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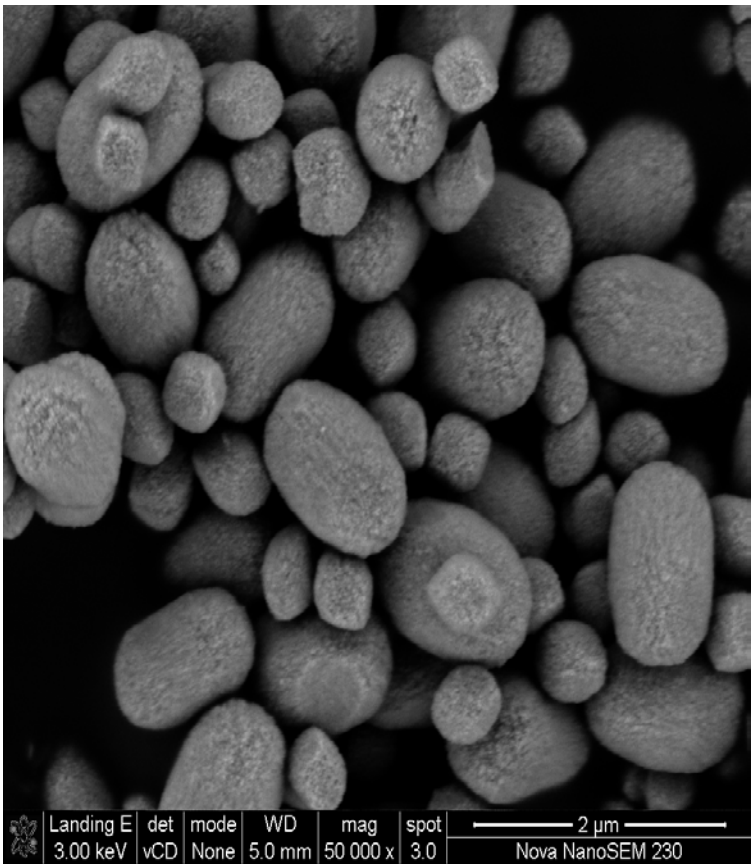

Editor-In-Chief

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Content

Editorial

This issue is a special edition covering the African-nano-conference of Focus Nanotechnologyy Africa-US-EU-Africa-Asia and Caribbean Academy of Nanoscience and Nanotechnology (FONAI-USEACANN) at Sheraton hotel, Abuja Nigeria; January 10, 2020. It will be focused on the 7 thematic areas of USEACANN: Nano-education, nanomedicine, nano-agriculture, nanoelectronics, nanoenergy, nanofiltration and nanosensors. What makes nanoscience and nanotechnology exciting is the convergence of knowledge in a multi-disciplinary, multi-institutional and multinational way. The convergence of knowledge as with nanoscience to resolve common problems human cannot and setting pace for beyond innovative nanoresearch cannot be overstated. This edition continues with the tradition of reporting quality nanoresearch and my sincerest appreciation goes to all the participants of the conference and Advance NanoFocus Inc for being a sponsor.

Editor-In-Chief

Ejembi John Onah

Professor of Chemistry, Nanoscience and Nanotechnology

President/CEO, Focus Nanotechnology Africa Inc. (FONAI)

USEACANN-Africa Nano-Conference; Sheraton Abuja-Nigeria; January, 2020

Abstracts

Keynote address

Nano Progress; The Way Forward for Africa

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JONPI-A1

Nanoscience and nanotechnology is an emerging field with ubiquitous applications in all fields of knowledge including education, energy, transportation, medicine, environment, electronics, artificial intelligence, internet of things (IOT), agriculture, filtration, etc. Nanoscience and nanotechnology is therefore the future where all fields of knowledge converge in a mulit-disciplinary, multi-institutional and multi-national ways. The Africans started civil society through the Egyptian civilization and originated subjects like chemistry that is the basis for nanoscience and nanotechnology today. This great record of originating civilization must continue in this quest to pioneer the field of science for all round development. This presentation will give an overview of the activities of Focus Nanotechnology Africa (FONAI) AND US-EU-Africa-Asia and Caribbean Academy of Nanoscience and Nanotechnology (USEACANN) covering 189 countries. Specifically the presentation will bring to view nano-chemical synthesis and the seven thematic areas of focus in Africa and globally including nanoeducation, nanoagriculture, nanomedicine (helicases, mutation, neurology, etc), nanoelectronics (nanoarticial intelligence, nanorobots, quantum computing), nanoenergy, nanofiltration and nanosensor. The establishment of a first of a kind Nanoacademy in Africa competitive with anywhere in the world to offer only PhD will be further presented and the future for Africa Nano.

Keywords: Nanoscience, nanotechnology, nanomedicine, nanoeducation, nanoenergy, nanoelectronics

Nanosensors

Nanosensor; an Overview

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JONPI-A2

In recent years the problem of contamination of food, agricultural produce, air, soil and water by pesticides, heavy metals, petroleum hydrocarbons, microorganisms, food additives, and other toxic substances, which pose serious risk to human health and the environment, has led to the need to develop rapid, precise and reliable methods of detection and identification of these contaminants, with a view to eliminating them. One of the most prospective technologies is the application of nanoscience and nanotechnology in the development of nanosensors, which are cost effective and efficient methods of detection, monitoring, and quality control. The possibility of nanosensor integration to information and communication technology broadens the scope of application of nanosensor technology to various fields such as medicine, bioinformatics, artificial intelligence, energy, etc., and provides ample opportunities for further research and development. As an alternative to fossil fuel combustion, nanotechnology can be applied to enhance the quality and efficiency of biofuels in compression ignition engines to replace diesel fuels. The use of nano-additives of alumina will likely improve the mechanical performance of diesel engine because it would reduce the emission levels of all pollutants (NO_x, UHC and CO and smoke opacity) in the exhaust gaseous due to its improved catalytic effect on the fuel combustion process. Several industrial processes are high energy consuming processes with corresponding high temperatures, given that the addition of nanoparticles improves combustion efficiency it will directly reduce the temperature of combustion systems increasing the overall efficiency of the system. It has been shown that the addition of nanoparticles improves the evaporation rate, it goes to say a controlled addition to increase the concentration of nanoparticles to the equilibrium volume fraction (equivalent to critical wetting concentration in surfactants) in biofuels can help one accurately predict the combustion rate of biofuels in combustion (mechanical) systems. However, there are limited well-controlled investigations on potential toxicities of nanoparticles, and it seems that additional long-term studies (preferably using multiple particle sizes) are needed to better characterize and understand the risk of using these particles. As a team, Baze University Abuja is

interested in focusing our research in nanoscience and nanotechnology in the areas of nano-agriculture, nanomedicine, nanosensors / artificial intelligence and nano-energy with a view to creating innovative solutions, to drive technological advancement and development in Nigeria.

Keywords: Nanosensor, nano-agriculture, nanomedicine, nano-artificial intelligence, nano-energy

Plant Mediated Synthesized Metal Nanoparticles: Interrogation of their Electrochemical Behavior towards the Detection of Environmental and Biologically Important Molecules

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JONPI-A3

Hazards and toxicity associated with the physical and chemical synthesis protocol of metal nanoparticles has recently led researchers to look for alternative routes that is eco-friendly, cheap and fast; the green chemistry approach where plant extracts and microorganism are used in the bioreduction of the metal salt is fast gaining popularity in the field of nanobiotechnology. In this presentation the metal salts are reduced to their "nanoform" through a one-step synthesis protocol using leaves extract of a plethora of plants. Optical property, Plasmon resonance, phytochemical activity for the reduction as well as the particle size of the metal nanoparticles presented was determined using advanced spectroscopic and microscopic techniques such as UV-visible spectroscopy, FTIR spectroscopy, Scanning electron microscopy etc. In addition to these techniques, electrochemical techniques such as cyclic voltammetry and impedance spectroscopy was used to interrogate the behavior of the metal nanoparticles towards a 1-electron transfer redox probe with a view to establish their viability for use in the detection of environmental and biologically important molecules. Future direct on synthesis of organic nanosensors for nanomedical and environmental applications will be also highlighted

Keywords: Nanosensor, nano-green chemistry, nanobiotechnology, voltammetry

Gas Nanosensor from Carbon Nanotube

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JONPI-A4

Gas nanosensors receive a considerable interest due to their important role in a wide range of domestic and industrial applications such as medical diagnosis, environmental pollution monitoring, food industry, public safety and agriculture. A sensor could be simply defined as an active surface which is enhanced physically as it interacts with certain gas. The characteristics of a good sensor include sensitivity, selectivity, repeatability, fast response time and recovery time. In order to attain these characteristics, the choice of material that could be employed as sensing layer need to be carefully selected. Carbon nanotubes (CNTs) are considered as excellent materials for gas sensing applications due to their high sensitivity, high aspect ratio, chemical stability and capability for various functions. In this research, carbon nanotubes will be synthesized using Chemical Vapor Deposition. The synthesized material will be characterized using FESEM, Raman Spectroscopy, X-ray Diffraction. It will then be hybridized with polymer or metal nanoparticles which will be deployed as a sensing material for the nanosensor. The nanosensor will be fabricated using thick film technology with alumina as the substrate while platinum will be used as material for the electrodes. The sensor will then be integrated into a gas sensing set up and then tested towards ammonia gas with different concentrations. Ammonia gas was chosen due to its toxicity and promising characteristics when interacted with CNT. The fabricated nanosensor is expected to have good results with improved sensitivity.

Keywords: Nanosensor, carbon nanotube, XRD

Carbon Nanotubes/Gold Nanoparticles based Nano-electrochemical Sensor for trace Determination of Chloramphenicol in Milk

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JONPI-A5

Antibiotic residues in milk are of great concern to health regulatory agencies, milk consumers and dairy farmers, due largely to their effects ranging from allergic reactions, antibiotic resistance and ability to interfere with the technological properties of milk used for manufacturing fermented products. The conventional methods used in detecting these residues suffers some limitations, are expensive, time consuming and lack the capacity for point of care analysis. Electrochemical techniques are powerful and wide range analytical techniques which are based on electrical properties of analytes in electrochemical cell. The technique offers a higher degree of sensitivity, accuracy, precision as well as a wider linear dynamic range, with relatively low-cost instrumentation. In this work, a novel nano-electrochemical sensor will be fabricated by decoration of carboxylated multi-walled carbon nanotubes (MWCNTs) with gold nanoparticles (AuNPs) using ethylenediamine (en) as a cross linker (AuNPs/en-MWCNTs). Various characterization techniques such as; Field emission scanning electron microscopy (FESEM), energy dispersive X-Ray (EDX), X-Ray diffraction (XRD) and cyclic voltammetry will be employed to characterize the synthesized nanocomposites and the fabricated electrochemical sensor. The sensor will be employed for the trace detection of chloramphenicol in milk. Effect of some experimental variables such as; pH,

buffer, scan rate, accumulation potential, accumulation time and amount of casted nanocomposites, on the sensitivity of fabricated nanosensor towards detection of chloramphenicol in milk will be optimized.

Keywords: Nanosensor, chloramphenicol, MWCNTs, ethylediamine, AuNPs

Green Synthesis of Silver Nanoparticle; Characterization of Optical Properties

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JONPI-A6

Paradigm shift in technology has led to widespread utilization of nanoparticles. The combined knowledge of chemistry, physics and engineering via nanotechnology has resulted in wider range of applications in the field of science, medicine, agriculture, energy among others. This project focused on the synthesis of plant-mediated silver nanoparticles using aqueous extract of indigenous *Lawsonia inermis* plant as reducing agent in place of toxic chemicals. Optical measurements were carried out using Uv-vis spectrophotometer and photoluminescence (PL). The nanocluster was also characterized with transmission electron microscope (TEM) and X-ray diffraction (XRD). The silver nanoparticles (Ag NPs) displayed surface plasmon resonance (SPR) between 447 and 451 nm. Spherical-shaped and hexagonal-shaped nanoparticles with truncated edges were observed in the TEM micrograph of the as-prepared Ag NPs. The Ag NPs were highly crystalline as depicted in the X-ray diffractogram. Optical characteristics displayed by the nanoparticles are a suggestion of its possible application in colorimetric metal nanoparticles-mediated nanosensors.

Keywords: *Lawsonia inermis*, optical, TEM, XRD, nanosensors

Synthesis and Application of Nanomaterials as Nano-sensors and Nanofluids

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JONPI-A7

Previous and current researches in nanotechnology related research area at the Obafemi Awolowo University, borders on the synthesis of metal and metal oxide nanoparticles and their nanocomposites with carbon nanotubes (CNTs), graphene and phthalocyanines. The syntheses were achieved using the chemical deposition methods and the resulting nanomaterials are geared toward the successful fabrication and application of nano-sensors for the detection and determination of some chemical and biological analytes in food and environmental matrices, including clinical analysis for neurotransmitters, malaria, typhoid, diabetes etc. Other research areas include the synthesis of nanofluids from nanoparticles and the conventional heat transfer fluid (such as water) to create a unique fluid for heat transfer analysis. In many of these researches, the goal was to determine the different thermophysical properties of the nanofluids to ascertain their superiority for heat transfer applications. Recently, the experimental and numerical applications of these nanofluids in microchannel heat exchangers and for two-phase applications are in the pipeline. In the area of renewable energy, new and novel nanomaterials are currently being developed for potential application in battery; supercapacitors and light emitting devices. Lastly, nanotechnology is currently being used the protecting of metals from corrosion such as application of TiO_2 nanoparticle to protect low carbon steel in form of nanocomposites.

Keywords: Nanosensors, nanosynthesis, nanocomposites, nanomedicine

Electrochemical Sensor: a type of Nanomaterial and its Application in Air Pollution Monitoring

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JONPI-A8

Air pollution is one of the major consequences recent advancement in industrialization, economic growth and urban development. The issue of air pollution has attracted the interest of governmental and non-governmental organization due to its severe implication on human health and environment. Despite the traditional air pollution control measures and reduction strategies such flaring the pollutants into the atmosphere with the hope of being free from interaction with man, use of personal protective equipment in the workplace and industrial environment, installation of electric precipitator, scrubber and gas recycling device, the demand for clean air which is required for human existence has not been met due to cost of installation, maintenance and at times total negligence. The development of a suitable method for detection, monitoring and reduction of the pollution has not being matched with the pace of generation of pollutants. There is need for better developments or technological discoveries that overcome such limitation. Nanotechnology offers many advantages as suitable monitoring systems that can rapidly and reliably detect and quantify polluting sources for monitoring by regulating authorities to improve on the existing environmental technologies and create new technology that is better than traditional approaches. Such nanomaterials operate on the spectroscopic, fluorescence, chemiluminescence, non-dispersive infrared spectroscopic, light detection and ranging, electrochemical sensors, passive sensing etc. The basic principle and application of electrochemical sensors as an example of nanomaterials used in air quality monitoring based on nanotechnology ‘solid state gas sensors’ is reported.

Keywords: Nanosensor, electrochemical, environment

Nanomedicine

Nanomedicine; An Overview of Nanogenetherapy

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JONPI-A9

Application of nanoscience and nanotechnology in nanomedicine in recombinant DNA technology is becoming more pertinent than ever. Nano-recombinant DNA technology involves splicing of two or more different DNA fragments from different sources and insertion into a host to create a new genetic function and make at nanoscale. Nanogene therapy includes the addition or replacement of missing or defective gene into a patient's cell at nanoscale can prove to be more effective approach than the well-known micro techniques. Another aspect of nanomedicine is a fundamental understanding of nano-helicase structure and function and nano-stereoselective-synthesis of their analogues as cures of tithing diseases like cancer, tumor, HIV-AIDS, malaria, etc. This presentation will highlight all this among others.

Keywords: Nanomedicine, nanorecombinant DNA technology, nanogene therapy, nano-helicase, nano-chemotherapy

Synthesis, Characterization and Antimicrobial Studies of Silver Nanoparticles

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JONPI-A10

There has been growing interest in the preparation and study of silver nanoparticles (AgNPs) in the recent years, because they have been found to exhibit interesting antimicrobial activity. In this research work AgNPs prepared in a simple, cost effective and eco-friendly way using leaf extracts of *Azadirachta indica* and *Amaranthus hybridus* as reducing and capping agents were tested for antibacterial activity. The synthesized AgNPs were characterized using UV-Visible Spectrophotometer (UV-Vis), Scanning Electron Microscope (SEM) and Fourier Transform Infrared Spectrometer (FT-IR). From the results, the wave length of absorption of UV light occurred in the range of 430 to 470 nm and the range of 390 to 460 nm for nanoparticles synthesized using *Azadirachta indica* and *Amaranthus hybridus* leaf extracts, respectively. The nanoparticles were almost spherical in shape with the approximate sizes ranging from 11 to 75 nm for the ones prepared using *Azadirachta indica* and the range of 11 to 68 nm for *Amaranthus hybridus*. The antimicrobial actions of the synthesized AgNPs were tested against three species of bacteria. While synthesized nanoparticles using *Azadirachta indica* showed higher antibacterial activity against *Staphylococcus aureus* and *Pseudomonas aeruginosa*, those of Amaranthus *hybridus* showed higher antibacterial activity against *Staphylococcus aureus.*

Keywords: Nanomedicine, nanoparticle, antibacterial, SEM

Application of Nanotechnology in Biochemical and Biomedical Research; A Review

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JONPI-A11

Nanotechnology is the understanding and control of matter at dimension between approximately 1 to 100 nm, where unique phenomena enable novel applications. It encompasses nanoscale science, such as nanomedicine, nanobiology etc. Nanotechnology is the manipulation of matter on an atomic and molecular scale. It involves imaging, measuring, modeling, and manipulating matter at this length scale. Incorporation of functionalized and modified nanostructure in various / biochemical/biomedical applications has generated considerable research interest in recent years. The application of nanotechnology in medicine and biomedical engineering are vast, spans areas such as tissue engineering, diagnosis, cancer treatment, sensing, visualization, blood purification, and drug delivery. The present scenario demands designing of nanotools which can respond to the needs of biological problem and prepare more efficient biomedical approaches. The nanomaterials field includes subfield which develops or study materials having unique properties arising from their nanoscale dimension. It involves two approaches; the bottom-up approach that seeks to arrange smaller component into more complex assemblies, and top-down approach that seeks to create smaller devices by using larger ones to direct their assembly. The implication of nanotechnology is of major concern in industrial-scale manufacturing and the use nanomaterials on human health and the environment, as suggested by nanotoxicology research, since some nanoparticle products may have unintended consequences.

Keywords: Nanomedicine, nanotoxicology, nanobiology

Evaluation of the Biological Effects of *momordica charantial* Fractions Mediated Synthesis of Gold Nanoparticles (AuNPs) in Both Normal and Alloxan Induced Hyperglycemic Rats.

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JONPI-A12

Nanotechnology has gained worldwide popularity not only because of its wide spread applications. The current research is designed to evaluate the biological effects of *momordica charantial* extract mediated synthesis of gold nanoparticles (AuNPs) in both normal and alloxan induced hyperglycemic rats. The methanolic extract obtained from the cool maceration of the plant material with methanol will be fractionated using petroleum ether, chloroform and ethyl acetate in this order of increasing polarity .AuNPs will be synthesized by mixing the each aqueous fraction with $AuCl_3$ solution separately for 24hrs. The AuNPs will be characterized using UV-Spectroscopic analysis, Scanning Electron Microscopy (SEM), Fourier Transform Infra-red Spectroscopy (FTIR) analysis. The biological activity such as hypoglycemic, hypolipidemic, hepaprotective and nephroprotective effects on each *momordica charantial* fraction mediated synthesis of AuNPs will be assayed using Wister rats. A total of thirty rats will be divided into five groups with each group containing six rats. Group (i) serves as control will receive only distilled water whereas hyperglycemia will be induced into the rats in groups ii, iii, iv and v by injecting alloxan intraperetonially at a dose of 100 mg/kg body weight in freshly prepared 0.01 citrate buffer of pH 4.5 after fasted overnight .Groups iii ,iv and v will be treated with petroleum ether AuNPs , chloroform AuNPs and ethyl acetate AuNPs at a dose of 100 mg/kg body weight orally once in a day for 28 days respectively while group ii will serve as diabetes control and will receives only distilled water. Serum levels of antioxidant defend enzymes such as catalase (CAT), glutathione peroxidase (GPX), super oxide dismutates SOD and peroxidation marker like malondialdehyde (MDA) will be estimated. Blood glucose level as well as liver and kidney function test will be evaluated. The kidney, liver and heart will be harvested and process for histological examinations. This study will provide an opportunity for the discovery of plant based synthesis of AuNPs that may be used as hypoglycemic or hypolipidemic effects with little or no contradiction .

Keywords: Nanotechnology; hypoglycemic; hypolipidemic; hepaprotective, AuNPs

Green Synthesis of Silver and Gold Nanoparticles Using *Tithonia diversifolia* and *Acalypha wilkesiana*: Effect of Operational Parameters, Characterization and Antimicrobial Studies

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JONPI-A13

Tithonia diversifolia (TD) and *Acalypha wilkesiana* (AW) as tropical medicinal plant extracts will be efficient for Green synthesis of Silver and Gold Nanoparticles resulting in the formation of TD-Ag-Nps, AW-Ag-NPs, Au-TD-Nps and Aw-Au-NPs for antimicrobial studies. The Nanoparticles will be characterized by physicochemical, analytical and spectroscopic techniques vis-à-vis phytochemical screening, morphology determination using Transmission Electron Microscopy (TEM), Scanning Electron Microscopy (SEM), Energy Dispersive X-ray (EDX), and functional group determination by Fourier Transform Infrared (FTIR) spectroscopy. The thermal dependence of the nanoparticles will be monitored by Thermogravimetric analysis (TGA). The phytochemical screening will be done to determine the phyto-molecules present in the tropical medicinal plants and responsible for bioreduction of silver and gold nanoparticles. TEM will reveal the size of the nanoparticles, the shape and elemental distribution of TD-Ag-Np, AW-Ag-NPs, Au-TD-Nps and Aw-Au-NPs will be determined by SEM and EDX. The crystallinity of the nanoparticles synthesized will be obtained using X-ray diffractometer (XRD) and the Surface Plasmon Resonance (SPR) by Ultra-violent Visible Spectrophotometer (UV-Vis). Experimental optimization of operational parameters imperative to this study will be carried out investigating effect of pH, Concentration, Contact-time, Volume ratio and Temperature. The synthesized nanoparticles will be tested against prevailing Gram positive and negative Multi-drug Resistance microorganisms (MDRM). The outcome of this study will find great relevance in Bio-process Engineering, Biotechnology and Food Science.

Keywords: Nanomedicine, green synthesis, gold nanoparticle, silver nanoparticle, TEM

Nanotoxicological Indices at Exposure for Vigna Subterranea

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JONPI-A14

Given heightened patronage of nanotechnology, effects of silver nanoparticles exposure on four geographical cultivars of Vigna subterranea were evaluated. A grasp of the interactions between nanoparticles and plants could reflect potential impacts of exposure to nanoparticles on important health indices, and consequently overall human health. Silver nanoparticles were inoculated into half strength Hoagland growth medium and had seedlings of 4 cultivars of Vigna subterranea grown in it for 15 days, with subsequent assessment of toxicological responses. Up to 90% reduction in leaf width and leaf dryness due to exposure were recorded and were marked ($p \leq 0.05$). Exposure to silver nanoparticles markedly decreased mean plant height (40%) and leaf area (45%) in all treatments in comparison to control. Measured produced Chlorophyll was indirectly proportional to sensitivity of studied cultivars to silver nanoparticles. Similarly, bioaccumulations of silver in shoot tissues were more in the most tolerant cultivar and could be explored for phytoremediation of impacted water. The rate of transpiration decreased with time and was higher in the most sensitive cultivars that showed sharp decline in vigor after 3 days. Evaluation of response to induced oxidative stress using expressed superoxide dismutase activity revealed significant decrease up to 43% in more sensitive cultivars showing impaired integrity. Environmental nanocontamination evident in depleted cell integrity and hampered photosynthetic ability of study plants was recorded and portends danger in potential decline in food production. Also, documented variations at response of oxidative stress markers with sensitivity to nanotoxicity is remarkable implying that one specie does not represent the high variability and diversity of phylla present in the plant kingdom.

Keywords: Nanocontamination; Vigna subterranea; Silver nanoparticles, nanotoxicity and nanomedicine

Toxicological and Biochemical Investigation of Biologically synthesized Nanoparticles of Extracts from *Ziziphus*

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JONPI-A15

Various plant parts have been reported for a myriad of efficacious purposes in folklore and reports have scientifically placed to the fore *Ziziphus mauritiana* and *Z. spina-christi* leaves as antimicrobial and antidiabetic agents. The important questions of their toxic effect have not been answered. The aim of this study is to evaluate the antidiabetic potentials of nanoparticles of these plants and their toxic effects. This study will carry out the green synthesis of nanoparticles of *Ziziphus mauritiana* and *Z. spina-christi* leaf extracts using established protocols and characterized these nanoparticles using UV/Visible spectrophotometry, Fourier transform infrared (FTIR) spectroscopy, transmission electron microscopy (TEM), X-ray Diffraction (XRD) and Energy Dispersive X-ray (EDX) analyses. Antidiabetic potentials of the nanoparticles and toxicological activity will be evaluated using brine shrimp lethality assay (BSLA), genotoxic effect with *Allium ceppa* test and *in vivo* toxicological assay. This study will contribute to knowledge on the antidiabetic and toxicological effects of biogenic nanoparticles of *Z. mauritiana* and *Z. spina-christi* leaves in animals.

Keywords: Green biosynthesized nanoparticle, *Ziziphus* species, toxicological, antidiabetic

Developing a Cancer Nanotherapeutic Conjugate of Isocitrate Dehydrogenase Inhibitor

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JONPI-A16

This study is aimed at developing a nanotherapeutic conjugate of isocitrate dehydrogenase (IDH) inhibitors and mesoporous silica nanoparticles (MSNs) for direct delivery to targeted cancer cells. The inhibitors will be (a) structural analogs of the substrates used to allosterically regulate the activity of IDH and (b) structural analog of IDH substrate (isocitrate) to serve as competitive inhibitors. The inhibitors and MSNs will be synthesized. Literature has revealed that the tri-carboxylic acid (TCA) cycle is an important metabolic pathway in cancer cells as well as normal cells. When cancer cells are subjected to stress such as hypoxia and nutrient depletion, they resolve into sourcing alternative survival means such as glutaminolysis that eventually leads to generation of α-ketoglutarate, protein deacetylation to acetate and then Acetyl CoA and fatty acid oxidation to Acetyl CoA[4]. A good look at most of the alternative survival means adopted by cancer cells during nutrient depletion and other related stress, are linked to the TCA cycle and as such halting the TCA cycle through the rate determining step by inhibiting Isocitrate Dehydrogenase (IDH) (the rate determining enzyme) will cause the death of the cancer cells as there will be severe depletion of energy and necessary precursors for the survival of the cancer cells. These IDH inhibitors will have to be delivered directly to the cancer cells as to avoid them acting adversely on normal cells hence, the choice of conjugating the inhibitors to MSNs for

specific and selective delivery. It has been recorded that most cancer cells possess mutated IDH isoenzymes (mIDH1 and mIDH2) which differs from the IDH functional in normal cells, the advantage of these differences will also be used to specifically and selectively target the cancer cells. The effect of this conjugate will be determined both in vitro and in vivo.

Keywords: Cancer nanotherapeutic, silver nanoparticle

Polymeric Nanoparticle

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JONPI-A17

Nanotechnology is the study of very small materials within the range of 1 – 100 nm. These materials exhibit properties different from the bulk materials, such as electrical conductance chemical reactivity, magnetic and optical effects as well as physical strength as a result of their small size. Nanotechnology have different potential applications in many fields of life, including; Health and Medicine, Electronics, Transportation, Energy and Environment, Space exploration.in the field of medicine, nanotechnology has been variously applied in treatment and detection of disease like diabetes, cancer, Parkinson's disease, Alzheimer's disease, cardiovascular diseases and multiple sclerosis as well as different kinds of serious inflammatory or infectious diseases (e.g. HIV). With the help of nano medicine early detection and prevention, improved diagnosis, proper treatment and follow-up of diseases is possible. With the help of nanotechnology, damaged tissue can be reproduced or repaired. In our research group at SHESTCO, our interest is in the area of nano-medicine. We synthesize both metallic nanoparticles and polymeric nanoparticles. For the metallic nanoparticles, biosynthesis of gold nanoparticles was achieved in a record time of less than 30 seconds (1^{st} time ever!) from locally sourced plant material. Funtionalization of the gold nanoparticles with some molecular recognizing units for targeted dug delivery in the treatment of breast cancer was carried out. The gold nanoparticles are also being applied for the early detection of breast cancer. In terms of the polymeric nanoparticles, biodegradable polymers were used such as Chitosan, Alginate, for drug encapsulation into nanospheres. These polymeric nanoparticles were applied for targeted drug delivery against cancer and diabetes. SHESTCO nanoresearch group has also established a standard functional cell culture laboratory; breast cancer cell lines like MDA-MB-234, MDA-MB-468 and the normal breast cell line MCF-10A. Equally produce were indigenously anticancer drug, Prodigiosin, which have been tested and extensively studied to understand the mode of its action against cancer.

Keywords: Nanomedicine, polymeric nanoparticle, anticancer

Ethnomedicinalbioactivesin Nano based Delivery

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JONPI-18

The term nanomedicine is used to refer to the application of nanotechnology in healthcare. The development of nanomedicines has greatly improved solubility and bioavailability of medicines making it easier to target sites that were hitherto difficult to reach. Consequently, they can achieve the same therapeutic effect at smaller doses than the conventional counterparts and with lower adverse effects and offer impressive resolutions for various life-threatening diseases.
The World Health Organization (WHO) reported that in developing countries, 80% of the basic health needs of the population are met by traditional medicine. However, the bioactive molecules present in the plants in most cases, have low bioavailability and consequently low efficacy. Nanomedicine can revolutionize the development of formulations based on natural products, with capacity to resolve all the issues limiting the large scale application of these bioactive compounds.
The present project will focus on the discovery and application of nanomaterials in improving both the efficacy of novel and conventional drugs.

Keywords: Nanomedicine, nanodrug delivery, ethnomedicinalbioactivesin

Green Synthesis of Lipid nanostructured Nanoparticles using Vegetable Oil

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JONPI-A19

Due to the adverse effects of the toxic chemicals and solvents used in the synthesis of nanoparticles on human health and environment coupled with the huge expenses of these chemicals, green synthesis of nanoparticle is now strongly advocated around the world. In recent years, new drug development has been less efficient and sufficient because even though it usually produces an exciting result in in-vitro experiments initially, the in vivo results do not produce the expected results in some cases. This observation may be due to many reasons ranging from poor drug absorption, and distribution in the tissues to low solubility and toxicity effects due to high variation in the plasma levels. These observations raise the need for production of suitable drug – carrier system to overcome these problems. Some hybrid nanoparticles may be suitable for this purpose. Ideally, nanoparticles used for drug delivery applications are less than 100nm in size and should have biodegradable materials like polymers, nanocomposites and lipids. These ideal nanoparticles will not have the problems attributable to their counterparts. Therefore, the aim of this research is to synthesis lipid nanostructured nanoparticles from renewable sources; castor oil and ricinoleic acid. Surfactants like Tween 80 and Poloxamer 188 with glycerine as co-surfactant will be used. Ultrasonification and high pressure homogenization methods will be used for the synthesis of the nanoparticle. The synthesized nanoparticle will be characterized using dynamic light scattering technique to determine the particle size. The charge stability and the polydispersity index will be analyzed using a Zeta Analyzer. The morphology of the synthesized lipid nanocarrier will be examined using transmission electron microscopy method (TEM). The thermal stability of the lipid nanoparticle will be determined using differential scanning calorimetry (DSC) or Thermal gravimetric analysis. X ray diffraction technique and Fourier transform infrared (FT - IR) analysis will be used to determine the crystal morphology and the functional groups present. The obtained result will help to know the ability of castor oil as a potential lipid nanostructured nanoparticle and thus highlighting its possible industrial and pharmaceutical uses as a source of green and environment friendly nanoparticles.

Keywords: Green synthesis, nanomedicine, castor oil

Nano Drug Delivery; an Overview

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JONPI-A20

Nanomedicine, an arm of nanotechnology is a growing field of medicine cum biomedical sciences that applies the principles of nanotechnology to diagnose, treat and prevent or control infectious diseases using specific physiological/molecular understanding of the human body, with the overarching aim of improving human health. Generally, nanomedicine take advantage of the improved physical, chemical and biological properties of biological materials at the nano-scale level (i.e., at the molecular scale – usually 0.1-100 nm). With the technological advancement currently available and evolving in the field of nanotechnology, nanomedicine could be medically employed to create biomedical materials and other medical devices that can interact with the human body (particularly the cells, body fluids and tissues) at the sub-cellular scales (0.1-100 nm) with a high degree of precision and specificity, especially in reaching target infected sites of the body promptly. In the developing parts of the world (Nigeria inclusive), there are plethora of infectious diseases of poverty – which have contributed a great deal to the morbidity, mortality, and the alarming rate of poverty in these regions. Many of the infectious diseases (such as tuberculosis (TB), malaria, schistosomiases to mention a few) are still without a permanent cure; and this could be tied to the development of drug resistant strains of the causative agents and the paucity of the development of effective novel drugs to counter the inefficacies of some available drugs. There are some reports of some local herbs in Nigeria and other parts of Africa that have shown some level of efficacy (maybe at the laboratory level or so) against some of the diseases notable in Nigeria and Africa. However, these local herbs have not yet being converted to a nanosized hybrid biomolecules or therapeutics that can be used to effectively tackle some of these diseases. Some of these medications including the drugs currently used to treat these diseases can also be delivered into the body using novel drug delivery systems (such as liposomes) made available through nanotechnology. In our futuristic work, we intend to carryout experiment geared towards the nanoparticle of some putative herbal medications in Nigeria. We envisage that these nano- drugs and therapeutics will have better bioavailabilty, thus reaching their target sites on time, and reducing the dosage, toxicity and frequency of drug intake associated with some available drugs. The use of nanoparticles or nanosized therapeutics and nanosized drugs could efficiently facilitate the subcellular distribution and *in vivo* antimicrobial activity of nanosized drugs in the infected cells, tissue or body fluids of recipient (sick/infected) human hosts. This novel strategy can help to address the major problems of failed therapeutic interventions directed to some Nigerian/African diseases including malaria, schistosomiases and TB to mention a few. Nanomedicine holds the

potential to drive prompt and early detection, prevention, control and improved diagnosis and treatment infectious diseases and other non-infectious diseases of man.

Keywords: Nanomedicine, infectious diseases, nanosized drugs

Estimating the Future Trends of Application for Nanotechnology in Early Detection of Communicable Diseases

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JONPI-A21

Communicable diseases are diseases that can spread from one person to another and cause a large number of people to get sick. They are caused by germs such as bacteria, viruses, fungi, parasites or toxins. Early detection of infections that are communicable would go a long way in preventing an outbreak or epidemic which in turn could lead to loss of lives. Examples of such outbreaks was the Ebola hemorrhagic fever (EHF) or otherwise simply known as Ebola , whose recurrent outbreak starting from 1976 till date, with an estimated mortality of between 25% and 90% has been cause for concern in both developed and undeveloped nations. The study aims to estimate how far the adoption of current nanotechnology solutions such as the use of highly sensitive fluorescent nanoparticles, therapeutic agent encapsulation using nanoparticle vehicles and sensitive nanobiosensors are aiding early infection detection, immune response modulation and overall quality of health. The study aims to carry out an extensive review of literature describing the applications of diverse nanotechnology solutions with respect to satisfactory impact analysis results. The study would also highlight and critique future directions of nanotechnology adoption in early detection of communicable diseases.

Keywords: Nanomedicine, detection, communicable diseases, nanoparticles

Risk Assessment on Nano-drugs; an Overview

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JONPI-A22

Nanoscience and Nanotechnology have huge potentials to bring benefits to many areas of research and application. However, the current state of scientific knowledge about this aspect of science and technology in Africa is yet to be fully explored. A special interest will be focused on the toxicological risk assessment of emerging nanomaterials which includes but not limited to cytotoxicity, effect on biogenesis and cell organelle activity, acute and chronic organ specific and systemic toxicity effects as well as environmental impact/ecotoxicity. To achieve these toxicological risk assessments, we hope to develop rapid, accurate and effective testing strategies to access the impact of these nanomaterials on human health and the environment. All synthetic methods targeted at reduced side effects will be greatly explored through optimization of various green synthetic methods. *In vivo* evaluation of bio-distribution, retention, metabolism and elimination of nanomedicines will also be of great interest to us. Further evaluations of adverse drug, food, blood proteins, phytochemicals and cell organelles interactions with nanomedicines and nanomaterials will also be of concern to us. Follow-up research on the development of synthetic methods to control nanoparticles morphology, their size distribution, the nature of their interfaces and their stability in several media geared towards reduced adverse interaction and toxicity will be advanced.

Keywords: Nanomedicine, nanosafety , nanodrug delivery

Nanomedicine in Nigeria; an Overview

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JONPI-A23

Nanomedicine is one of the leading research areas with the most promising technologies in recent time. Born from nanotechnology, it can be defined as a field of study that makes use of nanoparticles at the atomic and molecular levels (1nm-100nm). Due to their small size at the nanoscale and with improved solubility and bioavailability, nanoparticles can easily penetrate cells and reach difficult target sites that other conventional therapeutic substances cannot reach with reduced adverse effects. Thus, nanoparticles can serve as versatile drug delivery systems, carrying both chemotherapeutics and imaging agents to targeted sites. A broad spectrum of materials including synthetic, semi-synthetic and biological materials is used to synthesis nanoparticles. Nanoparticles have shown to be of medical importance as can be used to develop drug delivery tools, diagnostics and medical devices, enhanced gene therapies and drugs for various diseases. In Nigeria, the application of nanotechnology to biomedical research and medicine is still at its infancy. Little research has been done in the field of nanomedicine. A few researches have focused only on the synthesis of metal nanoparticles using plant biomolecules or extracts and have been limited to *in vitro* tests on their antioxidant and well as antimicrobial activities. Little has been done on animal model studies to assess the therapeutic response as well as the toxic effects of the synthesized nanoparticles to specific diseases. Also, the mechanism of therapeutic action of these nanoparticles has not been elucidated. More so, little or no focus has been laid on how to purify these nanoparticles and formulate them as drug delivery tools or therapeutic agents. As such, the production of nanoparticles in Nigeria for various medical and therapeutic applications is still miles away. The challenges of the growth of this technology reside on limited financial resources, lack of specialized laboratories for interdisciplinary research and lack of skilled or specialized professional for such research. Nano-helicase structure and function for prevention and cures of cancer, tumor, HIV-Aids, malaria, etc will be also presented.

Keywords: Nanomedicine, nanoparticles, nano- helicase

Development of Metal Nanoparticles using Purified Compounds from Indigenous Plants and Studies on their *in vitro* and *in vivo* Biological Activity

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JONPI-A24

Metal nanoparticles (NPs) have excellent physicochemical properties and as a consequence have found applications in diverse fields. Biomolecules present in plant extracts can be used to reduce metal ions to nanoparticles in a single-step green synthesis process. This biogenic reduction of metal ion to base metal is quite rapid, readily conducted at room temperature and pressure, and easily scaled up. Synthesis mediated by plant extracts is environmentally benign. The reducing agents involved include the various water-soluble plant metabolites (e.g. alkaloids, phenolic compounds and terpenoids) and co-enzymes. Drugs bound to nanoparticles have been claimed to have advantages compared over the conventional forms of the drugs. Nanoparticle bound drugs have an extended half-life in vivo, longer circulation times and can convey a high concentration of a potent drug to where it is needed. The size of the drug nanoparticle and its surface characteristics can be modified to achieve the desired delivery characteristics. As the nanoparticle-bound drug is not able to circulate broadly, its side effects are reduced and a high localized concentration can be achieved where it is needed. Using a single compound isolated from a plant source or two or more types of compounds a “special” type of nanoparticle can be synthesized that has a multi-effect on its intended target. We intend to isolate compounds from plants, purify them, establish their biological activity profile and then synthesize nanoparticles using various metals, mainly silver. These nanoparticles will be characterized using UV, FTIR, SEM, TEM, XRD and EDS will be used to characterize them and their *in vitro* activity will be studied against specific pathogens as well as *in vivo* studies in specific disease conditions using mice models. This use of plant extracts for making metallic nanoparticles is inexpensive, easily scaled up and environmentally benign. It is especially suited for making nanoparticles that must be free of toxic contaminants as required in therapeutic applications since plant extracts and compounds isolated from them are mostly safe for human consumption. Applications in targeted drug delivery and clinical diagnostics can be developed and this can be extended to applications in veterinary medicine and agriculture.

Keywords: Nanoparticle, nano-green chemistry, nanomedicine

Silver Nanoparticle and Stem Cells in averting Organ Damage

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JONPI-A25

The increase resistance to medications of some diseases in human beings and animals are a source of major concern. These is because, some of these diseases are either not sensitive or do respond slowly to medications. Nanomedicine as an advanced form of nanotechnology using silver nanoparticles capable of treating infectious and non-infectious diseases can be employed. Silver has been used as antimicrobial and in cancer treatment, although associated with some toxicity. Nanomedicine using silver nanoparticles and cellular therapy can be integrated for a better result, since nanoparticles treatment are associated with cytotoxicity, the regenerative attribute in cellular therapy can avert the tissue damage. Various analytical approaches have been used to determine the antimicrobial, anti-inflammatory and anticancer activity of silver nanoparticles in vitro and in vivo. These include disc diffusion test, agar diffusion test, MIC, MBC, while TEM, STEM, X-ray analysis, high angle annular dark field (HAADF), Dynamic light scattering (DLS), will be employed in other to determine the morphological changes in the microbial cell wall and also in the damaged tissue. We hope administration of silver nanoparticles together with bone marrow mesenchymal stem cells (BMSCs) can avert the toxicity and tissue damage due to the production of growth factors by the BMSCs and also the transplanted BMSCs can help in tissue regeneration, repair of dysregulated genes as seen with antituberculosis drug rifampicin, a well known toxic drug for the treatment of Mycobacterium tuberculosis. This research is premeditated to boost alertness of complimentary method of using mesenchymal stem cells and silver nanoparticles to avert toxicity and to arouse silver nanoparticle research.

Keywords: Silver nanoparticles, antimicrobial, anticancer, mesenchymal stem cell

Nanomedicine: An Exciting Trend in chemotherapy

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JONPI-A26

Nanomedicine is a field of therapeutics that has generated renewed interest in modern times. It involves the use of nanometer sized particles usually in the range of 1-100 nm for therapeutic purposes. These particles differ from their parent macromolecular compounds in their functional properties; optical, electrical and structural. These size-induced advantages enable their use for diverse purposes of: diagnostics, drug delivery, drug targeting, imaging and early detection of diseases. To achieve these purposes, synthetic and natural substances are used and formed either by using the top –down approach (breakdown of macromolecular substances) or the bottom –up method (aggregation of molecularly sized particles) of synthesis. Conjugation to nanometer sized particles has also been employed for targeted therapy. Several delivery systems have been formulated for this purpose: Polymeric nanoparticles, metallic nanoparticles, lipid nanoparticles, conjugated nanoparticle systems, as well as carbon nanomaterials. In Africa, the nanomedicine thrust has been its use in the eradication/mitigation of common tropical diseases like malaria, microbiologically induced illnesses and other neglected tropical diseases as well as exploring its diagnostic potentials. Several African researchers (including Nigerians) have investigated the potential of nanomedicine in enhancing delivery of poorly soluble drugs, achieving targeted drug delivery, overcoming resistance patterns of microorganisms, reducing dose-dependent toxicity of drugs via use of nanosized particles with greater surface area to volume ratio and enhancing drug penetration into poorly penetrable sites e.g. brain through the blood brain barrier. These researches have offered glimpses of success and the potential of nanomedicine in addressing the drug related needs of the continent. However, a lot still needs to be done especially in the area of effective and cost-efficient diagnosis of ailments as well as the use of nanotechnology in treating some of the diseases referred to as neglected tropical diseases (due to their prevalence in developing countries of the world –notably in Africa).The focus of my future research will be in utilizing nanomedicine-based approaches in improving the drug therapy of these neglected tropical diseases with emphasis on: Malaria, Trypanosomiasis, Filariasis etc. In addition, there will be collaboration with other experts to provide heat-stable vaccines that would not require the cumbersome cold-chain for storage. Furthermore, the possibility of single dosing of multiply dosed vaccines e.g. hepatitis B, would be explored. Success in this area of vaccine technology would go a long way to ensure the delivery of more efficacious vaccines devoid of the complicities arising from loss of therapeutic efficacy as a result of deficiencies in the cold chain distribution channels.

Keywords: Nanomedicine, tropical diseases; vaccine delivery, nano-diagnostics

Nano/Micro-particulate Dispersions of Lipids and Biopolymers as Drug Delivery Systems and Micro-bioreactor

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JONPI-A27

In recent decades, intensive researches had been focused on the encapsulation of bioactive compounds in food and pharmaceutical/medical fields using biopolymer complexes and lipid dispersion systems, especially lipid vesicles (or liposomes). However, there still remain major challenges standing in the way of new advances in this field of research. Notable among the obstacles include low entrapment efficiency, difficulty in size control with keeping high entrapment efficiency, low stability of vesicles. Also, research on protocells (primitive cell models) has attracted attention in an interdisciplinary field, all toward the origin-of-life studies and modern synthetic biology. As a synthetic bioreactor, liposomes have been exploited towards the synthesis of functional green fluorescent proteins; active pore-forming protein - hemolysin; and as a promoter for RNA cleavage microreaction. However, most of the studies have been based on vesicles with symmetric phospholipid distributions that do not mimic the heterogeneous distributions of lipids in cells. To address the above challenges, future researches would focus on the following thematic areas: (i) Formulation of lipid vesicles using multiple emulsification and solvent evaporation integrated process for enhanced encapsulation and delivery of hydrophilic and hydrophobic bioactive substances, (ii) Development of lyophilized oral formulations of anti-diabetic drugs encapsulated in nano dispersions of polyelectrolyte-surfactant complexes, (iii) Advanced method for utilizing lipid dispersion systems by high electrical field pulse, towards entrapment of thermosensitive anti diabetic drugs, and (iv) Development of membrane-clickable vesicle bioreactor as a protocell biomimicry and biochemical switch. The followings are the expected outcomes of the various investigations: (a) The vesicles entrapping hydrophilic molecules with high efficiency could have potential applications as micro/nano carriers for the efficient delivery of bioactive functional materials in food, pharmaceutical products, cosmetics, and other related fields; (b) The novel formulation of nano encapsulated glibenclamide and metformin HCl in powdered form for pediatric reconstitution; (c) Development of a novel technique with potential for the entrapment of food enzymes and functional anti diabetic peptides (e.g., insulin, glucagon) into liposomes. The entrapment of these thermosensitive functional peptides into liposomes cannot be achieved by the conventional method of vesicle preparation due to their possible denaturation by ultrasonication; (d) Formulations of lipid vesicles with significant degrees of membrane heterogeneity and trans-asymmetry (hetero-vesicle with micro/nano charged domains) mimicking prebiotic cells and capable of metabolic synthesis and release. The research would provide great

advancements in the utilization of nano/micro particulate carrier systems in areas of pharmaceutics, food, cosmetics and related fields.

Keywords: Nanomedicine, lipid vesicles, nanoentrapment, nanochannel

Synthesis of Copper Nanoparticles in Gelatin Matrix for enhanced Antibacterial Activity.

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JONPI-A28

Copper is a cheaper alternative to various noble metals with a range of potential applications in the field of nanoscience and nanotechnology. However, copper nanoparticles have major limitations, which include rapid oxidation on exposure to air. Therefore, alternative pathways should be developed to synthesize metal nanoparticles in the presence of polymers and surfactants as stabilizers, and to form coatings on the surface of nanoparticles. The aim of this research is to synthesize, characterize and test the antibacterial activities of copper nanoparticles. Synthesis of copper nanoparticles will be carried out with gelatin as a stabilizer by reducing $CuSO_4.5H_2O$ ions using hydrazine. Ascorbic acid and aqueous NaOH will also be used as antioxidant and pH controller, respectively. The effects of NaOH, hydrazine, concentration of gelatin as stabilizer will be studied. The synthesized copper nanoparticles will be characterized by UV-visible spectroscopy (UV-vis), powder X-ray diffraction (XRD), transmission electron microscope (TEM), energy dispersive x-ray (EDX), thermogravimetric analysis (TGA), and zeta size and potential measurements. The UV-vis will be used to confirm the formation and stability of the CuNPs. The optimum concentration of gelatin will be determined. The supporting materials used in the synthesis will be tested for biocompatibility and the obtained products for stability in air. The synthesized CuNPs will be tested for antibacterial activity against Gram-positive; *Staphylococcus aureus* (S276), *Bacillus Subtilis* (B29) and Gram-negative; *Salmonella choleraesuis* (10708) and *Escherichia coli* (E266).

Keywords: Copper nanoparticles, gelatin, antibacterial activity

Lead Ions Hydroxyapatite Nanocrystals as Medical Implants

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JONPI-A29

Nano crystalline apatites have been the object of extensive research in several inter-displinary areas with objectives ranging from better understanding of the formation mechanisms in natural mineralization process to its applicability to biomedical and industrial materials (Roveri and Palazzo, 2007). Lead toxicity is a major environmental health problem especially with bone been the major reservoir for body burden of lead. Although lead has shown to impair bone metabolism in animals and at the cellular level, the effect of Pb^{2+} ion with an essential metal ion Ca^{2+} on the structure and activity of a bone matrix has as well not been studied. The general objective is to study the structural and functional properties of the Calcium Hydroxyapatite (Ca-HA) Nano-crystals and effects of Lead ions on it as it regards to its application as medical implants. Nano crystalline hydroxyapatite (HA) will be prepared at physiological conditions of pH (7.4) and temperature (37^oC) by precipitation and hydrothermal methods using $Ca(NO_3).4H_2O$ and $NH_4H_2PO_4$ as precursors. The prepared samples will characterized via Particle size Analyzer (PSA), Fourier transform infrared spectroscope (FT-IR), energy dispersive X-ray fluorescence (XRF/EDX), X-ray diffraction (XRD), Brunauer–Emmett Teller (BET), Scanning electron microscopy (SEM), Transmission electron microscopy (TEM) and Thermogravimetric /Differential thermal analyzer (TG/DTA). The synthesized HA will then be tested for their bioactivity in-vitro via immersion in a simulated body fluid (SBF) solution for 21 days where the pH of SBF will be constantly monitored and the % weight loss of the HA estimated and then characterized via XRF/EDX, FTIR, XRD and SEM. The HAs' will subsequently be doped with lead (Pb^{2+}) ion from Chloride and Nitrate sources respectively and characterized using XRF/EDX, FTIR, XRD and SEM. Future directions of synthesis of organic nanosensors of nanomedical and environmental applications will be highlighted.

Keywords: Nanomedicine, nanosensors, hydroxyapatite, nanocrystals, precipitation hydrothermal

Nanoemulsified rice bran wax policosanol ameliorates plasma F_2-isoprotane, homocysteine and heart histology through the modulation PPARG in diet induced hyperlipidemic rats

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JONPI-A30

Policosanol, a mixture of long-chain alcohols found in animal and plant waxes has several biological effects including lipid-lowering that have been extensively studied. However, its bioavailability is low, hence the need to improve the bioavailability. We have formulated and characterized policosanol nanaoemulsion previously. To investigate the effects of rice bran wax policosanol nanoemulsion (NPOL) on plasma levels of F_2-isoprostane, homocysteine, heart histology, and expression of peroxisome proliferator-activated receptor gamma (PPARG) in hyperlipidemic rats. High-fat diet containing 2.5% cholesterol was used to induce hyperlipidemia in Sprague Dawley rats. The hyperlipidemic rats were treated with NPOL and rice bran wax policosanol (POL) in comparison with normal diet (ND), high-cholesterol diet (HCD) and simvastatin-treated rats. Plasma levels of F_2-isoprostane, homocysteine, heart histology, and hepatic mRNA expression of PPARG were evaluated. The NPOL significantly ($P< 0.05$) reduced plasma F_2-isoprostane and homocysteine, preserved heart histology, and down-regulated hepatic PPARG mRNA. The results suggest that, the modest effect of NPOL on plasma F_2-isoprostane, homocysteine, and preservation of heart histology could be through the modulation of PPARG

expression on a background increased assimilation of rice bran wax policosanol. A review of future work on nano-helicase, structure and function will be also presented.

Keywords: Policosanol, nanoemulsion, F_2-isoprostane, homocysteine, heart histology, PPARG, nano-helicase

Synthesis and Characterization of Silver Nanoparticles using Onion Peels and Carrot Petiole Aqueous Extract and Molecular Docking Analysis of various target proteins related to diabetes mellitus.

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JONPI-A31

Nanotechnology is currently observing a significant progress in eco-friendly method of Nano synthesis and growing concern is especially devoted to new and emerging nanoparticles based on plant compounds in the field of drug discovery. Plant crude extracts that contain secondary metabolites (e.g flavonoids) are an exciting possibility for Nano synthesis that is yet to be explored. Biomolecules present in some plant compounds have been reported to be responsible for the formation and stabilization of silver nanoparticles. Onion peel is regarded as waste in the food industry and if not properly discarded may cause environmental pollution, likewise carrot petiole. It has been reported that quercetin and quercetin 4'-O-glucopyranoside are the major flavonoids in red onion peel. This study seeks to synthesized Silver (Ag) nanoparticles using onion peels, monitor formation of silver nanoparticles using UV-Visible spectrophotometer, purify the synthesized nanoparticles by centrifugation, lyophilized Silver (Ag) nanoparticles, check the formation of silver nanoparticles by X – ray diffraction (XRD), analyze silver nanoparticles using energy dispersive absorption spectroscopy to further confirm the presence of the signal characteristic of elemental silver, analyze the size of synthesized silver nanoparticles using Transmission Electron Microscope (TEM), carryout antibacterial assay, determine the morphology of the synthesized silver nanoparticles using Scanning Electron Microscopy (SEM) determine minimum inhibitory concentration (MIC), investigate the electron transfer ability of synthesized Silver (Ag) nanoparticles using electrochemical techniques and molecular docking studies between ligands and molecular targets (glucokinase, Fructose 1, 6- bisphosphates 1, Human multidrug resistance protein 1 and cytochromes P450). Biosynthesis of nanoparticles using plants is very cost effective and thus can be used as an economic valuable alternative for the extensive production of Nanoparticles for various industrial application including pharmaceutical industries.

Keywords: AgNPs, nanomedicine, plant extract, biomolecules, molecular docking,

Nano Antibiotics Derivatives of Tricarbonyl (2-methoxycyclohexa dienyl) Iron Complexes

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JONPI-A32

The nucleophilic addition reaction of some selected antibiotics with 2-methoxy tricarbonyl (η5-cyclo hexadienylium) iron has generated its 1,3-diene antibiotic derivatives which might possess better antimicrobial activities. The synthesized complexes were characterized spectroscopically by infra-red, nuclear magnetic resonance (1D and 2D-NMR) and mass spectra measurement. The immobilization of the synthesized adducts on aluminum-silicate nanoparticles and multi-walled carbon nanotubes led to the formation of the nano antibiotic derivatives of the synthesized adducts which might exhibit a high degradation and decolorization efficiency for methyl orange (MO).

Keywords: Nucleophilic, antibiotics, nanotubes, 2-methoxy((η^5-cyclohexadienyl)

The Nano-lipsome-encapsulated Haemoglobin in Delivery of Oxygen to Ischemic Region of the Brain

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JONPI-A33

Stroke is the leading cause of death resulting from neuro vascular accidents and inflammatory processes surrounding the event are the main culprits. Use of Lipidic nanoparticles in recent years has generated a lot of interest especially for its usefulness as a drug delivery system (DDS), such as the artificial oxygen carriers. This study will utilise nano-liposome-encapsulated haemoglobin (LEH) as a nanoparticulate oxygen carrier containing haemoglobin, to help in retarding the effect of inflammation. Here, we are going to observe the level of inflammatory biomarkers in ischemic stroke induced rats involving the 1stgroup with 20 rats which will be administered saline compared with 2nd group 20 rats labelled LEH, during 60-min following stroke. The measured biomarkers will be creatinine CD 163, alanine transaminase, TNF-, IL-6, IL-1, CINC-1, and IL-22.

KeywordS : Stroke, nano-liposome-encapsulated haemoglobin (LEH), drug delivery system (DDS)

Nanofiltration

Nano-filtration Technology

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JONPI-A34

Membrane filtration is a purification technique where membrane acts as selective barriers that prevent the passage of pollutants. Some of these pollutants include organics, nutrients, turbidity, microorganisms, inorganic metal ions and other oxygen depleting pollutants. Nanofilteration (NF) is one of the widely used membrane processes. The process however, allows relatively clear water to pass through. There is water everywhere however, most water bodies contains some level of impurities. Contaminants find their way into water body from runoff from domestic, agriculture, sewage and industries. The high demand for quality water therefore requires that water and wastewater be treated for use. This objective can be carried out with modern technology such as nanofilteration (NF) to achieve the goal for the availability of potable and quality water. NF is a pressure-driven membrane technology for the treatment of water and wastewater. This new technology can remove solutes with molecular weight within 200–1000 g mol^{-1} range. It removes most viruses, natural organic matter, a range of salts and heavy metals. NF also removes divalent ions that make water hard. In this way it softens hard water. It also removes harmful contaminants like pesticides compounds and organic macromolecules. NF is of lower energy consumption and higher flux rates. Membranes that are used in NF have a pore size in the order of nanometers (nm) (1×10^{-9} m). Hence small ions are often removed in the process. It has significantly higher water permeability. NF process requires that the membranes are charged hence the mechanism is not purely filtration but also osmotic. There are a wide range of nanofilteration membranes available in the market. Each membrane targets the removal of specific or groups of constituents. Membrane companies have developed nanofiltration membranes capable of 95 percent salt removal. Groundwater is the main source of drinking water in most developing countries. This source is mostly contaminated with chemicals such as nitrates, and organic molecules such as halogenated hydrocarbons and aromatic compounds. All these can effectively be handled by the applications of NF, a very effective method of treating water and wastewater.

Keywords: Nanofiltration, membrane, osmosis, pressure-driven

Expected Opportunities and Issues in the Application of Nanotechnology to Water Treatment in Developing Nations

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JONPI-A35

One of the United Nations Millennium Development Goals is to ensure greater access to cheap and reliable clean water sources. Though clean water is important for all aspects of industrial, commercial and domestic activities, water pollution and the depletion of water resources have been on the increase. This has therefore decreased the availability of clean, usable water and increased the potential for major water crises that could have severe implications on food security and public health. The situation will expectedly be more serious in developing countries where water supplies and treatment technologies are scarce. Presently, nanotechnology appears to be an economical way of treating old and emerging water pollutants. This notwithstanding, some engineered nanomaterials, however, have the tendency to turn to pollutants and become a threat to public and environmental health. This paper will therefore critically look at the applications and effects of nanotechnology from the perspective of water quality and water security for developing countries.

Keywords: Nanotechnology, nanofiltration, opportunities, challenges, developing countries

Nanofiltration; an Overview

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Edwin Clark University Kiagbodo,

JONPI-A36

The world nanofiltration market is forecast to grow at a compound annual growth rate (CAGR) of 37.2% from 2015 through 2020, reaching nearly $2.2 billion in total revenues by 2020. Therefore, advances in nanofiltration can accelerate the realization of the millennium goal to provide affordable clean water for the poor. Increasingly, greater research efforts are being directed towards the production of nanofibers and nanocomposite fabrication. Our research team has identified electrospinning as the most notable technology available today that can be conveniently exploited for nanofiber production but there is need for commercialization of the process. Indeed, if nanofibers with high surface areas are functionalized by incorporation of photocatalytic catalysts and/or surface modification, such nanofibers can be applied to membrane filters to capture various organic and metal pollutants in wastewater treatment. The challenge of providing potable and readily available drinking water is a major concern of the developing economies. Nigeria and indeed, the Niger Delta area is striving to combat this developmental goal. Thus, Edwin Clark University, Kiagbodo intends to devote reasonable research resources towards nanofibers and nanofiltration project. It is surmised that a significant impact of nanofiltration may lie in the exploitation of such techniques as Forward Osmosis (FO) processes that are widely considered for the wastewater treatment applications. Similarly, a much more commercially promising application of FO membranes is for the Pressure Retarded Osmosis (PRO), which could be used to harvest the energy of the salinity gradient. Also, concerted efforts are being made to execute projects on PRO that would provide viable alternatives for recycling energy from industrial scale RO processes. Some research efforts are being dedicated in demonstrating the feasibility of carbon nanotube membranes for forward osmosis applications. A high membrane permeability and related structural integrity could be achieved by utilizing Carbon Nanotube (CNT) ideal pores. However, there remain serious gaps in research about the chemistry and the major construction constraints in using ultrathin polymer membranes and films, their characterization and details of how to overcome the

most important factor limiting the market progress of the technology, namely the absence of highly permeable carbon nanotube membranes for forward osmosis.

Keywords: Nanofiltration, nanofiber, osmosis, CNT, nanocomposites

Nanofiltration Technology from Moringa Oleifera Seed

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JONPI-A37

Addressing poor water quality in developing countries, where an estimated one billion people lack access to potable quality water, is a primary motivating factor for this community developmental efforts and is a key component of the Millennium Development Goals (MDGs) in Nigeria. This research therefore seeks to address poor water quality and water scarcity in Lokoja, Kogi state, Nigeria, where an estimated 5 million people lack access to clean and portable water but the locals around the river Niger depend solely on the water from this river for drinking and domestic uses. This unclean water is often responsible for the widespread diarrheal illness and water related diseases amongst the locals and for the middle class and institutions in this location, a lot of resources and funds are spent to have access to clean and portable water. The short term goal is to develop a nanofiltration technology that is indigenous, easily reproducible and cost effective using locally available seed from the multi-purpose tree Moringa oleifera Lam. (M. oleifera) as coagulant and activated carbon derived from the seed pods, shells, stems and their mixture. This will ultimately lead to establishing reproducible standard steps for the development of low-tech water purification technology solving the issue of scarcity of clean and portable water associated with developing countries. The long term goal is to establish a nanoresearch based nanofiltration technology, where the research outputs will on one hand proffer solution to scarcity of clean and portable water and augment the epileptic town water supply. Our ultimate goal is to achieve an installed cost effective and improved water treatment plant that reaches network parity versus conventional treatment technologies and competes favorably against current conventional water treatment technologies.

Keywords: Nanofitration, molinga oleifera, activated carbon

One-pot Synthesis of Glycine Functionalized Manganese Dioxide Nanoparticles for the Efficient Degradation of Manganese Dioxide Nanoparticles

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JONPI-A38

MnO_2 nanostructures were successfully synthesized through a bio-mediated route with glycine acting as the reducing, capping, stabilizing and functionalizing agent. Glycine molecules coupled to the surface of the nanoparticles was identified using Fourier Transform Infra-red (FTIR). An average crystallite size of 70.27±2.75 nm was obtained from X-ray Diffraction (XRD) studies. Dynamic Light Scattering (DLS) showed the effects of pH on the hydrodynamic size and polydispersity index of the nanoparticles. Field Emission Scanning Electron Microscope (FESEM) highlighted the irregular morphology of the nanoparticles with average particle size of 80nm excluding agglomerates. Time profiles of the degradation of methylene blue in the presence of H_2O_2 showed an increase in the degradation ability of the nanoparticles with increasing reaction pH. The functionalized MnO_2 nanoparticles (MnNPs) exhibited superior degradation ability at 79% after 60 minutes. In principle, the glycine functionalized MnO_2 nanostructures might be envisaged as efficient oxidants for the treatment of organic dye-containing wastewater under similar degradation conditions.

Keywords: Nanofiltration, MnNPs, waste water

Nanofiltration Technique in the Purification of Waste Water

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JONPI-A39

There are many types of membrane processes in use. A nanofiltration (NF) membrane is a type of pressure-driven membrane that has properties in between those of ultrafiltration (UF) and reverses osmosis (RO) membranes. Industrial applications of nanofiltration are quite common in the food and dairy sector, in chemical processing, in the pulp and paper industry, removal of surfactants and finishing agents which are used in textile industries, waste water recycling instead of being disposed of in landfill sites, improves the removal efficiency of color, COD, conductivity, alkalinity and total dissolved solids (TDS), preferential rejection of heavy metals, and purification of acid and base. The application of membrane technology in water and wastewater treatment is increasing due to stringent water quality standards. In this research, water and waste water samples from various sources in Keffi LGA will be collected and analyzed for pesticides, heavy metals, and physicochemical parameters using the nanofiltration technique.

Keywords: Heavy metals, nanofiltration, pesticides, physicochemical

Sol Gel Preparation of Hematite Nanoparticles for Environmental Applications

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JONPI-A40

Sol gel method was employed in the synthesis of hematite nanoparticle. The hematite nanoparticle was characterized by some physico-chemical methods such as pH, bulk density, point of zero charge, micro pore volume and surface area. The nanoparticles were further characterized using Fourier Transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), X-ray fluorescence (XRF), scanning electron microscopy (SEM) and transmission electron microscopy (TEM). Since an important physical property of nanoparticle is their ability to form suspension, the material was subjected to sedimentation experiment. The results revealed the texture and colour of the hematite to be fine and red with point of zero charge of 7.50, bulk density of 1.857 g/cm^3, percent yield of 91.7%, surface area of 36.6 m^2/g, micro pore volume of 0.01078 cm^3/g and micro pore area of 21.9537 m^2/g. The FTIR spectrum of the nanoparticle illustrated characteristic bands of hematite at 481.98 and 588.00cm^{-1}. The XRD patterns showed the crystalline phases of the hematite nanoparticles indicating a high purity of the sample while the XRF result showed that the nanoparticle is mainly hematite with a 94.70 % of Fe_2O_3. The SEM images revealed spherical and oval shapes for the sample while the TEM images revealed average diameters in the range 27.86-75.01 nm. The sedimentation rate of the hematite nanoparticles was influenced by pH of solution. The rate of sedimentation was slow at pH 6 and 8 but very fast ant pH 10, this can be supported by the bulky nature of the material. Therefore, the hematite nanoparticle presented better characteristics for environmental applications such as heavy metal removal from wastewater due to high BET surface area and greater pore volume

Graphical representation: SEM micrograph and XRD pattern

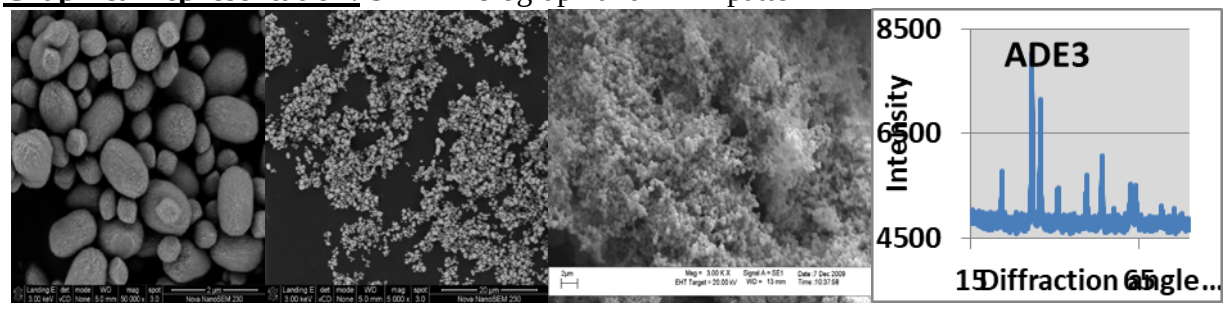

Fig:SEM micrograph of Hematite

Keywords: Hematite nanoparticle, sol-gel, nanofiltration

Synthesis of Iron and Silver Nanoparticles using *Polyandraamarus and Bosnia senegalensis* Extract.

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JONPI-A41

In the recent years there have been search for water and wastewater treatment processes, the alternative methods in achieving greater and higher standard for quality drinking water, industrial effluent standard and wastewater reuse. Emphasis has been given on the application of nanoparticles and nanostructured materials as efficient and viable alternatives to conventional adsorbents. Because of their importance from an environmental perspective, special emphasis has been based on some of this metal for it removal of the metals Fe, Cd, Cr, As, Zn, Hg, and Cu. This research intends to synthesize new Iron and Cadmium nanoparticles from aqueous extract of leave and stem extracts of *Polyandra amarus* and *Bosnia senegalensis*. The plant extract material not only makes the process eco-friendly, but also the abundance makes it more economical applied in the purification of laboratory stimulated waste water, industrial effluent with optimization using the different conditions of the nanoparticle production such as time, temperature, pH, and volume of the aqueous extract.

Keywords: Nanofiltration, nanoparticle, nanobiotechnology, waste water

Water Treatment Technology with Photoelectrocatalysis: Synthesis of Novel Boron Doped Diamond-Metal Nanoparticles Composite for Treatment of Organic Pollutants

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JONPI-A42

Clean Water and Sanitation by 2030 is the sixth goal of the United Nation Development Programmes' (UNDP) Sustainable Development Goals. To actualize this goal there must be concerted efforts at development of water treatment technologies. Advanced oxidation processes (AOPs) such as photocatalysis, electrocatalysis and photoelectrocatalysis for the treatment of organic pollutants have received attention recently but not without drawbacks that are limiting their commercial applications. The application of these AOPs for water treatment is promising if the drawbacks of incomplete mineralization; cost and availability of raw materials for catalyst production; operation condition of catalysis among others are solved. The common photocatalyst used is TiO_2 but operates most effectively in the ultraviolet (UV) light region < 387 nm which raise question of electricity cost as against harnessing the free visible or UV light of the sun. The modification of TiO_2 to make it visible light sensitive is a strong consideration. Boron doped diamond have also been reported for electrocatalytic degradation of organic pollutants. The study is therefore designed to harness the synergistic effects of photocatalysis and electrocatalysis to develop low energy consuming photoelectrocatalysts from readily available raw materials that will have the potentials of mineralizing classical organic pollutants, emerging contaminants and kill micro-organisms. It will also explore the possibility of developing point of use mini-reactor from the materials produced after optimization of the operating conditions and mechanism of actions. The mini reactor will then be applied in a field pilot study. The project is designed to build human capacity and add value to water treatment technology at both mini and mega levels.

Keywords: Nanofiltration, nanoelectrocatalysis, nanophotocatalysis, organic pollutants

Nanoenergy

Research title: Production of Biogas for Human Consumption from Organic Wastes using Anaerobic Digestion System

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JONPI-A43

As the global energy consumption continues to be a challenge; alternatives from nanoenergy can be sought. A lot of vegetables, fruits and many other agricultural products have been observed to be wasted in Benue state of Nigeria over the years. These wastes can be used as substrate for the production of biogas which is environmentally friendly. Reactors or digesters will be fabricated and used to retain the wastes for biogas production. The reactors will be constructed at one hundred litre volume using iron containers which will be bought and taken to a welder. Iron pans will be provided for proper sealing of the containers. Two openings that protruded outwards will be created on top of the container. One of the openings will be treaded and a fitting cover will be employed to close and open the container at appropriate intervals for loading and decanting of the wastes. A device will be provided inside the container that will be used during the experiment to continuously stir the slurry. This is to avoid scum and temperature gradient in the reactor. The other opening will be connected to other containers with appropriate substances to separate and refine the gas. After refining, the gas will be collected and stored for consumption. Wastes will be collected from market squares, abattoirs, animals and crops farms including domestic wastes. Wastes will be prepared by separating indigestible material and taken to University of Mkar campus behind the General Biology Laboratory. Clean Water will be added to the waste in a ratio of 3:2 to get the desired total solid concentration of the slurry for easy digestion. The research will be conducted by a team of scientists from College of Science and Education, University of Mkar, Mkar.

Keywords: Nanoenergy, biogas, anaerobic digestion

Magnetoelectric Nanogenerator and Industrial application

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JONPI-A44

The excessive depletion of fossil fuel for generation of electricity constitutes great challenge to the socioeconomic development of many nations. The advancement of science and technology expands the horizon of electric power generation, transmission and distribution, metamorphosed the smart world, and subsequently causes power consumption to shrink daily. This research focuses on harnessing nanoenergy for domestic use and for the automatic control of pneumatic machines in the industrial settings. The source will be solid-state modeled and based on magnetoelectric nanotechnology that will ensure stability and reliability of supply. For the industrial settings, microcontrollers and protective devices will be incorporated in order to ensure that the system is capable of controlling the precision engineering operations and speed requirements, and also improved starting torque of the industrial machines. The implementation of this project will not only cushion the debilitating effects of epileptic and unreliable power supply in the country, but it will substitutes the use of alternating current (a.c.) electricity for industrial operations and save the millions of naira, which would have been spent for supplying electric power for pneumatic industrial operations.

Keywords: Nanonergy, nanogenerator, electric power

Development of Nano-catalysts for Fuel Application

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JONPI-A45

The projected rise in global human population clearly infers that the associated energy consumption will be on the increase. Therefore, establishing a balance between the escalating energy consumption and the declining nature of the fossil fuels reserves must involve wide and prolific researches in related areas. Currently, bulk catalytic materials are widely employed for energy production from both biomass and fossil feedstocks. However, these bulk catalysts are associated with variety of challenges including non-cost effectiveness, low catalyst-efficiency, recyclability challenges, poor resistance to poisons and limited reliabilities. To address these challenges, the application of nanoscale catalysts is a focused priority area of interest. Accordingly, our research interest target the development of nanoscale zeolite and oxide systems that could be applied for both biomass and fossil fuels valorization into energy and petrochemicals. The catalysts will be designed using validated international procedures and fully characterized with the aid of reliable facilities such as FT-IR, SEM, TEM, Porosimeter, XRD and XPS. This will then be used for methanol-to-gasoline (MTG), methanol-to-propylene (MTP), natural gas reforming, heavy crude oil aquathermolysis and catalytic cracking and also the exploration of more promising areas targeting nanotechnology for energy sustainability.

Keywords: Nanoenergy, nanocatalyst, petroleum

Nanosolar Cell Synthesis for harnessing Renewable Energy Sources

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JONPI-A46

Nanotechnology may be defined in general terms as the manipulation of matter on a near-atomic scale to produce new structures, materials, systems, catalysts and devices that exhibit novel phenomena and properties. Various fields of endeavors are presently seeking ways of harnessing nanotechnology for realization of more efficient, cost effective and environmentally friendly products and systems. Of particular interest to electrical and electronic engineers are the applications of nanotechnology in various areas such as lighting, heating, renewable energy, energy storage, fuel cells, hydrogen generation, transportation etc. The South East region of Nigeria like every other region in the country is faced with acute shortage of electric power supply mainly due to inadequate power generation cum poor transmission and distribution infrastructures. Worthy of note is the fact that various research efforts have shown that one of the major approaches to solving this problem is the adoption of distributed generation which typically involves generation of power and distribution of the power in the same locality without having to transmit the power over very long distances. The major focus of this research effort is on the deployment nanotechnology concepts in developing nanogrid systems which can be used to harness the available renewable energy resources in the south eastern region of Nigeria. It is proposed that nanotechnology holds great prospects for improved power generation from renewable energy resources especially in solar photovoltaic (PV) systems and batteries for energy storage. While the applications of nanotechnology in electrical and electronic systems are becoming broader by the day, the emphasis of this research will dwell mainly on the deployment of nanotechnology for enhancement of solar PV panels and the associated batteries for more efficient harvesting and storage of solar energy for improved power supply in various localities in the South East region of Nigeria. Organic nanosolar cell synthesis as an overview will be also presented.

Keywords: Nanoenergy, nanosolar cell, synthesis, nanogrid

Synthesis of Palladium Nanoparticles doped on TiO_2 and Photocatalytic Hydrogen Production via Water Splitting

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JONPI-A47

Pd nanoparticles will be prepared by microwave, sol immobilization, and thermal methods under relatively mild conditions and incorporated into TiO_2 mesoporous photocatalysts. The photocatalytic mechanism will be thoroughly investigated and demonstrated by conducting a wealth of characterization techniques such as powder X-ray diffraction (XRD), nitrogen adsorption isotherm, transmission electron microscopy (TEM), UV-visible diffuse reflectance spectroscopy (DRS), X-ray photoelectron spectroscopy (XPS), atomic absorption spectroscopy (AAS) and photoluminescence (PL) spectroscopy. The samples photocatalytic activity under visible light (l > 400 nm) irradiation for production of hydrogen from splitting of water without Pt as a co-catalyst will be studied. The dependence of the solar hydrogen evolution rate by visible light irradiation on the method of catalyst synthesis will also be studied and the rate of the production of hydrogen by the most active photocatalyst will be determined. Future direct on synthesis of organic nanofibers for nanofiltration application is envisaged

Keywords: Nanoenergy, nanocatalyst, water splitting, XRD

Functionalized Biopolymeric Composite: A Platform for Nanomeric Scale Metal Nanoparticles Interaction

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JONPI-A48

The feasibility of functionalizing bio-inspired polymeric materials with desirable cross linking agents is expected to find wide application in future metal-biocomposite device fabrication due to shift from the use of synthetic polymer as a stabilizer in nanocomposite to non-toxic biopolymeric material. Typically, our group has been involved in the study of chitosan and its hydrophilic equivalent, quaternary trimethyl chitosan (QTC) with improved binding properties as a support for metal nanoparticles synthesized via facile system-induced method. Such functionalized biopolymeric nanocomposites include, chitosan-pyridinedicarboxylic acid/nickel(II), and cobalt(II) nanocomposites and QTC-chitosan/Bi nanocomposite prepared by reacting QTC-chitosan in the presence of metal salts/oxides using chemical reduction methods. Various nanosized materials are obtained with uniform nanoscale morphology and large pore size distribution. The various reactions testing indicated that these nanocomposites exhibited enhanced heterogeneous catalytic performance. This is attributed to uniform nanoparticles structure, large pore size distribution and stabilization effect of the chitosan mixed ligands, which prevented agglomeration and accelerated the adsorption of reactant molecules. The resulting catalytic performance led to a better understanding of designing and using such metals for a number of catalytic applications.

Keywords: Nanoenergy. chitosan, biopolymeric, nanocomposites, metal-biocomposite, agglomeration, adsorption

Synthesis and Physicochemical Properties of Zinc and Indium Phthalocyanines Conjugates

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JONPI-A49

This work reports on the conjugation of semiconductors quantum dots (QDs), gold (AuNPs) or Fe_3O_4 magnetic (MNPs) nanoparticles to 4-(4,6-diaminopyrimidin-2-ylthio) substituted indium or zinc phthalocyanines (Pcs). The QDs and MNPs were linked to the Pcs via an amide bond and by chemisorption unto AuNP surface. There is a general decrease in fluorescence quantum yields of the Pcs in the presence of all the nanoparticles. There is an increase triplet quantum yields for Pcs in the presence of AuNPs and QDs, but not in the presence of MNPs. AuNPs conjugates irrespective of the central atoms have the highest singlet oxygen quantum yield and are more photo-stable than all the other conjugates. Metallophthalocyanines (MPcs) are less photostable in the presence of MNPs.

Keywords: Phthalocyanine AuNPs, Quantum dots , nanoenergy

Deposition of Cadmium Chalcogenide Thin Films through AACVD and the Formation of $Pr_2N_2P_3^+$ ion Supported by DFT and Mass Spectrometric Studies.

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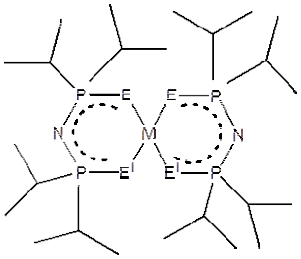
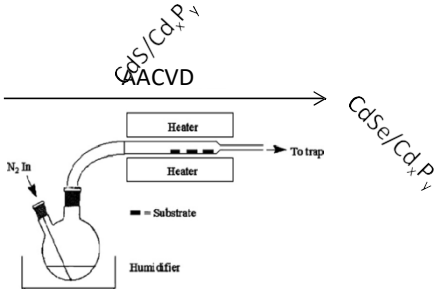
JONPI-A50

Cadmium dichalcogenoimidodiphosphinate complexes, $Cd[(EP^iPr_2)_2N]_2$ (E = S, Se) were synthesized and used as single-source precursors to deposit thin films of cadmium chalcogenides on glass substrates. Cadmium chalcogenides are useful materials in solid-state solar cells, photoconductors, field effect transistors, sensors and transducers. Aerosol-assisted chemical vapor deposition (AACVD) of $Cd[(SP^iPr_2)_2N]_2$ leads to the growth of cadmium sulphide and/or phosphide thin films on glass substrates. Decomposition of the precursor has been studied by pyrolysis- gas chromatography/mass spectrometry and modelled by density functional theory (DFT). Furthermore, AACVD of $Cd[(SeP^iPr_2)_2N]_2$ deposits cadmium selenide and/or cadmium phosphide on glass substrates, depending upon the growth conditions. The phase, structure, morphology and composition of the films were characterized by X- ray powder diffraction (XRD), scanning electron microscopy, energy dispersive X-ray analysis and X-ray photoelectron spectroscopy. The XRD indicated a hexagonal phase for cadmium selenide, whilst cadmium phosphide was monoclinic. Pyrolysis gas chromatography-mass spectrometry and density functional theory were
used to deduce a breakdown mechanism for the deposition that favored the formation of a new aromatic $^iPr_2N_2P_3^+$ ion.



M = Cd; E = S, Se



Keywords: Nanoenergy, nanosensor, chemical deposition, nanofilm

Fabrication of III-V Semiconductor Nanowires for Applications in Nanodevices

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JONPI-A51

Semiconductors nanowires (NWs) have attracted enormous interest as promising candidates for novel electronic and optoelectronic devices owing to their extraordinary optical, electronic and structural properties coupled with their reproducible and precisely controlled synthesis and geometry which are key requirements for highly efficient optoelectronic device applications. As shown in Figure 1, NWs enhance optical absorption and have been successfully utilized as building blocks for a new generation of high-performance electronic and photonic devices including solar cells, light emitting diodes, transistors, lasers, detectors and new sophisticated applications.

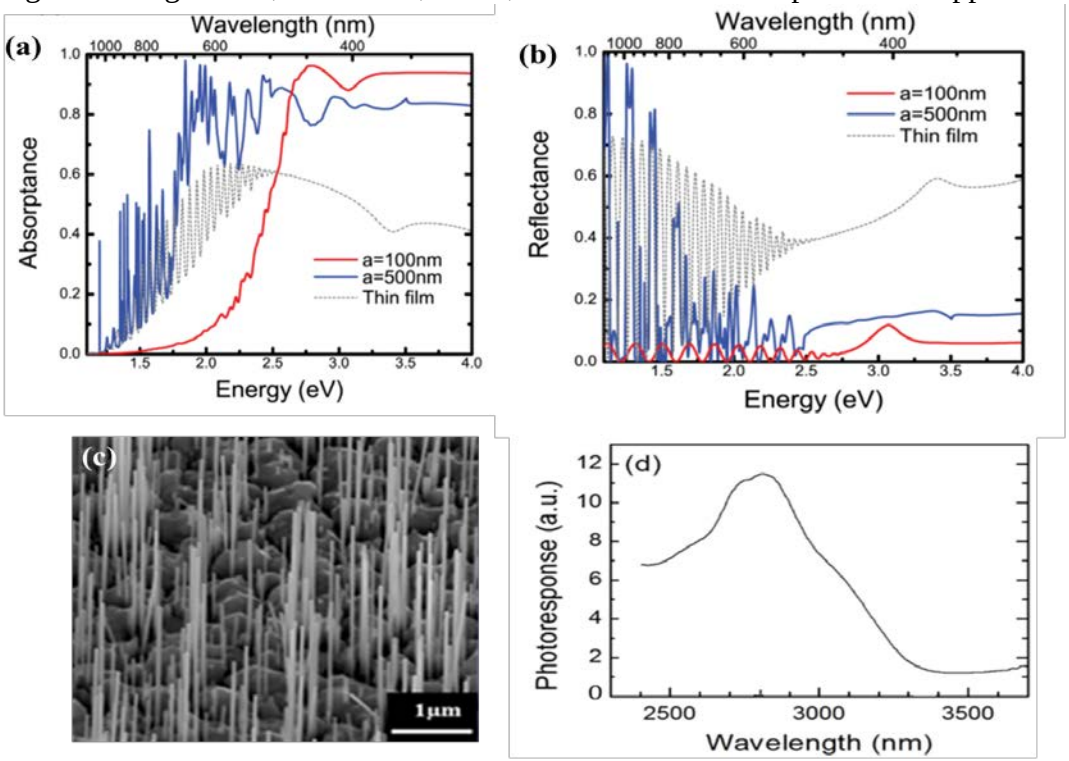

FIGURE 1: Optical absorptance of Si NW array as a Function of energy (eV) and wavelength comapared with Si thin films (a). Optical Reflectance of Si NW array as a Function of energy (eV) and wavelength compared with Si thin films (b) [2]; 45° tilted SEM images of InAs NWs grown on graphitic substrates (c); Room temperature spectral photoresponse of InAs NW/graphite hybrid device (d).

The fabrication of InAs and InAsSb NWs by molecular beam epitaxy (MBE) is reported. The surface morphology of the resulting samples was studied by a FEI XL30 SFEG scanning electron microscope while transmission electron microscope images were taken with a JEOL-JEM 2100 microscope working at 200 kV. Figure 1a shows the 45° tilted SEM images of InAs NWs grown on graphitic substrates. InAs NWs/graphite infrared photovoltaic detectors were fabricated. It will be shown that the InAs-NWs/graphite heterojunction devices exhibits rectifying behaviour. Room temperature photovoltaic response with a cut-off wavelength of 3.4 μm was demonstrated. This result demonstrates the enormous potential of NWs for the fabrication of advanced, functional, optoelectronic Nanodevices. A review of future nanoresearch on nanosolar cell will be also presented
Keywords: Nanowires, nanoelectronics, III-IV semiconductor, nanosolar

Nanoelectronics

The Internet of Nano-Things

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JONPI-A52

The Internet of Things (IoT) has emerged as a promising paradigm where things such as interconnected machines/devices and objects which are embedded with computing capabilities are seamlessly connected through a communication medium to many application domains. The emergence of the Internet of Things paradigm has augmented the research scope of Wireless Sensor Networks demand. Wireless Sensor Networks consist of micro-sensors which are capable of monitoring physical and environmental factors including temperature, vibrations, humidity, seismic event, etc. and are expected to play a vital role in the Internet of Things since these smart sensors are the building blocks for the IoT concept. Advances in technology have shown that there are certain application domains which require very tiny, concealable, and non-intrusive Things or devices. Advancement in nanomaterials such as graphene as introduced a novel paradigm-shifting concept for the Internet of Things known as the Internet of Nano-Things (IoNT), based on the connectivity of nanoscale networks or nanomachines with existing communication medium to process their information in a distributed manner, and for a contextual service management systems. The Internet of Nano-Things is the basis of numerous present and future applications including Internet of Bio-Nano Things which can be used for biomedical applications such as immune system support, bio-hybrid implants, and health monitoring etc., industrial applications (food and water control), military applications (nuclear, biological, and chemical defenses), and environmental applications, and massive-scale deployments, etc. Despite the interconnectivity solution of microscale Things, the need for gateway and the network management over the Internet remain an open research area in order to actualize the vision of the Internet of Nano Things for the various application domains. Considering the harsh and variable nature of nanonetwork environments, there is a need for efficient and end-to-end reliability of nanosensor data in nanonetworks. However, the fifth-generation (5G) mobile network is envisaged to support and enable the Internet of Nano-Things applications. The presentation will highlight all this among others.

Keywords: IoNT, 5G, nanosensors, nanoelectronics

Comparative Studies on Photophysical and Optical Limiting Characterizations of Low Symmetry Phthalocyanine linked to Fe3O4–Ag Core–shell or Hybrid Nanoparticles

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JONPI-A53

Phthalocyanines (Pcs) and their derivatives are extensively studied macrocycles to develop nonlinear optical devices used for protecting light sensitive materials and improve night vision from dangerous laser radiations. Previous studies have shown that the optical limiting behaviour of Fe3O4 NPs can be enhanced when they are in contact with Ag domains. The mechanism responsible for the magneto-optical properties of Fe3O4/Ag NPs has been attributed to two-photon absorption (TPA), and nonlinear refractions [3,4]. Stabilization of Fe3O4@Ag core–shell or Fe3O4–Ag heterodimer NPs with Pc macrocycles could give rise to new smart materials with improved NLO strengths compared to individual NPs. This work describes for the first time the comparative photophysical and optical limiting properties of low symmetry zinc phthalocyanine, covalently linked to Fe3O4@Ag core–shell or Fe3O4–Ag heterodimer NPs in DMSO. We also report for the first time on the optical limiting potential of the Fe3O4@Ag core–shell in comparison to its Fe3O4–Ag heterodimeric derivative in toluene prior to surface functionalization. NLO characterizations of the samples were performed using the open-aperture Z-scan technique with a mode-locked Nd: YAG laser delivering 10 nanosecond (FWHM) pulses at 532 nm. The absorbance of the conjugates in DMSO were kept at ~0.76 measured in a 0.2 cm glass cuvette. Triplet quantum yields and NLO parameters of phthalocyanine improved due to the combined effects of magnetic–metallic nanoparticles. A direct relationship between the increased triplet excited state absorptions by already excited molecules and reverse saturable absorption (RSA) was established as the predominant mechanism responsible for nonlinearity of the samples. Our findings show that, at the same approximate concentrations and conditions, Pc-Fe3O4-Ag enhanced the OL potentials of Pc more than Pc-Fe3O4@Ag.

Keywords: Nanoelectronics, nanoparticle, Fe3O4–Ag

Nano-Secure: A Secure Communication Network and Applications

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JONPI-A54

Nanotechnology has provided excellent and effective opportunities for various applications such as water purification, smart cities, solar energy, agriculture, health monitoring and many more. In the last few years, research conducted on nanotechnology has resulted in the development of several nanomaterials such as nano-machines. Nanotechnology suffices as a promising tool capable of eradicating some of the economic and environment challenges experienced in most developing countries. The application of nanotechnology to key areas like water, medicine, food, energy, agriculture and multimedia applications can produce innovative solutions which will greatly improve the life-styles in developing world. In addition, the rapid dissemination of multimedia applications such as telemedicine, e-learning, tele-conferencing, e-presence, across the Internet have opened-up new research paradigm across the globe. Nanotechnology provides a new approach for generating, processing and transmitting multimedia contents at the nanoscale, by introducing a novel communication paradigm called Internet of Multimedia Nano-Things (IoMNT). IoMNT is simply the connection of multimedia nano-devices with the conventional communication networks and Internet, IoMNT are easily extendable to advanced applications in diverse fields. The traditional compression techniques, network protocols and security solution mechanism deployable on the Internet are not sufficient in handling multimedia nano-devices due to its underlying infrastructures and peculiarities of physical layer designs. In this research, a novel communication scheme suitable for IoMNT named **Nano-Secure** is proposed. An efficient compressing technique and advanced security mechanism suitable for multimedia nano-device will be embedded in this scheme. The new compression algorithm will effectively support encoding/decoding of images (or video chunks) from nano-cameras or nano-projectors. Furthermore, the security mechanism will entail new encrypting and decrypting tools to ensure data integrity and privacy measures in multimedia nano-devices. Nano-Secure will be implemented using programmable nano-bio-chip sensors. The research output will be compatible with most nano-machines. Finally, Nano-Secure will be tested using different case studies at the Federal University of Agriculture, Abeokuta, Nigeria (with focus on nano-agriculture; for example, animal tracking devices, food quality and nanomedicine such as e-health monitoring and e-drug delivery).

Keywords: Nanosecure, nanoagriculture, nanomedicine, IoMNT

Smart Nanodevices for Environmental Applications

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JONPI-A55

This work is a review of smart nanodevices for environmental applications. Nano-robots are intelligent programmable machines built on the nano scale to carry out a specific task. They are extremely helpful in medicine and industry. Nano-robots are new microscopic warriors and can remove up to 95% of conventional and non conventional pollutants in just 1 hour. It is estimated that by 2050, there will be more plastic than fish in the world's oceans. Waste metals such as lead, arsenic, iron, mercury, cadmium, manganese and chromium affect the delicate ecological balance making things very difficult for humans and animals that rely on it for food in the near future. Environmental pollution is at an all-time high, much of it stem from industrial activities such as electronics manufacturing. Use of self-powered nano-robots that can capture heavy metals from contaminated solutions, transport them to desired places and even release them for 'closing the loop' is a robust concept towards tackling environmental pollution.

Keywords: Smart nanodevices, environmental applications, programmable machines, environmental pollution, nano-robots

Nanoeducation; Curriculum Development and Training

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JONPI-A56

Nanonscience and nanotechnology is an emerging field and nano-education is a crucial part to creating awareness necessary for the growth of this highly impacting field. This paper will be focused at:

1. Nanoscience and nano-education curriculum development at the bachelor, masters and PhD levels
2. The training of PhDs to foster the building of nano-educational teachers
3. Publication of nano-educational books and other instructional materials including journals

These objectives can be achieved by formation of first rate nano-academic institutions competitive with anywhere in the world, this is what this paper explores.

Keywords: Nanoeducation, nano-curriculum development nano-instructional material

NANO Science and Technology in North Africa

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JONPI-A57

In recent years, significant progress has been made in developing collaborations between African Countries in nanotechnology. In this presentation; attempt will be made to highlight nanoeducation in North Africa so far and how FONAI-USEACANN will assist in closing the gap of areas of needs. The supports from FONAI, AMANAT AND NANOAFNET acknowledged.

Keywords: Nanoeducation, nanoprogress, NANOAFNET

Nanotechnology: The Past, Present and Future Scenario in Nigeria

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JONPI-A58

Nanotechnology is the creation and utilization of materials, devices and system through the control of matter on the nanometer scale. West and South-East Asia countries has adopted this technology to create high technology in area of electronics, medicine, agriculture and development in area of new material and space. Nigeria nanotechnology is presently at the baby stage which need intense care for maturity to yield advancement in medicine, agriculture, economics, electronics and energy that will bring developmental transformation in Nigeria. Though National Agency for Science and Engineering with National Center of Nanotechnology and Advance Material under its umbrella have been saddles with this responsibility, however Nano education is highly needed. Nanotechnology education involves a multidisciplinary natural science education that provide the most complete and reliable source of information on current developments in nanoscale science, technology, engineering, and medical education. This paper review the past, present advent of nanotechnology in Nigeria in order to direct or redirect the focus of Nanotechnology group to achieve her goals for the country.

Keywords: Nanoeducation, multidisciplinary, nanonatural science

Nanotechnology and Climate Change Mitigation: A Feasibility Study of Socio-Cultural and Economic Acceptability

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JONPI-A59

Global warming with associated effect of climate change is currently the major environmental concern in the world and will most likely continue with this priority for a long period of time. Global warming is usually caused by man-made carbon-associated gas emissions, also known as greenhouse gases, resulting in enormous climate change/concern. The major source of carbon emissions is from the combustion of fossil fuels, such as coal, oil, and gas in power plants, automobiles, emissions from transportation vehicles, industrial facilities. Since the beginning of the industrial era, the total anthropogenic GHG emissions have continued to increase despite a growing number of climate change mitigation policies. According to IPCC, the contribution of the industrial processes to this increase is about 78% of the total GHG emissions increase from 1970 to 2010. The impacts of global warming and climate change are seemed and expected to be severe in the developing countries mainly due to Low GDP, low adaptive capacity, weak institutional frameworks and policies to combat climate change, wide-spread use of fire-woods cooking stoves with low thermal combustion and gas flaring in the Niger-Delta. The problem of global warming and climate change in Nigeria will be exacerbated by existing environmental and social economic challenges, such as population explosion, problem of municipal solid waste management, massive deforestation, desertification in the Sudano-Sahel, high poverty rate, militancy and terrorism. These increases in GHGs contribute to the warming of the earth by increasing the amount of long wave solar radiation that the atmosphere can trap, causing a rise in the global average temperature. For areas in the southern Nigeria, the effects of this rise in temperature, include sea level rise, coastal, flash, river flooding and flood poundage in the urban centers, surface water pollution etc., while in the extreme north of the country, decreasing rainfall amount, heat wave related sickness and encroachment of desert are evident. The 2012 flood which was believed to be caused in part by climate change and release of excess water from Ladgo dam, Republic of Cameroon was the first of its kind the last 40 years in the country. The flood which began in July 2012 killed 363 people, displaced over 2.1 million people across 30 states of the country. In the north, Nigeria loses about 350,000 hectares of land every year to desert encroachment and this has led to demographic displacements in villages across 11 states in northern Nigeria. As huge as the threats are, Nano technology is an emerging technology that has the potentials to mitigate the climate change by reducing CO_2 levels in the atmosphere. Over the years, scientists have developed nanoCO_2 harvesters that can suck atmospheric carbon dioxide and deploy it for industrial purposes. In addition, the technology can efficiently capture toxic pollutants from water and degrade solid waste into useful products, improve energy use efficiency and introduce new energy sources to the market such as photovoltaic technology for solar cells; the hydrogen economy and fuel cells; batteries and supercapacitors for energy storage; and improved insulation for houses and offices. Unfortunately, this technology is still very new in Nigeria and one reason for this, is the ongoing debates on the socio-cultural and economic acceptability of the technology and its consequences, both anticipated and unanticipated. This underscores the need for a detailed feasibility study to determine key social, cultural and economic issues relating to the acceptability of Nanotechnology in climate change mitigation and environmental management, it's social-economic impact as well as improve our understanding of the meeting point of Nanotechnology and Local Content Development in Nigeria.

Keywords: Nanoeducation, global warming, mitigation, socio-cultural acceptance

Nano-agriculture

Nano-genetically optimized Adaptive Neuro-fuzzy Interference System for Plant Food Leaf Quality Detection

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JONPI-A60

The Federal Government of Nigeria in a statement during a non-oil export dialogue convened by the Policy Development Facility Phase II funded by UK Aids said that the failure of manufacturers to conform to global standards in production and packaging explained why some Nigerian food products were rejected in the international market. Similarly, according to the head of inspection of the Nigerian Agricultural Quarantine Service (NAQS) in the South West Zone, Dr. Moses Adewumi, the United Kingdom authorities rejected a consignment (bitter leaf, wrapping leaf, pumpkin leaf, waterleaf, native pear, backyard eggs etc.) of agricultural produce from Nigerian 2018 worth =N= 5million for failing to meet up with the expected quality requirements. These factors and many more like the application of chemicals both for production and preservation constitute reasons why Nigeria's agricultural products are rejected as export commodities in international market. These approaches affect by reducing the quality of agricultural products. As a result, agricultural goods are not only wasted but devalued resulting to loss of huge direct foreign earnings. The effect of this on the country's economy is enormous particularly for a country like Nigeria in which agriculture plays a major role in the economy. The determination of plant food quality cannot be done by farmers but requires expert approach. It requires a mechanism that could detect to a high degree of precision and accuracy, the quality of products based on their physicochemical and microbiological features. Determining the quality of plant food products before exporting will not only save cost of rejection but will also save the image of the country from such attendant shame in the international community. Research will be conducted using multispectral image of the plant's leaves. After processing the images, color wavelet features are extracted and provided to nano-genetically Optimized Adaptive Neuro Fuzzy Inference System (ANFIS) along with the disease types. This system will reorganize accurately the acceptable color.

Keywords: Nano-genetic, neuro-interference, nano-agriculture

Nano-Agriculture: The Implications for Pest Control and Crop Productivity in North-East Nigeria

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JONPI-A61

Food security is and continues to be one of the most discussed and crucial issues amongst developing countries of the world. With the differing interest of conservation of natural habitats and the growing need to maximize food production through prudent use of arable lands; it has become pertinent to employ the best of technology and science such as nanotechnology; an interdisciplinary science with broad applications across various fields and in agriculture; all stages of production, processing, storing, packaging and transport of agricultural produce and products. Our interest is borne out of the need to tackle one of the core challenges in the North east, specifically Gombe State which we have identified as agricultural productivity and pest control. These challenges are exacerbated by the regions vulnerability to desertification, drought and windstorms. Agriculture provides food for humans, directly and indirectly; and as world population increases, there is also a concomitant increase in demand for food. This may result in a serious crisis considering the fact that land; the biggest natural resource is fixed while demand for it is infinite. This research is targeted at solving the problems associated with crop production and aims to provide palliatives that will enable crops to benefit from precision farming techniques, enhanced ability to absorb nutrients, withstand environmental pressures and resist pest and other pathogens. The research will improve, consolidate, and introduce more efficient and targeted use of inputs, disease detection, and control. Other objectives will be to develop effective systems for processing, packaging and storage of agricultural products.
Further, this research presentation will use nanoparticles that have been proven to be eco-friendly to avoid any damage to the ecosystem for nano-agriculture application.

Keywords: Nano- agriculture, Food security, pest control

Bio-efficacy of Silver and Zinc Nano-particles coated with Neem Oil against Rice Weevil

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JONPI-A62

Rice (*Oryzae sativa* L.) is the world's most important domestic food crops providing a staple food for nearly half of the world population. In Nigeria, one of the major reasons for the low yield of rice is depredation by the tropical insect pests called "rice weevil"(*Sitophilusoryzae* L.). Adult weevils feed on rice and lay their eggs inside rice kernels, where the larva can develops to the adult stage. This causes extensive losses in the quality and quantity of commercial products as well as it results in deterioration of seeds. Methyl bromide (Me-Br) and phosphine (PH_3) are used on storages, these may lead to several problems on stored products as well as environment. Therefore, alternatives pests control methods, need to be developed. This research aims to determine the Entomo-toxicity of AgNPs and ZnNPs coated with Neem oil against rice weevil *Sitophilus oryzae* L. **T**he strain of Rice weevil to be used will be collected from farms and rice stores and will be maintained in the laboratory. Specimens used in the bioassays will be adult 7–14 days old. Synthesis of nanoparticles will be carried out as described by Gunalan *et al*. (2011). Toxicity effects of neem oil, Ag coated and Zn-coated NPs on *S. oryzae* will be carried out according to standard methods (with some modifications as necessary). The area preference test described by McDonald *et al*. (1970) will be used to evaluate repellent action of neem oil and Ag and Zn coated NPs on *S. oryzae.* Anti-feedant activities will be assessed by the methods of Keita *et al*. (2001) and Mahdi and Rahman (2008) with some modifications as needed.

Keywords: Nanoagriculture, rice weevil, AgNPs, ZnNPs

Bionanocomposites: Preparation and Properties Evaluation in Food Packaging Materials

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JONPI-A63

Nanotechnology is now recognized as one of the most promising areas for technological development in the 21st century. Nanotechnology involves the characterization, fabrication and/or manipulation of structures, devices or materials that have at least one dimension (or contain components with at least one dimension) that is approximately 1 – 100 nm in length. Nanotechnologies such as nanocomposites would be able to among other things (i) enhance desired properties and (ii) introduce new additional functionalities. In materials research, the development of polymer nanocomposites, for example, is rapidly emerging as a multidisciplinary research activity whose results could increase the applications of polymers to the great benefit of many different industries. The incorporation of nanoparticles to composite materials to produce polymer nanocomposites has generated a great deal of attention due to enhancement of some properties such as thermal, mechanical and gas barrier. Nanotechnology has a great potential because nanostructures display a high surface-to-volume ratio and specific properties. The growing interest in the environmental impact of non-biodegradable wastes has led to numerous studies on the development of materials that degrade more rapidly. Thus, numerous biopolymers have been exploited to develop biodegradable food packaging materials whose properties can be enhanced by the addition of reinforced nanosized compounds or fillers to form composites. To this end, polymer-based nanocomposites packaging materials with bio-functional properties have a huge potential for application in the food packaging industry. The need for the development, characterization and production of low-cost biodegradable nanocomposite packaging materials as a “new trend” in food packaging using polymeric materials is considered an alternative for near – future food packaging materials.

Keywords: Nanocomposites, biodegradable, food packaging

Nanoparticle from Agricultural Waste for Wastewater Nanofiltration

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JONPI-A64

Generating carbon materials as adsorbent for treatment of wastewater from agricultural waste has long been studied with extensive literature because of their large adsorption capacity and low cost, however, recent advancement in this area has specified the use of nano particles as new adsorbents for removal of organic pollutants at low concentration under varied conditions. This research will explore various agricultural waste materials used in the production of carbon nanoparticles (CNPs), as well as methods used to synthesis CNPs and also provide views on the employment of CNPs for the treatment of wastewater contaminated with organic pollutants from industrial and domestic sources. The research will further investigate the impact of CNPs chemistry on it adsorption performance on some substituted phenols. Finally, creation of new pore structures or as-desired pore structures in new hierarchical materials will be investigated.

Keywords: Nanoparticles, carbon, agricultural waste, organic pollutants

Application of Nanotechnology in Food Packaging

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JONPI-A65

This study was conducted to develop and characterize cassava starch zinc-nanocomposite films for fruits and vegetables packaging. Nanocomposite biodegradable films were produced by blending cassava starch, zinc nano particle and plasticizer (glycerol). Cassava starch was obtained from fresh harvested cassava tuber, zinc nano particle was produced in the laboratory from zinc acetate, and glycerol was purchased from a local shop. Blending ratios of 1000 g cassava starch, 45, 50 and 55 % (w/v) glycerol and 0, 1, and 2 % (w/v) zinc nanoparticles were formulated, mixed and homogenized, with the help of the screw mixer, to form the nanocomposites, which was then dried in oven at 50 ^{o}C for 48 hours, after which it was ground to powder. Thermoplastic were prepared, from a dispersed mixture of 24 g of the nanocomposites and 600 ml of distilled water, and heated to 90 ^{o}C for 30 minutes, then poured in to a mould to cast. For each composite three different thickness (15, 16, and 17µm) of the film was produced. The films were characterized and optimized based on their barrier, thermal, mechanical and structural properties. The optimum qualities of films based on the properties studied were obtained for the values of Glycerol: Zinc nanocomposite: film thickness 50:1:17; 55:1:17; 55:2:17 respectively. The microbial and quality parameters, including β-carotene and ascorbic acid of okra, cucumber, tomatoes and garden-eggs were determined after packaging, for a period of 9 days in the temperature range of 10–27 ^{o}C, using the optimally selected films and a 10 µm low density polyethylene (LDPE) material as control. The results of the characterized attributes of the film revealed that the oxygen and water vapor permeability increased with glycerol concentration and decreased with thickness; but the full width at half maximum (FWHM) and d- spacing increased with thickness. The higher degree of d- spacing obtained is a consequence of higher polymer intercalation and exfoliation. Also, only 2 % degradation of the films were observed on exposure to temperature ≤ 100 ^{o}C; indicating that they are thermally stable and can be used for packaging applications in the tropics. The results of the effects of temperature, period and packaging material on the microbial and quality attributes of the fruits and vegetables revealed that the films containing 1 and 2 % zinc nanoparticles suppressed the growth of microorganisms and retained quality than the LDPE film at 27 ^{o}C and day 9 of packaging. The result shows that addition of zinc nanoparticle improved the quality of the biodegradable packaging material for fruit and vegetable.

Keywords: Nanoagriculture, nanoparticle, packaging, food science

Weed Management using *Sida cordifolia* Nanoemulsion for Sustainable Agriculture

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JONPI-A66

As demand increases for sustainable agriculture and concern grow regarding the extensive use of synthetic chemicals, contamination of environment, herbicide resistance, increasing cost, soil acidity and insect pest, attention is focused on reducing reliance upon synthetic herbicides and finding alternative strategies for weed management. *Sida cordifolia* (family Malvaceae) is one of the invasive weed specie in northern Nigeria whose allelopathic effect, though recognized are not yet fully established. The role of allelopathy (positive or negative) of *S. cordifolia* extract nanoformulation will be determined in a set of experiments (in vitro and in situ). Nano emulsions can be used in agriculture for formulation of natural herbicide which could be effective with improve penetration ability at low dose, reduce residual effect on soil and environmentally friendly. The result of this study is expected to generate information on germination inhibition, growth response and identification of phytochemical compounds of *S. cordifolia* using HPLC and GC-MS. The objective of this research is to evaluate the phytotoxicity performance of nanoformulation of *S. cordifolia* leaf extract on growth of *Lactuca sativa, Lycopersicon esculentum, Zea mays, Ipomea asarifolia, Senna obtusifolia* and *Senna occidentalis*. The extract would be prepared followed by particles stabilization and characterized using a Particles Size Analyzer (PSA). Data collection on germination index, seedling growth, biomass, chlorophyll content,amino acid, relative membrane permeability RMP, response index (RI), Synthetic allelopathic index (SE), MDA content, and enzyme activities (SOD, CAT) would be determined. The overall finding could enhance our understanding of allelochemical inhibition; elucidate mechanism of allelopathins interference and potential application of nanoemulsion of *S. cordifolia* extract as template for natural herbicide.

Keywords: Nanoemulsion, nanoagriculture, phytotoxicity, germination

Nano-remediation of Petroleum contaminated Agricultural Soil

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JONPI-A67

Contamination of agricultural soils by petroleum hydrocarbon is an environmental concern in agriculture. Nano-remediation can be used to resolve this problem of environmental pollution; thereby making the soil available for nano-agriculture. This research focuses on modelling soil spectra of petroleum-contaminated sites using chemometrics and visible/near-infrared (vis-NIR) diffuse reflectance spectroscopy (DRS) for monitoring soil pollution and remediation.

Keywords: Nano-agriculture; Nano-remediation; DRS; Sustainable Agriculture

Nanotechnology and *in Situ* Remediation

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JONPI-A68

Maintaining and restoring the quality of air, water and soil is one of the great challenges of our time. Most countries face serious environmental problems, such as the availability of drinking water, the treatment of waste and wastewater, air pollution and the contamination of soil and groundwater. In many cases, conventional remediation and treatment technologies have shown only limited effectiveness in reducing the levels of pollutants, especially in soil and water. Nanotechnology promises a potential revolution in approaches to remediation. Nanoremediation has the potential not only to reduce the overall costs of cleaning up large-scale contaminated sites but also to reduce cleanup time, eliminate the need for treatment and disposal of contaminated soil, and reduce some contaminant concentrations to near zero—all *in situ*. Nanomaterials have highly desired properties for *in situ* applications. Because of their minute size and innovative surface coatings, nanoparticles may be able to pervade very small spaces in the subsurface and remain suspended in groundwater, allowing the particles to travel farther than larger, macro-sized particles and achieve wider distribution. *In situ* nanoremediation methods entail the application of reactive nanomaterials for transformation and detoxification of pollutants *in situ*. These nanomaterials have properties that enable both chemical reduction and catalysis to mitigate the pollutants of concern. No groundwater is pumped out for above-ground treatment, and no soil is transported to other places for treatment and disposal. Soil and groundwater contamination are closely linked. Methods targeting soil contamination indirectly affect the quality of the groundwater, and vice versa therefore a summary of the nanotechnologies used for soil and groundwater remediation will be made. New and more effective applications (on in situ soil/groundwater remediation) are therefore needed and will form the focus of my research. Proper evaluation of nanoremediation, particularly full-scale ecosystem-wide studies, needs to be conducted to prevent any potential adverse environmental impacts.

Keywords: Nanoremediation, nanoagriculture, groundwater, contamination, environmental impacts.

Clay-Plant Extract Nano Composite for Corrosion Inhibition of Mild steel in Alkaline medium

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JONPI-A69

The uses of nano materials for the inhibition of metals have proofed to be more efficient than the conventional inhibitors. This work focused on the use of nano composite materials obtained from plant extract for inhibition of mild steel. Nano particles was synthesized from *sida acuta* plant extracts by isolating active components of the extract and mixed with metal solution. A nano composite was made by mixing calculated amount of the as-prepared plant extract nano particle with modified natural red clay to form a nano composite inhibitor. The prepared clay-metal nano composite inhibitor was characterized using XRD, SEM, EDS and particle size analyzer. The developed green nano composite was investigated using weight loss and gasometric experiments. The inhibition efficiency was 67% when plant extract alone was applied to 76 % when the nano composite mixture was used. SEM image of mild steel with extract revealed the high degree of protection provided by mixed nano composite plant extract with mild depletion of material surface covered with oxide films. EDX spectrum showed prominent iron peak, as base material to depict reduction in lost of material due to inhibitory effect of the nano composite with high value of 78.06 % iron, 6.22 % carbon due to the presence of plant extract and 15.71 % Oxygen. The synthesized nano composite showed improved efficiency.

Keywords: Nanoagriculture, clay, nanocomposite, corrosion inhibition, mild steel

Cytotoxic Assessment of Calcium Nanoparticles-Remediated Polycyclic Hydrocarbon contaminated Water *Amaranthus caudatus*

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JONPI-A70

Crude oil spillage and pipe leakages have made farming more difficult for peasant farmers who depend on flowing water especially river water. This is due to the contamination of crude oil components especially polycylic aromatic hydrocarbon which affect the quality of water and are carcinogenic to humans. Nanoparticles have been reported to be excellent adsorbent for heavy metals, dyes and organic contaminants. However, the cytotoxic assessment of such remediated water on nutritional composition of vegetables for which the adsorption is performed has not been or scarcely reported. The study will focus on the synthesis of biogenic calcium nanoparticles using the stems of *Corchorus olitorius* and its use for remediating simulated naphthalene contaminated water. The remediated water will be used to grow *Amaranthus caudatus* to assess the possible effects it could have on its nutritional and bioactive contents. The effects of remediated water will also be assessed on the population of beneficial microorganisms and possible changes in their genes

Keywords: Nanoagriculture, nanobioremediation, *Amaranthus caudatus*

Nanogenetically Modified Crops: Past, Present and Future Part 2

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JONPI-A71

Before now, improvement in quality and quantity of agricultural crop produce was mainly guided by the principles and application of fertilizers, timely planting and later, breeding techniques, among other approaches. Research on agricultural nanogenetics has been ongoing for largely a decade, searching for solutions to several agricultural and environmental challenges, such as sustainability, improved varieties and increased productivity. The current challenges of pests and disease attacks, food security and climate change are engaging researchers in exploring the field of nanogenetics as new source of key improvements for the agricultural sector. Despite the huge potential benefits, the application of nanogenetics in agriculture are still comparably marginal and have not yet made it to the market, to any large extent in comparison with other industrial sectors; even when recent studies demonstrated that public opinion is not negative towards genetically modified crops (GMCs). On the other hand, the concept of genetically modified organisms (GMOs); especially in continent like Africa, has been greeted with criticisms and scepticisms; with the insinuations that products of this technology could raise bio-safety concerns. However, this belief is gradually phasing out, through public enlightenment and mass education. By this review, it is believed that rapid progress of nanotechnology in other key industries will over time be transferred to agriculture, which will in turn facilitate their development. In order to achieve this, new nanoscience regulations by various continents should focus on creating enabling environment for more investment opportunities in nanoagriculture, provide new awareness mechanism; especially in the developing countries and lastly, initiate new regulatory framework for the few products already on the market. This will no doubt enhance public perception and acceptance of genetically modified crops (GMCs). This presentation will highlight all these, among others

Keywords: Nanogenetics, nanoagriculture, GMCs

Nanogenetically Modified Crops Past, Present and Future Part 1

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JONPI-A72

In most developing countries and the world at large, agriculture is becoming their backbone and as the populations increases the demand for more food is experienced. The growing problems of land availability due to global urbanization, drought, crop pest and diseases, unpredictable climate change, use of chemicals and infertile soil has led to the use of modern technologies. The rising awareness that only conventional farming technologies may not increase crop production, produce healthy crops and ensure food security has led to application of nanotechnology in agriculture in producing nanogenetically modified crops. This technology will ensure controlled release of agrochemicals and site targeted delivery of various macromolecules needed for improved plant disease resistance, enhanced plant growth and efficient nutrient utilization. Nanogenetically modified crops are plants used in agriculture, the DNA of which has been modified using genetic engineering methods to improve yield, resistance to drought, frost or insect pest, diseases, enhance nutrition value and longer shelf life. Mostly the aim is to introduce a new trait to the plant which does not occur naturally in the crops. Nanoencapsulation processes show great uses on more efficient use and safer handling of pesticides with less environment exposure. The effects and uptake efficiency of nanoparticles on the crop growth, metabolic functions vary differently among plants and the use of nanosensors in monitoring of the soil conditions. Plant transformations are mediated by a nanoparticle which leads to genetic modification of plant for further improvement and increase in yield. Nanobiotechnology offers new set of tools to manipulate the genes using nanoparticles, nanofibers, nanotubes, nanoribbons and nanocapsules. Nanomaterials properly functionalized serve as a medium to transport large gene as well as chemicals that trigger gene expression in plants. Nanogenetically modified crops if properly utilized and regulated will contribute significantly to global food security and poverty reduction. This presentation will highlight all this as a review.

Keywords: Nanogenetically modified crops, nanobiotechnoloy, food security, nanoparticles, agriculture

The Nano Age of Nano-Genetically Modified Crops

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JONPI-A73

Feeding the growing human population globally entails a drastic approach that leads to increase in crop yield, plant pest/disease resistance and improved nutrition. To achieve these goals, existing breeding practices must be complimented with new techniques built from resent gain from genomic sequencing and the knowledge from genetic determinants underlying the agricultural traits responsible for crop yield and quality. Nanotechnology is gaining an increased interest in crop science especially in the application of nanoparticles. The use of nanoparticles for trans-membrane delivery of DNA into animal cell is now a popular trend globally. The different between cell-wall-free animal cell and cell-wall-bearing plant cell present a major challenge for using these nanoparticles in plant research. First research on the use of nanoparticles for gene transformation in plant demonstrate that mesoporouse silica nanoparticles (MSNs) and small surface functionalized nanoparticles (SSFNs) can be used to deliver both DNA and chemicals into either isolated plant mesophyll cell or intact plant leaves. They are also able to encapsulate chemicals in the pores and their surface be coated with DNA molecules. This work overviews the development of crop transformation techniques to the nanotechnology age. it presents new possibilities for crops basic research for improving plant productivity, optimize and automate water and agrochemical allocation, and enable high-throughput plant chemical phenotyping, reducing crop loss due to environmental and pathogen-related stresses, improving resource use efficiency and selecting optimal plant traits

Keywords: Nano-genetically-modified-crops, nanotechnology, nano-agriculture, crop improvement, biotechnology