimalarial, antitrypanosomal, antimicrobial efficacies and their potential towards HeLa cell line

Ogunmola, O.O[1,2]*., Larayetan, R[3,4]., Ayeni, G[5,6]., Majolagbe, O.N[7]., and Adedosu, T.A[1]

[1]Department of Pure and Applied Chemistry, Ladoke Akintola University of Technology, Ogbomoso, Oyo State, Nigeria
[2]Department of Chemistry, Emmanuel Alayande College of Education, Oyo, Nigeria
[3]Department of Pure and Industrial Chemistry, Kogi State University, Anyigba, Nigeria
[4]Department of Pure and Applied Chemistry University of Fort Hare, Alice 5700, South Africa
[5]Department of Biochemistry, Kogi State University, Anyigba, Nigeria
[6]Department of Biochemistry, School of Life Sciences, University of KwaZulu-Natal, Westville Campus, Durban, South Africa
[7]Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: olurantiogunmola@gmail.com

NANO2022/B045

Keywords
Gossypium barbadense
Gossypium hirsutum
AgNPs
Cytotoxicity
Antimalarial activity
Antitrypanosomal activity
IC50

Abstract

Gossypium barbadense (GB) and *Gossypium hirsitum* (GH) both belong to the cotton genus and the family Malvaceae; they are natural plants fibre of immense economic importance. To examine antiplasmodial, antitrypanocidal and antimicrobial properties from the biogenic synthesis of silver nanoparticle (AgNPs) obtained from the aqueous leaf extracts of two species (*Gossypium barbadense* GB and *Gossypium hirsitum* GH) of Malvaceae family.
Biogenic silver nanoparticles (AgNPs) were generated by utilizing aqueous extracts of *Gossypium barbadense* (GB) and *Gossypium hirsitum* (GH) plants to reduce silver nitrate ($AgNO_3$). X-ray diffraction (XRD), ultraviolet–visible spectroscopy (UV-Vis), scanning electron microscopy (SEM), energy dispersive X-ray (EDX), transmission electron microscopy (TEM), and the fourier transformed infrared (FTIR) spectrophotometer were used to characterize them. The XRD spectra revealed that the AgNPs were crystalline, whereas the TEM pictures of GB-AgNPs and GH-AgNPs were well disseminated, with no agglomeration and irregular forms of average size of 21 nm. The nanoparticles biosynthesized revealed a cubic, triangular and spherical shaped materials and that the AgNPs were composed of silver, oxygen, and carbon only, according to the SEM and EDX results. The UV-vis analysis indicated that the biogenic AgNPs were detached,

	with absorption bands of 468 and 472 nm, respectively. FTIR revealed absorption bands around 1700 cm^{-1} that were common to both AgNPs, indicating C=O stretching due to the amide bond; additionally, a peak at 420 cm^{-1} was detected for both GB and GH NPs, which is consistent with the absorption band of AgNPs. *In vitro* testing of the biosynthesized GB and GH AgNPs with *Plasmodium falciparum* of the chloroquine sensitive (3D7) strain revealed a very strong antimalarial activity with IC50s of 1.2 and 0.96 µg/mL, poor antitrypanosomal potentials, and a good record of inconsequential cytotoxicity against Human cervical cancer cell line (HeLa), as well as a strong inhibitor against Gram positive and negative bacteria strains. Both AgNPs have significant antiplasmodial and antibacterial properties. As a result, the biogenic AgNPs of GB and GH could be interesting candidates for use in nanomedicines and other areas where similar applications are required.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Effect of nanoparticles on biogas yield of cocoa pod co-digested with chicken manure at mesophilic temperature

Adebayo, A.O*., Olaniran, J.A., and Omoyeni, O.D
Department of Agricultural Engineering, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: aoadebayo57@lautech.edu.ng

NANO2022/P046

Keywords
Anaerobic digestion
Biogas
Cocoa pod
Chicken manure
Nanoparticles
Fe_3O_4

Abstract

Anaerobic digestion (AD) is the biological degradation of organic matter carried out by a microorganism consortium in the absence of free oxygen. The main product of AD is biogas which is a proven alternative to conventional energy sources. However, the slow rate of biodegradation along with the presence of impurities have been reported in biogas. The addition of nanoparticles (NPs) to AD process can influence its performance. This study aimed at determining the effects of NPs on anaerobic co-digestion of chicken manure (CM) and cocoa pod (CP). The chemical and thermal properties of CP, CM and inoculum were determined using standard methods. The experiment was carried out in a laboratory scale batch reactor operated at mesophilic temperature (37± 1°C). Anaerobically digested material from a preceding experiment was used as inoculum. The selected NPs based on literature was Fe_3O_4. The substrates, X (50% CM : 50% CP) and Y (50% CM + 50 % CP + NPs) were fed into the digestion vessesl. The volume of the biogas produced was measured daily. The composition of the gas produced [methane (CH_4) and carbon dioxide (CO_2)] were determined using Seitron, grade (IP-20) gas analyzer. The tests were conducted in two replicates. The organic dry matter (oDM) biogas yields of X and Y were 370.75 and 457.28 NL/kg_{oDM} respectively while the fresh mass biogas yields were found to be 85.71 and 105.72 NL/kg_{FM} respectively. Thus, it can be concluded that the addition of NPs increases biogas yields of CM and CP co-digested at 1:1.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Process optimization of furfural production from algae

Abdulbaqi, A
Department of Chemical Engineering, Ahmadu Bello University, Zaria, Nigeria

*E-mail: packsedit@gmail.com

NANO2022/P047

Keywords
Macroalgae
RSM
Furfural
UV-Vis
FTIR

Abstract

This research studies the optimized furfural production from macroalgae biomass using Response Surface Methodology (RSM). Macroalgae biomass feed was subjected to delignification pretreatment using sodium chlorite and acetic acid. The pretreated feedstock later underwent acid hydrolysis to produce furfural, adopting the Box-Behnken experimental design to establish the relationship between varied process parameters — temperature (50 - 150 ^{o}C), time (30 - 90 min), and acid concentration (5 - 20%) — on the yield of furfural. Results of the delignification process demonstrate a significant reduction of lignin present (46%) in the biomass feed while revealing a 36% increase in the hemicellulose content of the feedstock. The regression analysis of the experimental data shows that the quadratic model best describes the relationship between process parameters and the desired response (Furfural yield), with a predicted R^2 of 0.9562 and adjusted R^2 of 0.9904. Data from the experimental design established the optimum conditions for maximum yield. 18.3% acid concentration 141 ^{o}C and 89.6 min led to a maximum predicted furfural yield of 63%. These conditions, when tested experimentally, were in close agreement with a 64.8% average yield. FTIR and UV spectroscopy was used to confirm the presence of furfural. The carbonyl functional group was detected at 1733 cm^{-1} wavelength, while spikes at 2922 cm^{-1} and 2855 cm^{-1} wavelength indicated the presence of the aldehyde function group. This study confirmed that acid concentration, reaction temperature, and reaction time significantly impact furfural yield and that a delignification pretreatment step helps to increase the holocellulose content needed for furfural production.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

GC-MS analysis and antibacterial activities of silver-mediated nanoparticles using ethanol extract of *Cassia sieberiana* DC

Amodu, S[1]*., Aina, D.A[1]., Ezeamagu, C.O[1]., Oyewole, T.E[1]., Adewunmi, G.A[2]., Animashaun, R.O[2]., and Adaramola, F.B[2]

[1]Department of Microbiology, [2]Department of Basic Sciences, School of Science and Technology, Babcock University, Ilisan Remo, Ogun State, Nigeria

*E-mail: samuelamodu7@gmail.com

NANO2022/B048

Keywords
AgNPs
Antibacterial activities
Cassia sieberiana
Chemical compounds

Abstract

Among various metal nanoparticles, silver nanoparticles (AgNPs) have gained significant attention. Studies have shown that AgNPs ensure effective drug delivery at target site. In this study, green synthesis of AgNPs using ethanol stem bark extract of *Cassia sieberiana* and its antibacterial activities was investigated. Dried stem bark of *C. sieberiana* was purchased from Oke Aje Market, Ijebu- Ode of Ogun State, Nigeria and pulverized. Extract was obtained by maceration in ethanol. Chemical compounds in *C. sieberiana* extract were investigated using Gas Chromatography-Mass Spectrometry (GC-MS). The AgNPs extract was characterized using UV-Visible Spectroscopy (UV-VIS), Fourier Transformed Infrared Spectroscopy (FTIR), X-ray Diffraction (XRD), Scanning Electron Microscopy (SEM) and Transmission Electron Microscopy (TEM). The GC-MS analysis of *C. sieberiana* extract revealed 3 chemical compounds (Benzimidazole, 7-Nonenoic acid and 6-Heptenoic acid). The UV-vis spectrum peaked at 420 nm. The FTIR identified biomolecules responsible for biogenic reduction of AgNPs at 3400 cm^{-1}. The XRD indicated clear and distinct peaks confirming high purity and crystalline nature of phytosynthesized AgNPs. The SEM and TEM showed the AgNPs extract were spherical in shape with average sizes ≥50 nm. The AgNPs extract showed Minimum Inhibitory Concentration ranging between 0.35 and 1.40 µg/ml against *Escherichia coli*, *Morganella morganii*, *Enterobacter hormaechei* and *Shigella flexneri*. The study concluded that *C. sieberiana* AgNPs extract displayed higher antibacterial activities against gastroenteritis-associated bacteria. However, the exploration and development of novel antimicrobials as well as toxicological study of the phytosynthesized AgNPs are recommended for further studies.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biogenic synthesis and antibacterial activities of silver-mediated nanoparticles using pulp extract of *Dacryodes edulis*

Amodu, S[1]*., Aina, D.A[1]., Ezeamagu, C.O[1]., Oyewole, T.E[1]., Adewunmi, G.A[2]., Animashaun, R.O[2]., and Ogunwenmo, K.O[2]

[1]Department of Microbiology, [2]Department of Basic Sciences, School of Science and Technology, Babcock University, Ilisan Remo, Ogun State, Nigeria

*E-mail: samuelamodu7@gmail.com

NANO2022/B049

Keywords
Antibacterial activities
D. edulis
Multi-drug resistance
Nanotechnology
Silver nanoparticles

Abstract

The emergence of biogenic synthesis of silver nanoparticles had radically changed the field of nanotechnology because of its outstanding benefits. In this study, the green synthesis of silver nanoparticles (AgNPs) using pulp extract of *Dacryodes edulis* and its antibacterial activities were investigated against multi-drug resistant bacteria. *Dacryodes edulis* fruits were purchased from Ketu Market in Lagos, Nigeria. The seeds separated from the pulps after drying and the dried pulp pulverized using electric blender. Extract was obtained by maceration in aqueous solution. The green synthesized AgNPs were characterized by UV-Visible Spectrophotometry, Fourier Transformed Infrared Spectroscopy (FTIR) and Scanning Electron Microscopy (SEM). Antibacterial activities of AgNPs extract were evaluated against *Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*. The AgNPs formed were dark brown in colour and showed maximum absorbance at wavelength of 415 nm while the distinct peaks at 3448.84 cm^{-1}. The FTIR spectrum indicated that protein molecules in the extract were responsible for the reduction and stabilization of the synthesized AgNPs. The SEM showed that the AgNPs were spherical shapes with the size ranging from 30-50 nm. The AgNPs particles also showed remarkable antibacterial activities (8 – 30 mm) against *E. coli*, *P. aeruginosa* and *S. aureus*. In conclusion, the results obtained from this study revealed that the green synthesized AgNPs pulp extract of *D. edulis* demonstrated higher antibacterial activities and could be relevant in the development of novel antibacterial agents for medical and pharmaceutical applications.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Electromagnetic pigging using superparamagnetic nanomaterials: a review

Wansah, J.F*., Akpan, J.J., Achimugu, A., Ocheje, J.A., Akeredolu, B.J., and Iyen, C
Department of Pure and Applied Physics, Federal University Wukari, Wukari,Nigeria

*E-mail: fomunyuydzesinyuy@gmail.com

NANO2022/P050

Keywords
Crude oil
Dewaxing
Pigging
Pipeline
Nanomaterials

Abstract

A review of electromagnetic pigging of crude oil pipelines using paramagnetic nanomaterials is the subject of this study. Crude oil, associated gas and other components while being transported in steel coated pipelines get cooler precipitating wet solid materials on pipes restricting flow thereby presenting economic, environmental and human risks. This work looks at descaling, dewaxing and protection of live pipelines *in situ* with electromagnetic pigs using superparamagnetic nanomaterials. In-line intelligent electromagnetic pigs are introduced into the pipeline for dewaxing and descaling followed by injection of superparamagnetic nanomaterials for curing and protecting of the inner pipeline walls. This can increase the durability and strength of the pipes by 3-8 times. Using superparamagnetic nanomaterials in oil and gas industry greatly enhances strength, durability, productivity and protects the environment.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Recovery of oil from drilling waste using nanomaterials: a review

Achimugu, A
Department of Pure and Applied Physics, Federal University Wukari, Wukari,Nigeria

*E-mail: achimuaugustina@gmail.com

NANO2022/P051

Keywords
Crude oil
Nanomaterials
Oil recovery
Mobility improvement
Drilling

Abstract

Nanotechnology has been used in various areas of human endeavour including electronics, biomedical, pharmacy, and oil and gas industries for over the years. Its application in oil and gas industry are of a major importance such as in drilling exploration refining, reservoir sensing, production operation flow assurance and enhanced oil recovery. The oil upstream industry conventional methods of recovering oil from drilling waste are not efficient such as the thermal methods, hydrocarbon gas methods and electromagnetic method. Therefore less expensive, more efficient and environmentally friendly enhanced oil recovery from drilling waste methods are needed. Nanomaterial can serve in that capacity, which is it acts as an agent to extract residual hydrocarbon trapped oil inside the reservoir and enhanced the recovery of oil from drilling waste by penetrating through pore throat. It also has the ability to reduce interfacial tension, control viscosity of aqueous soil which lead to reasonable alteration of the reservoir properties for oil mobility improvement. This review aims at providing insight on the use of nanomaterial in enhancing oil recovery from drilling waste in upstream industries. In addition the impact of nanomaterial on oil mobility ratio and its mechanism of oil recovery from drilling waste which include disjoining pressure, wettability alteration and interfacial tension reduction were extensively discussed and analyzed.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Photoresponsive performance of MoS_2-based photodetector using improved liquid phase exfoliation method

Akeredolu, B.J[1,2,3*]., Ahemen, A[1]., Amah, N[1]., Onojah A.D[1]., Shakya, J[3]., Gayathri, H.N[3]., and Ghosh, A[3,4]

[1]Department of Physics, University of Agriculture, Makurdi, Nigeria
[2]Department of Pure and Applied Physics, Federal University, Wukari, Nigeria
[3]Department of Physics, Indian Institute of Science, Bangalore 560012, India
[4]Centre for Nano Science and Engineering, Indian Institute of Science, Bangalore 560012, India

*E-mail: akeredolu@fuwukari.edu.ng

NANO2022/P052

Keywords
MoS_2
Photodectors
Liquid phase exfoliation
Photoresponsivity
Optoelectronics

Abstract

The phoresponsivity of MoS_2-based photodetectors can be achieved with highly dispersive molybdenum disulfide (MoS_2 NSs) in liquid-phase exfoliation. Here, in this work, we demonstrate an approach to improving the existing liquid phase exfoliation method to prepare highly dispersed nanosheets of MoS_2 in IPA/water solvent, for optoelectronics use. The nanosheets were characterized using various characterization techniques including scanning electron microscopy (SEM), transmission electron microscopy(TEM), atomic force microscopy (AFM) and Raman spectroscopy, x-ray diffractometer (XRD), and UV-Vis spectroscopy. Meanwhile, the nanosheet results obtained have an average lateral size of 350-500 nm, a thickness not less than 5 nm, and high crystallinity in the 2H semiconducting phase. We further demonstrate a MoS_2 photodetector that has the advantage of utilizing the whole area as a junction for the effective separation of electron-hole pairs. The photoresponse performances of the MoS_2 photodetector-based MoS_2 were investigated. When the bias voltage was 4 V, the photocurrent, photoresponsitivity, specific detectivity, and external quantum efficiency of MoS_2 photodetector are 0.55 μA, 6.11 mA/W, 3.4 ×10^9 Jones, and the rise and fall times of the MoS_2 photodetector were 1.0 s and 1.22 s. The results provide an excellent method for the fabrication of inexpensive improved optoelectronic performance.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Distribution Rare Earth Elements in sediment cores from Lagos Lagoon, Nigeria

Shelle, R.O.D[1,2]., and Oyatola, O.O[1]*
[1]Nigerian Institute for Oceanography and Marine Research, Lagos, Nigeria
[2]Federal University of Agriculture, Abeokuta, Nigeria

*E-mail: oyatolaoo@niomr.gov.ng

NANO2022/P053

Keywords
Lagos lagoon
Rare earth elements
Core sediment
Contamination factor
Enrichment factor

Abstract

Sediments are ecologically important components of the aquatic habitat and are also a reservoir of contaminants, which play a significant role in maintaining the trophic status of any water body. This study was carried out to assess the concentration of rare earth elements (REEs: La, Y, Ce, Pr, Nd, Sm, Eu, Gd, Dy and Ho) that are present in Lagos Lagoon. Sediment core samples (40 to 50 cm long) were collected, sliced at 10 cm each, dried and analyzed by Inductively Couple Plasma Mass Spectrometry (ICPMS). The concentrations of the REEs were below the baseline values (Upper Continental Crust) in all the stations except station 3. The calculated contamination factor (CF) and enrichment factor (EF) ranged from low to moderate contamination and no enrichment to moderate enrichment respectively. Pollution load index shows that the entire sample stations were not polluted.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis, characterization and antifungal efficacy of copper-chitosan nanoparticles

Atanda, S.A[1]., Shaibu, O.R[2]., and Agunbiade, F.O[2]
[1]Nigerian Stored Products Research Institute, Ilorin, Nigeria
[2]Department of chemistry, University of Lagos, Yaba, Lagos, Nigeria

*E-mail: the19icon@gmail.com

NANO2022/B054

Keywords
Chitosan
Copper nanoparticles
Antifungal activity
Charcaterization

Abstract

The need for new class of antifungal agents has been on the increase due to resistance by fungi to antimicrobial agents. Chitosan-mediated copper nanoparticles was prepared in a facile step, characterized using Fourier transform infra-red spectrophotometry (FTIR), scanning electron microscopy (SEM) and energy dispersive X-ray florescence (EDXRF) and its antifungal property evaluated against *Aspergillus flavus, Aspergillus niger* and *Candida albicans*. FTIR spectroscopy showed prominent peaks at 3476, 1651, 1781 and 470 cm^{-1} which are typical bands of hydroxyl, amide, carbonyl functional groups and copper ligand respectively. EDXRF showed copper as the most intense peak, while SEM images revealed copper chitosan nanoparticles with monoclonal shape with diameter ranging between 7.56-36.24 nm. Mean inhibition at a concentration of 40 mg/ml against *Aspergillus flavus, Aspergillus niger* and *Candida albicans* was 30.50 mm, 50.67 mm, and 46.70 mm respectively. Copper chitosan exhibited remarkable antifungal action on the tested organisms accentuated by the capping effect of chitosan.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biosynthesis of silver nanoparticles using bacterial feather hydrolysates for the enhancement of growth and nutraceutical properties of leafy vegetables

Adelere, I.A[1,2]., and Lateef A[2]

[1]Department of Microbiology, Federal University of Technology, Minna, Nigeria

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

*E-mail: isiaka.ade@futminna.edu.ng

NANO2022/B055

Keywords
Feather hydrolysate
AgNPs
Vegetables
Phytostimulatory effect
Phytopathogens
Lipid peroxidate

Abstract

This study reports the biosynthesis of silver nanoparticles (AgNPs) using feather hydrolysates (FH) obtained after chicken feather degradation by keratinolytic *Bacillus safensis* LAU 13 and *Aquamicrobium defluvii* FH 20. Phytostimulatory effect of the biogenic AgNPs on *Corchorus olitorius*, *Amaranthus caudatus* and *Celosea argentea* cultivated in soil treated with 50-150 µg/ml AgNPs was investigated compared to NPK fertilizer (15-15-15) and water as positive and negative controls, respectively. Vegetables grown with AgNPs (150 µg/ml) of each of the two isolates demonstrated 1-1.58 folds improvement in seed germination, shoot height, root length, leaf sizes, chlorophyll contents and other growth parameters compared to their controls. Hydrogen peroxide and DPPH radicals scavenging activities of the AgNPs-fertilized vegetables were over 1.1-folds better than their respective controls. AgNPs treatment enriched the total phenolic, flavonoids, and proanthocyanidin compounds in the vegetables by more than 1.05-folds. The particles positively influenced the catalase activity of the vegetables and also induce lipid peroxidate (LPO) inhibition against ferrous ion (Fe^{2+}) damage in the precision-cut liver slices by 1.05-1.21-folds improvement over the untreated plants. The AgNPs demonstrated inhibitory activity (60.33 – 88.20%) against phytopathogenic fungal strains of *Aspergillus niger*, *Aspergillus flavus* and *Fusarium solani*. Application of the biogenic AgNPs performed considerably better than the NPK fertilizer virtually in most cases. Thus, results obtained in this study indicate that the FH-mediated AgNPs have potential application as a better substitute to conventional inorganic fertilizer to promote sustainable agricultural food production in an eco-friendly manner.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

The availability of critical minerals for Nigeria's renewable energy and economic development: an assessment of the role of nanotechnology

Aliu, H.O
Department of Petroleun Engineering, University of Ibadan, Ibadan, Nigeria

*E-mail: aliuhusseino@gmail.com

NANO2022/P056

Keywords
Nanotechnology
Minerals
Renewable energy
National development
National wealth

Abstract

Mineral assets form a major source of national wealth and can provide a country with opportunity for economic development. Nigeria is rich in minerals identified as critical to energy transition and can leverage nanotechnology to optimize these mineral resources for developing her renewable energy, thereby improving her economy. This review aims to present the available minerals in Nigeria for clean energy production. It will also introduce significant applications of nanotechnology in the utilization of the minerals for renewable energy development. The papers reviewed are summarized carefully to give an overview of the role of nanotechnology and the potential of the minerals in improving the various sources of renewable energies. We hope that this paper will serve as a motivation to the government, researchers and investors to promote nanotechnology as a tool for the optimization of the minerals, development of Renewable energy and improvement of the economy.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Microstructural and nanomechanical properties of AlCoCuFeSi high entropy alloys for renewable energy applications

Dada, M[1,2]*., and Popoola, P[2]
[1]Department of Metallurgical and Materials Engineering, University of Lagos, Akoka, Nigeria
[2]Department of Chemical, Metallurgical and Materials Engineering, Tshwane University of Technology, Pretoria, South Africa

*E-mail: dadadupeola@gmail.com

NANO2022/P057

Keywords
Nanomechanical properties
High entropy alloys
Laser additive manufacturing

Abstract

The mechanical properties of high entropy alloys fabricated via additive manufacturing have been widely studied in the literature. However, the investigation into the influence of heat treatment on the nanomechanical performance and deformation behaviour of additively manufactured high entropy alloys remains limited. In this study, the elastic modulus, hardness and creep at room temperature of AlCoCuFeSi high entropy alloys via additive manufacturing nanoscale were explored using a Nano indenter before and after heat treatment as metal hydrides for energy storage applications. The heat-treated high entropy alloys showed a 10% improvement in hardness and 23% increment in elastic modulus compared with the as-built high entropy alloys at 200 mN applied load attributed to the significant grain refinement. However, a slight reduction in the creep resistance was observed.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Efficiency of carbon nanotubes from environmental waste as cement admixture

Gado, N*., Yahaya, I.M., and Izuagie, T
Department of Pure and Industrial Chemistry, Sokoto State University, Sokoto, Nigeria

*E-mail: ymansur64@gmail.com

NANO2022/P058

Abstract

Keywords
CNTs
Coconut shell
Potato peel
Cement composites
Compressive stregth
Flextural strength

Nanomaterials can change and modify the properties and functions of cement-based materials. The traditional cement materials have weak sustainability characteristics that are insufficient to develop high quality performance structures. Besides that, modifications of compressive and tensile strength and durability durations of cement composites are required. Adding CNTs into cement composites enhance and increase the compressive strength as well as the flexural strength comparing to the normal compressive and flexural strength that are obtained from plain cement composites. In this research work, carbon nanotubes were green synthesized from environmental waste specifically coconut shell, and potato peels and their efficiency as cement admixtures investigated. An increase in UV-Vis absorbance in the region 210 to 250 nm with time indicated the synthesis of CNTs. The FTIR spectrum peak of CNTs in the 800−1800 cm^{-1} range indicated dependent of CNTs on chirality. The SEM morphology of CNTs displayed uniform and well-aligned materials. There was an increase in the setting time when the mixture of cement and CNTs was increased above 3.5 wt%. The CNTs-cement mixture shows an increase in compressive strength after 24 h. The results have indicated that the green synthesised CNTs have good prospective as cement admixture.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Evaluation of chemical and antimicrobial activities of silver nanoparticles synthesised from *Calotropis procera* leaf extract

Sulaiman, H*., Yahaya, I.M., and Izuagie, T
Department of Pure and Industrial Chemistry, Sokoto State University, Sokoto, Nigeria

*E-mail: ymansur64@gmail.com

NANO2022/P059

Keywords
AgNPs
Calotropis procera
Green synthesis
Antimicrobial activities

Abstract

Plant extract-based green synthesis of nanoparticles has become a famous approach in the field of nanoscience. In this research, silver nanoparticles (AgNPs) were prepared by an efficient and accomplished approach using *Calotropis procera* (CP) leaf extract as a bio-reducing and stabilizing agent. The considerable colour transformation in the reaction mixture from light green to dark brown is an indication of the formation of CP-AgNPs. The as-synthesized silver nanoparticles were chemically characterized by UV–Vis and FTIR. The UV–Vis spectrum obtained display the absorption in the visible range from 200 to 1000 nm, with a sharp peak appearing at 430 nm which confirms the formation of CP-AgNPs; additional absorption peaks at 280 nm is also observed, which belongs to the phytomolecules from *Calotropis procera* extract remaining on the surface of CP-AgNPs as capping agents. FTIR analysis confirms that the plant extract plays a dual role as a bio-reducing and capping agent. The tested CP-AgNPs displayed almost similar antimicrobial activities with that of standard antimicrobial drugs, such as streptomycin and nystatin. Their improved antimicrobial activity can be ascribed to the quality of resultant nanoparticles including, uniform size, shape, and aqueous colloidal stability of nanoparticles. Furthermore, it is concluded that the synthesis of silver nanoparticles using *Calotropis procera* extract is an inexpensive, easy and eco-friendly approach that eliminates the application of toxic reagents which may cause environmental damage.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Green synthesized carbon nanotubes as adsorbent of environmental toxic metals

Isah, A*., Yahaya, I.M., and Izuagie, T
Department of Pure and Industrial Chemistry, Sokoto State University, Sokoto, Nigeria

*E-mail: ymansur64@gmail.com

NANO2022/P060

Keywords
CNTs
Water treatment
Metal absorption
Banana peel
Orange peel

Abstract

Many methods have been reported to remove heavy metal ions from wastewater, such as chemical precipitation, coagulation, ion exchange, membrane filtration, and electrochemical treatment, just to mention a few. These methods have been used in many industries with good effects, but all of them have their own shortcomings. Carbon nanotubes (CNTs) have attracted great attention in the wastewater purification of heavy metal ions due to their large specific surface area, small size, hollow and layered structure. In this study, the potential of carbon nanotubes produced from vegetables waste as adsorbents of toxic metals were investigated by applying a one-step water assisted method that uses the calcining products of orange and potato peels as raw materials to produce a sustainable and environmentally friendly carbon nanotubes adsorbent for environmental toxic metals. From our previous work chemical (UV-Vis and FTIR) and morphological characterisation of the green nanomaterials produced have proved them to have CNTs properties. In comparison between the two samples, the potato peels absorb more of Cu (0.12), Fe (0.40), Pb (0.14) and Ca (636.1) while orange peels absorb more of Mg (59.7) and Zn (0.06) as such banana peels have more absorbing capacity than the orange peel. However, for 3 h and 5 h, the two samples were in equal absorption in which the banana peel absorbs more of Cu, Fe, and Ca while orange peel absorbs more of Mg, Zn and Pb. The results of both of banana and orange peels revealed that the higher the retention time, the more the absorption of the toxic metals by the CNTs.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Effect of TiB_2 addition on the microstructure evolution of FeCrV15+TiB_2 deposit fabricated via laser cladding technique

Jamiru, T[1]*., Popoola A.P.I[2]., Sadiku E.R[2]., and Aramide B.P[1]
[1]Department of Mechanical and Mechatronics Engineering, Tshwane University of Technology, Pretoria, South Africa
[2]Institute of Nano Engineering Research and Department of Chemical, Metallurgy and Materials Engineering, Tshwane University of Technology, Pretoria, South Africa

*E-mail: jamirut@tut.ac.za

NANO2022/P061

Keywords
Laser cladding
FeCrV15+TiB_2
Coatings
Surface modification

Abstract

To attain the needed performance, a growing trend in additive manufacturing of iron-based alloy is to modify the microstructure by changing fabrication parameters or adding alloying components. In this study, a FeCrV15 alloy with variable amounts of TiB_2 was effectively produced using a laser cladding technique. Optical microscopy, scanning electron microscopy (SEM), X-ray diffraction (XRD), Vickers micro-hardness, and pin-on-disk tribometer were used to investigate the effect of TiB_2 on microstructure, hardness, and wear performance. There was a high sporadic reaction as TiB_2 powder was introduced; this resulted in cracks, pores, and defects in the microstructure of the deposit's heterogeneous structure. As a result, its hardness, corrosion and wear performance are reduced. However, when compared to FeCrV15+TiB_2, the FeCrV15 deposits demonstrated an enhanced and superior anti-wear and anti-corrosion potential as this study revealed.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Experimental study of the electrical conductivity and thermal conductivity property of micro-based Al-Cu-Nb-Mo alloy

Uwa, C.A[1*]., Jamiru, T[1]., and Sadiku, E.R[2]

[1]Department of Mechanical and Mechatronics Engineering, Tshwane University of Technology, Pretoria, South Africa

[2]Institute of Nano Engineering Research and Department of Chemical, Metallurgy and Materials Engineering, Tshwane University of Technology, Pretoria, South Africa

*E-mail: nonso_uwa@yahoo.com

NANO2022/P062

Keywords
Al-Cu-Nb-Mo
Alloy
Electrical conductivity
Thermal conductivity
Sintering

Abstract

Al based alloys of a given compositional mix and manufacturing process have been found to be very good conductors of electricity. In the present study, Al, Cu, Nb, and Mo metal powders were weighed according to certain proportions and evenly distributed by mixing of the powder particles. The mixing of metal powders were carried using a tubular mixer for 12 h. The thermal conductivity of the mixed metal powders were measured with a Thermtest portable instrument. They were then poured into a graphite mold of 30 mm die diameter, pre-pressed, and put into a spark plasma sintering (SPS) furnace. The process parameters were varied as follows: axial pressure of 50 MPa was applied at a heating rate of 50 ^{o}C, and the sintering temperature range of 300-480 °C in a multi-stage heating method with a holding time of 10 min. The specimens were cooled to room temperature and unmolded to obtain aluminum-copper-niobium-molybdenum alloy. The electrical conductivity of the sintered alloy samples was obtained with HPS 2662 Precision Four-point Probe Meter. It was observed that the alloy with Al 93.5Cu4Nb1.5Mo1 composition with the density of 3.23 g/cm^3 gave the best property for electrical conductivity and thermal conductivity.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Green synthesis, characterization, antimicrobial activity and *in vivo* cytotoxicity test of silver nanoparticles for biomedical applications

Raimi, O.R[1]., Lateef, A[2]., Raimi, M.A[1]., Azeez, Z.M[1]., Afolabi, F[1]., and Afolabi, O[1]
[1]Department of Science Laboratory Technology, Osun State Polytechnic, Iree, Nigeria
[2]Laboratory of Industrial Microbiology and Nanobiotechnology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: allahuli2009@gmail.com

NANO2022/B063

Keywords
Green synthesis
Silver nanoparticles
Nauclea latifolia
Characterization
Antimicrobial activity
In-vivo-cytotoxicity

Abstract

Biogenic nanoparticles are two of the most clever weapons to fight the multidrug resistant "superbugs" due to their excellent biocompatibility and broad-spectrum antibacterial propensity. Silver nanoparticles (AgNPs) was synthesized using aqueous extract of *Nauclea latifolia* leaf. Electron microscope images confirmed the synthesis of almost spherical shaped silver nanoparticles with size range from 10-39 nm. The antibacterial activity was investigated against clinical isolates of twenty two strains of *Staphylococcus aureus,* fourteen strains of *Escherichia coli* and two strains of *Candida* species (*C. albicans* and *C. brusei*) through disk diffusion assay. The highest zone of inhibition for *S. aureus, E. coli* and *Candida* species were 16 mm at 120 µg/ml, 13 mm at 100 µg/ml and 16 mm at 120 µg/ml, respectively. No significant toxicity was observed when the levels of rat serum ALT, AST, GGT (liver function biomarkers) and creatine (kidney function biomarker) were determined. However urea result suggests damage to the kidney.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Influence of valerate complexation and bromelain encapsulation on morphological characteristics of polyhydroxybutyrate micronized particles

Nasir-Naeem, K.O[1*]., and Shittu, O.K[2]
[1]Biotechnology Advanced Research Centre, Sheda Science and Technology Complex, Abuja, Nigeria
[2]Department of Biochemistry, Federal University of Technology, Minna, Nigeria

*E-mail: khadeejahnasirnaeem@gmail.com

NANO2022/B064

Keywords
Poly(3-hydroxybutyrate)
Bromelain
Polyhydroxyalkanoate
encapsulant
Drug formulation

Abstract

Synthetic and natural polymers have been a significant part of the drug formulation system that is essential for weight consistency, stability, and release of therapeutics. Polyhydroxyalkanoates (PHA) are polyesters produced by microorganisms from renewable resources. Poly(3-hydroxybutyrate) (PHB), and its copolymer Poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) possess remarkable applications in drug delivery and formulation because of excellent biocompatibility and degradability. This study reports production of PHA nanoparticles loaded with bromelain and evaluated the influence of valerate complexation and bromelain encapsulation on the properties of PHB particles. PHB and PHBV particles with and without bromelain were prepared by triple emulsion solvent evaporation., and scanning electron microscopy (SEM) was used to examine the the physical and morphological characteristics of the PHB particles. Micrographs obtained showed spherical PHBV blank and bromelain-PHA particles with different surface appearances and sizes ranging from 25 - 50 µm. The average particle sizes of the PHB and PHBV microparticles loaded with bromelain were 20.02 ± 13.61 µm and 46.58 ± 11.13 µm respectively. The PHB microparticles presented a smoother surface with a few surface pores, while the bromelain-PHBV microparticles were rough with numerous surface pores. The variation observed in the microparticle surface textures and sizes could result from the influence of complexation of PHB with valerate as well as the interaction of the bromelain. These physical and morphological analyses can help shed light on the mechanism of release of the encapsulant in the PHA microparticulate drug delivery system.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Optimization of crosslinked starch/graphene oxide nanocomposite films for fruits and vegetable packaging

Kalu, A.O [1,2*]., Egwim, E.C[1,3]., Jigam, A.A[1]., and Muhammed, H.L[1]

[1]Department of Biochemistry, Federal University of Technology Minna, Nigeria

[2]Department of Environmental Biotechnology and Bio-conservation, National Biotechnology Development Agency (NABDA), Abuja, Nigeria

[3]Centre for Genetic Engineering and Biotechnology (CGEB), Department of Biochemistry, Federal University of Technology, Minna, Nigeria

*E-mail: fredykalu@gmail.com

NANO2022/B065

Keywords
Starch
Graphene oxide
Nanocomposite
Optimization
Packaging film

Abstract

The aim of this study was to develop starch-graphene oxide nanocomposite films for packaging applications with optimization carried out to determine the best combination of crosslinked starch, glycerol and graphene oxide for the mechanical, barrier, antimicrobial properties as well as film solubility. Cassava starch was crosslinked with oxidized sucrose while graphene oxide was synthesized using hummers method. Nanocomposite films were developed using design expert software and a Box-Behnken design at three levels of each independent variable at five centre point replicate was employed. The range of values were obtained by preliminary studies and the effect of the independent variable on response factors were studied which included tensile strength, young modulus, elasticity, water vapour transmission rate, oxygen transmission rate, solubility and antimicrobial activity against *S. aureus, E. coli* and *Aspergillus* sp. The average particle size of graphene oxide was 65.2 nm and the particle size distribution had a poly-dispersity index (PDI) of 0.174. The model equations for each response factor were developed of which as a two factor interaction and quadratic model was suggested. The optimal formulation for each nanocomposite film was 4.74 g crosslinked starch/2.63% graphene oxide/36.83% glycerol and the RAMPs plot showed that the model had a desirability of 0.731. In conclusion, optimisation of starch-graphene oxide films showed different effects of the independent variables on the mechanical, barrier, and solubility properties. The low difference between the predicted values and experimental values of indicates that the nanocomposite film was suitable for packaging application.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Fabrication of a facile β-cyclodextrin based nano-composite towards 2,4-dinitrophenol removal

Mamman, S*., Shuaibu, B.S., Isah, J., Mohammed, J., and Osuegba, O.S
Department of Chemistry, Nasarawa State University, Keffi, Nigeria

*E-mail: mammansuwaibatu@nsuk.edu.ng

NANO2022/P066

Keywords
Adsorption
Nano-composite
Dinitrophenol
Fabrication

Abstract

In this study, a facile β-cyclodextrin based magnetic adsorbent towards 2,4-dinitrophenol (2,4-DNP) removal was fabricated and explored. The material was characterized by Fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM), transmission electron microscopy (TEM), and X-ray diffraction (XRD). Various operational parameters such as effect of pH, contact time, sorbent dosage, initial concentration and temperature were optimized and evaluated via a batch adsorption experiment. The adsorption kinetic data revealed that the uptake of this compound follows pseudo second order model. Freundlich and Halsey isotherms best fitted the adsorption equilibrium data. The adsorption process was exothermic and spontaneous and a lower temperature favoured the adsorption process. Furthermore, hydrogen bonding, inclusion complex formation and π–π interactions were the main types of interactions involved.The synthesized material was green, easy to prepare and can be efficiently used in large scale without raising environmental concern.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Mycelia and lipase inhibitory properties of *Cassia fistula*-mediated gold nanoparticles

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

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

*E-mail: vaajayi@lautech.edu.ng

NANO2022/B067

Keywords
AuNPs
Biosynthesis
Cassia fistula
Antifungal activity
Lipase inhibition

Abstract

Over the last few decades, gold nanoparticles (AuNPs) have been reported for their tremendous impact on the health and food sector. The biologically synthesized AuNPs have attracted increased attention because they are environmental friendly and permits the usage of a very small amount of chemicals accompanied with limited toxic byproduct. In this study, the crude aqueous leaf extract of *Cassia fistula* (LCf) mediated synthesis of AuNPs and characterization via UV-visible absorption spectrum analysis, Fourier transmission infrared (FTIR) analysis, scanning electron microscopy (SEM) and energy dispersive X-ray (EDX) analysis was carried. The green-mediated LCf-AuNPs were evaluated for their mycelia and pancreatic lipase inhibitory properties. The colour change from colourless to dark brown and UV-visible absorption at 580 nm confirmed the synthesis of gold nanoparticles (LCf-AuNPs). The SEM micrograph displayed particles with both spherical and irregular shapes, while the EDX spectra revealed gold as the most prominent metal. Also, the FTIR spectroscopic analysis showed peaks that correspond to the OH compound of phenols or alcohol, -NH_2, N-H amines of protein, and C=O, C-O of carbonyl groups. Significant mycelia inhibitory effect of LCf-AuNPs was observed against the growth of *Aspergillus niger* (64.29%), *A. flavus* (50.70%), *A. fumigatus* (47.73%), and *Fusarium solani* (47.65%). Similarly, the LCf-AuNPs exhibited pancreatic inhibitory activity comparable with the orlistat standard ranging from 17.62±0.58 to 88.93±0.81% with an IC_{50} value of 121.3 µg/ml. The outcome of the research studies revealed the potential of green-mediated LCf-AuNPs for suitable application as anti-fungal and anti-obesity agents in pharmaceutical industries.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Eco-friendly synthesis of silver nanoparticles using stem bark of *Jatropha tanjorensis* and evaluation of anti-trypanosomal activity

Abedo, A.J*., and Abutu, S.R
Nigerian Institute for Trypanosomiasis Research (NITR), No. 1, Surami Road, Kaduna, Nigeria

*E-mail: onyinoyi1999@gmail.com

NANO2022/B068

Keywords
Jatropha tanjorensis
Green synthesis
Silver nanoparticles
Anti- trypanosomal activity

Abstract

African trypanosomiasis is a parasitic protozoan disease which affects man and his domesticated animals, if not treated it can be very fatal. In the last two decades, nanoparticle research has become one of the most important areas in modern materials science research. More recently green synthesis of silver nanoparticles (SNPs) is gaining recognition and is widely used in the field of medicine due to their unique chemical and physical properties. This paper reports the phytochemical, synthesis of Silver Nanoparticles (AgNPs) using aqueous stem extract of *Jatropha tanjorensis* and investigating their anti trypanosomal potentials. The phytochemical screening of this plant extract revealed the presence of some secondary metabolites such as flavonoids, tannins and saponins among others which act as both reducing and capping agents. Stable and spherical shape controlled Ag NPs were formed within 5-10 min after slow heating on water bath at 50 ^{o}C. The synthesized silver nanoparticles were characterized using UV-visible spectroscopy, Scanning Electron Microscopy (SEM), X-ray Diffractormeter (XRD) and Fourier Transform Infrared Spectroscopy (FTIR). The UV-Visible spectrum of colloidal solutions had absorbance peaks at 526.6- 620.4 nm. The formed silver nanoparticles were found to be spherical in shape with average size in the range of 30-120 nm. Furthermore, synthesized nanoparticles were also tested for anti-parasitic activity on *Trypanosoma brucei brucei in vitro* which showed good activity with MIC value of 0.25 mg/ml.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Production of graphene using local contents

Elemo, E*., Adegbe, A., and Obarolo, A
Department of physical and life Sciences, National Space Research and Development Agency, Abuja

*E-mail: enochelemo@gmail.com

NANO2022/P069

Keywords
Graphene
Exfoliation
Energy storage
Batteries

Abstract

Graphene is a new material that has been making waves and attracting a lot of attention in the last decade and is being researched on because of its superlative properties, and its various interesting and innovating uses. The production of graphene using a top-down graphene exfoliation method from graphite, such as liquid-phase exfoliation was adopted in this work, which is efficient due to its low cost and high scalability potential. Due to the energy storage problem facing the world in terms of functionality of fundamental materials, we ventured into the enhancement and fabrication of fast charging, high capacity and efficient batteries using graphene. Power bank of 26000 mAh and 40000 mAh capacity were fabricated from the scratch using graphene as its primary component. A car battery, inverter battery and a 12 volt rechargeable fan battery were also enhanced with the graphene after the initial lithium ion in the battery were removed from the battery, and the results showed great outcome with each of the batteries sufficiently powered the car, the house and the fan, respectively. The results however showed that there is the need to produce cells ourselves that are compactable with the grapheme produced.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Biofabricated Ti-AgNPs in functionalized nanotextiles inhibited MDR bacterial strains and fungi

Aguda, O.N*., and Lateef, A
Laboratory of Industrial Microbiology and Nanobiotechnology, Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: opeaguda@gmail.com

NANO2022/B070

Keywords
AuNPs
Biosynthesis
Cassia fistula
Antifungal activity
Lipase inhibition

Abstract

Humankind from time immemorial has used textiles for diverse purposes that include manufacturing of consumer personal products, industrial, sports, security and military outfits, as well as medical utilities among others. Being made of biomaterials, fabrics are naturally susceptible to microbial attack that can promote their deterioration, thereby loosing value and functionalities. Microbes produce wide range of enzymes to degrade cellulose, hemicellulose, keratin as well as additives such as vanishes, dyes, adhesives and fillers in fabrics. Microbial deterioration of fabrics results in bad odours, loss of strength, discolouration and dissemination of pathogens that can cause diseases. Thus, there is need to infuse textiles with antimicrobial agents to offer biocidal properties. In this work, Ti-AgNPs (11.40-28.93 nm) that were fabricated by the wastewater of fermented seeds of *Parkia biglobosa* were used to functionalize silk and cotton with the aid of acrylic binder, and tested against MDR strains of *Klebsiella oxytoca, Pseudomonas aeruginosa, Staphylococcus aureus, Proteus mirabilis, Klebsiella pneumoniae,* and *Escherichia coli*. The antimicrobial potency of the fabrics functionalized with nanoparticles was remarkable with antibacterial activities of 15-24 mm against MDR strains and complete suppression of the growth of *Aspergillus niger* even after 5th cycle of washing. The nanotextiles obtained in this study can find useful specialized applications in the healthcare in producing aprons, beddings, wound-dressing fabrics and facemasks to prevent dissemination of pathogens, stem the scourge of drug resistance and hospital-acquired nosocomial infections. This will engender good health and well-being towards the attainment of SDG 3 of the United Nations.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Exploration of vertebrate animal wastes for the green synthesis of nanoparticles: A review

Abodunrin, A.E[1]., Yekeen, T.A[1*]., Azeez, M.A[1]., Lateef, A[1]., Badmus, J.A[2]., and Adebayo, E.A[1]

[1]Department of Pure and Applied Biology, [2]Department of Biochemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: tayekeen@lautech.edu.ng

NANO2022/B071

Keywords
Nanotechnology
Vertebrate
Animal waste
Eco-friendly
Biomolecules

Abstract

Nanotechnology is an emerging science reputed to have potential to solve various problems challenging existence of mankind. The series of benefit of nanotechnology are linked to various field of human endeavour that includes but not limited to medicine, engineering and sciences. Different techniques such as biological, chemical and physical are employed for the synthesis of nanoparticles. Biological method otherwise known as green synthesis is believed to be the safest due to its simplicity, involvement of no/reduce chemicals and biodegradability. The commonly used materials for the green synthesis are microorganisms and plant materials. These materials possess biomolecules as reducing and capping agents for nanoparticle production. The abundant presence of these biomolecules is reported in vertebrate animal waste materials. The waste generated by vertebrate animals are sources of concern because of poor waste management, as it litters and causes nuisance to the environment. The biomolecules in the wastes of vertebrate animals make them potential agents for nanoparticles synthesis but they are rarely utilized. Human hair, chicken feathers, cow urine, sheep urine, animal fur, and egg shell are few examples of wastes with beneficial biomolecules. Employing these waste materials for the green production of nanoparticles will provide value addition to the waste and thereby reduce environmental burden. Moreover, the use of vertebrate waste materials will assist in turning waste to wealth and breaking new ground. In our laboratory, the potential of human hair, animal fur, egg shell and chicken feather had been explored to synthesize nanoparticles for various applications. This review thus focused on the use of waste materials from vertebrate animals for green synthesis of nanoparticles and various budding applications.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Synthesis, characterization and application of a composite adsorbent in remediation of bitumen-polluted water

Ayelabola, J.A., Abiola,, B.E*., Olabemiwo, O.M and Esan, A.O
Department of Pure and Applied Chemistry, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: babawale2008@gmail.com

NANO2022/P072

Keywords
Nanotechnology
Nanocomposite
Bitumen water
Remediation
ZnNPs
Helix pomatia
Echinochloa pyramidalis

Abstract

Nanotechnology is one of the most advanced methods proven to be an effective method of polluted water remediation as a result of their high surface capacity. This study reports the remediation of bitumen-polluted water (BPW) using a composite adsorbent prepared from synthesized zinc nanoparticles and activated carbon of *Helix pomatia* (HP). The leaf extract of *Echinochloa pyramidalis* (antelope grass) was used to synthesize zinc nanoparticles (ZnNPs). The synthesized ZnNPs was characterized using Ultraviolet-Visible Spectroscopy, Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray Spectroscopy (EDX) and Fourier Transform Infrared (FTIR). The synthesized ZnNPs was impregnated on activated carbon of *Helix pomatia* to produce a composite adsorbent. The prepared composite adsorbent was applied to remediate BPW collected from Agbabu River, in Ondo State, Nigeria using the column adsorption technique. The UV-visible spectrum of ZnNPs shows maximum absorbance at 550 nm, while FTIR spectrum showed peaks at 1612, 2356 and 3148 cm^{-1} which indicate the C=C stretch in alkene, N-H stretching in amides and C-H stretch in alkyne respectively. Zn was prominent (70.56%) in the EDX spectrum and SEM analysis depicted spherical particles of about 124 nm. The nanocomposite remediated the bitumen-polluted water with pH, COD, turbidity, conductivity, TPH, oil and grease and BOD of 6.8, 18.54 mg/l, 4.92 NTU, 143.5 μscm^{-1}, 0.81 mg/l, 0.13 mg/l and 12.04 mg/l, respectively. The result of this study shows that the quality characteristics of bitumen polluted water were found to be improved when the composite adsorbent was applied in the treatment of the BPW.

Nano Plus: Sci. Technol. Nanomat. 5 (2022) 1-109
https://doi.org/10.48187/stnanomat.2022.5.001

Nano Plus: Science and Technology of Nanomaterials
Journal home page: https://www.stnanojournal.org/
ISSN: 2782-8166 (print) 2782-8174 (electronic)

Nanoparticles in the soil environment and potential for agricultural improvement

Azeez, M.A., Durodola, F.A*., Adubi, A.O., Lateef, A., Yekeen, T.A., and Adebayo, E.A
Department of Pure and Applied Biology, Ladoke Akintola University of Technology, Ogbomoso, Nigeria

*E-mail: feliciadurodola@gmail.com

NANO2022/B073

Keywords
Nanoparticles
Soil ecosystem
Agriculture
Flora
Fauna

Abstract

In the soil environment are found naturally occurring organic and inorganic particles, which are in the nanoscale range. The two forms are mostly associated together as a unit mass while in some cases the organic one which exists as colloids forms coatings over the surfaces of the inorganic particles. They provide support for both plants and animals, and also serve as medium for transportation of nutrients, pollutants, organics and heavy metals. Advancement in knowledge and scientific research has led man to creation of different nanoparticles and their subsequent manipulations to deliver goods and services. One of such is in the field of agriculture, which is the backbone of industrial revolution as sources of raw materials. The need to improve crop yield, and devise avenue for their better production and protection in a sustainable way has spurred the development of potentials for manufacture of nano-based materials. Many of these materials such as nanoparticles and nanoformulations, nano-fertilizers, nanopesticides and insecticides, nanobacteriocides and fungides, and nanosurfactants are in the market stall ready for use. Of serious concern is the wider use of these nanoproduct in the soil environment and their subsequent accumulation in the soil ecosystem. Apart from the immediate benefits, the fear of possible adverse effects of their long-term applications on soil microorganisms, flora, fauna, and more importantly on edaphic factors leading to soil infertility and impoverishment are unexpected. Therefore, this review explores the various benefits of nanomaterials on soil ecosystem, the expected fallout from long term applications and suggestions for sustainable use in agriculture.