List of Participants – 12th ANCAP Symposium
2nd – 4th December 2019, Dar es Salaam

S/N	Name	Country
1.	Dr. Deborah A. Abong'o	Kenya
2.	Mr. James Mbugua	Kenya
3.	Ms. Veronica Muinde	Kenya
4.	Dr. John Wasswa	Uganda
5.	Dr. Alfred Mubiru	Uganda
6.	Prof. Mark Zaranyika	Zimbabwe
7.	Prof. Pamhidzai Dzomba	Zimbabwe
8.	Prof. Rufus Sha’Ato	Nigeria
9.	Dr. Sylvester M. Tongu	Nigeria
10.	Prof. Nabil Bashir	Sudan
11.	Prof. Yousif O. H.M. Assad	Sudan
12.	Mr. Kefyalew Gomoro	Ethiopia
13.	Dr. Abera Gure Tufa	Ethiopia
14.	Prof. Theoneste Muhizi	Rwanda
15.	Dr. Jean Bosco Nkuranga,	Rwanda
16.	Dr. Aviti Mmochi	Tanzania
17.	Dr. Regina Peter	Tanzania
18.	Prof. John Mahugija	Tanzania
19.	Dr. Clarence Mgina	Tanzania
20.	Prof. Esther Lugwisha	Tanzania
21.	Dr. Makungu Madirisha	Tanzania
22.	Dr. Kessy Kilulya	Tanzania
23.	Ms. Tertula T. Gabriel	Tanzania
24.	Mr. Omary Swalaudini	Tanzania
25.	Mr. Cosma M.Kindole	Tanzania
26.	Mr. Lubaga G. Erasto	Tanzania
27.	Mr. Mramba Adam	Tanzania
28.	Mr. Ernest P. Lasti	Tanzania
29.	Dr. Fortunatus Rwegsira	Tanzania
30.	Dr. Quintino Mgani	Tanzania
31.	Dr. Grace Kinunda	Tanzania
32.	Camila Renson	Tanzania

12th ANCAP SYMPOSIUM

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The Twelfth Symposium of the African Network for Chemical Analysis of Pesticides and Other Pollutants (ANCAP)

2nd - 14th December 2019,
University of Dar es Salaam, Tanzania

ABSTRACTS

LECTURES

L 01

ANCAP Performance in 2018

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Abstract

The presentation is a summary of activities and performance for January to December 2018. The presentation discusses the main objectives of ANCAP for the triennium and gives a summary of the achievements for the last year of the triennium 2016-2018. The main achievements are on the very successful meeting that took place in Rwanda, the number of graduands during the year, publications promotion, public service and promotion of ANCAP. Further to this the presentation highlights opportunities in ANCAP for research, exchange of students and staff, repair of instruments etc. Lastly the presentation will highlight the objectives on 2019 – 2021 and the meeting with between African and European Scientist that took place in Ethiopia in October 2019 that was also attended by ANCAP

L 02

Effects of Industrial Processing on the Levels and Fate of Pesticide Residues in Tomato Products

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Abstract

This study investigated on how industrial processing operations affect the levels and chemical compositions of pesticide residues contained in tomatoes. The analytes in cleaned-up extracts of raw and processed tomato samples were analysed using gas chromatography-mass spectrometry (GC-MS). The detected pesticide residues in the samples included chlorothalonil, pirimiphos-methyl, chlorpyrifos, profenofos, endosulfan sulfate, lambda cyhalothrin, cypermethrin and metalaxyl. In general, the processed tomato products showed significantly reduced concentrations of the pesticide residues. The effects of unit industrial processing operations for tomatoes (e.g., washing, pulping and thermal processes) showed to degrade and/or eliminate the pesticide residues. Thermal processes were found to reduce more pesticide residues than other processes. The concentrations of the pesticide residues in the processed tomato samples were generally below the Maximum Residue Limits (MRLs) set by FAO/WHO, except in some tomato paste samples. Among the processed products, tomato sauce samples were found to be the least contaminated while tomato paste samples were the most contaminated. The findings are explained by the concentration effects for the case of tomato paste and the dilution effects for the case of tomato sauce. The levels of the pesticide residues in unprocessed tomato samples and tomato pomace samples were enormously high. The concentrations of the compounds were higher in pomace samples than in the unprocessed samples and this could be due to the fact that the pomace includes the skin that has a tendency to retain the residues.

L 03

Application of Entomopathogenic Fungi as Potential Bio-Pesticide against *Tuta absoluta.*

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b Department of Chemistry, University of Dar es Salaam

Abstract

Bio-pesticides are types of pesticides derived from living organism such as animals, plants, bacteria, fungi and certain minerals. Entomopathogenic fungi are alternatives to chemical pesticides and among the methods for pest control. The virulence of these fungi have been tested under the laboratory conditions successfully and the selected species are evaluated under the field conditions with major success. Due to efficiency of bio-pesticide, products can be commercially available to control pests and disease.

Tomato is among the potential vegetable fruit to human diet. In Tanzania, tomato has been vulnerable to various pests and *Tuta absoluta* is the most devastating pest destroying up-to 100% of the harvest. Currently the chemical pesticides have not given the promising results, hence an alternative control must be established. To the best of the literature surveyed, entomopathogenic fungi such as *Metarhizium spp* and *Beauveria spp* has been suspected to be the most virulent species of EPF against crop pests. Therefore, the limited information on the use of these fungal species in Tanzania has encouraged further need for their investigation in this study.

In this study, these fungi were isolated from soil of the tomato fields through a selective and semi-selective media for EPF to obtain pure isolates. Pure fungi were tested for hydrolytic enzyme production, as the virulence against pests involves the combination of enzymatic degradation by endoproteases, aminopeptidases and acetyl-glucoseaminidase. Spore suspension of nine samples of entomopathogenic fungi were quantified to the most virulence concentration of 2.5×10^7conidia per mL using neubaour heamocytometer as per Tadales et al. (2017). *Tuta absoluta* larvae were collected from tomato plants at green house to manifest pesticidal effect of the fungi. Mortality of larvae was monitored from the first 24 hours of manifestation of fungi to 14th day and results were established. The dead larvae were collected from petri-plates and kept in humidity to promote fungal development and sporulation in order to confirm that the larvae died due to infection by each particular fungal strain. The cadaver were placed under the microscope to confirm sporulation.

The 6 fungal isolates performed maximum mortality with confirmed sporulation and are expected to be identified by DNA extraction, sequence analysis of the extracted DNA and the resulting sequence are aligned by a specific tool in a genome database to identify the fungi.

L 04

Investigations on the Efficiency of Raw and Activated Sugarcane Bagasse in the Removal of Phenolic Compounds from Water

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Abstract

The work aimed at investigating the efficiency of raw and activated sugarcane bagasse in the removal of phenol and 4-chlorophenol from water. For this purpose, the prepared adsorbents were characterised by using FTIR, TGA while the adsorption experiments were performed by using UV-Vis. Based on the experimental results, it was found that for efficiency removal of phenol and 4-chlorophenol was achieved with 0.5 g with high efficiency removal of 95.6% and 90.6% for phenol and 4-chlorophenol, respectively adsorbed onto activated sugar cane bagasse (ASCB) compared to raw sugarcane bagasse (SCB) and carbonised sugarcane bagasse (CSCB). In addition, the same efficiency removal was achieved for contact time of 3 h and 20 mg/L of initial adsorbate concentration in the removal of phenol and 4-chlorophenol. The optimum pH for maximum adsorption of phenol and 4-chlorophenol were found between 6 and 8 with maximum efficiency removal of 89.7% and 92.0% of phenol and 4-chlorophenol, respectively onto CSB compared to ASCB and SCB. The thermal gravimetric analysis showed the thermal stability of temperature between 200-400 ºC and 600-800 ºC, where sugarcane bagasse decomposed at temperature between 400-600 ºC. In order to describe the adsorption mechanism of adsorbate vis-à-vis adsorbents (SCB, CSCB and ASCB), the functional groups were identified as the cause of differences in adsorption as it was revealed by FTIR analyses. Amongst substantially functional groups that were found include –OH (C-OH, P-OH, COOH,) C=O, C=C (in aromatic ring), C-O (ethers, esters). Furthermore, phenol adsorption fitted excellently to the Langmuir onto CSCB, which indicated monolayer and homogeneous adsorption mechanism while 4-chlorophenol fitted with the Freundlich adsorption onto ASCB with predominance of physical adsorption on heterogeneous site. Furthermore, the adsorption was spontaneous and respected pseudo-first-order kinetics model.

Key words: Sugarcane bagasse, adsorption, phenol, 4-chlorophenol, activated carbon

L 05

Evaluation of the Efficiency of Bacterial Species Isolated from Soil in Bioremediation of Diazinon, Pirimicarb and Atrazine Pesticides

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There is a great concern of pesticides contamination in soil, air, water, food and the environment. Soils are contaminated with pesticides residues due to excessive application of agrochemicals. Removal of pesticides residues is vital for soil and food production. The objective of this research work is to evaluate the bioremediation efficiency for pesticides utilizing bacteria species as source of carbon. Three pesticides namely Diazinon, Pirimicarb and Atrazine and three bacterial species; *E.coli, Salmonella* and *Staphylococcus;* isolated from soil were studied for this purpose. Single and different combination of pesticides concentration levels of 10, 25 and 50 ppm were prepared, assayed and tested for pesticides bioremediation with different combinations and concentrations of bacterial species cultured in broth media. Bioremediation of pesticides were calculated in concentration percentage after 24 hours. Results showed that for the three pesticide concentrations 10, 25, and 50 ppm, *Staphylococcus* was highly efficient on Diazinon removal by 62%, 63.2% and 68.6%, respectively; Pirimicarb removal was 44%, 52.4% and 53.8% respectively; Atrazine removal was 61%, 65.6% and 70.6% respectively. Efficiency of *E. coli* removal on Diazinon was 59%, 60.8% and 63.8%; on Pirimicarb was 44%, 52.4% and 53.8%; Atrazine 57%, 60.8% and 64.4%. *Salmonella* efficiency on Diazinon bioremediation was 49%, 51.2% and 55.8%; on Pirimicarb removal was 61%, 63.2% and 68.4; and on Atrazine biodegradation was 48%, 50.4% and 57.2%. Mixture of *Salmonella* and *Staphylococcus* bacteria showed remediation of 64.8% for Atrazine, 74.4% for Diazinon and 75.7% for Pirimicarb. The combined effects of *E. coli* and *Staphylococcus* bacteria resulted in pesticide removal in the following order; Atrazine 66.8%, Diazinon 76.3% and Pirimicarb 77.7%. The combination of *E. coli* and *Salmonella* give rise to 60.5% removal of Atrazine 72.7% for Diazinon and 49.7% for Pirimicarb. When the three species of bacteria mixed together, their combined effect was 83.4% on Pirimicarb bioremediation; 82.0% on Diazinon and 69.1% on Atrazine. The highest significant value of interaction between a mixture of bacteria and pesticides in bioremediation of pesticides was recorded for all bacteria with Pirimicarb and the lowest value was found for *E.coli* and *Salmonella* with Pirimicarb. Results showed cell growth rate of 32.22×10^4 for diazinon, 30.43×10^4 for pirimicarb and 31.43×10^4 for atrazine. *Salmonella* bacteria showed the lower growth rates compared to other species. The rate of growth on diazinon was 21.58×10^4, pirimicarb 22.89×10^4 and on atrazine 20.71×10^4 respectively. Bacteria efficiency on bioremediation of pesticides from contaminated soil is promising and could be used safely for cleanup, yet more research on mechanisms and kinetics needs to be further investigated.

L06

Levels of Polybrominated Diphenyl Ethers (PBDEs) in Water and Sediment from Open City Drains in Makurdi Metropolitan Area, North Central Nigeria

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Abstract

Polybrominated diphenyl ethers (PBDEs) have been classified as persistent organic pollutants (POPs) as well as endocrine-disrupting compounds (EDCs). This study determined the concentrations of six PBDE congeners (BDE 47, BDE 99, BDE 100, BDE 153, BDE 154 and BDE 183) in water and sediment samples from open city drains, in the Makurdi Metropolitan Area, North Central Nigeria, using gas chromatogragh – mass spectrometer. These congeners are components of the penta- and octaBDE formulations that have been banned by the European Union. The samples were collected from the drains, bi-monthly, for one year across dry and wet seasons. All the congeners considered were found to be present in both water and sediment. The levels of Σ_6PBDEs in water ranged from 0.05 – 0.28 ngL^{-1} during dry season and 0.02 – 0.36 ngL^{-1} during wet season while their levels in sediment during dry and wet seasons ranged from 3.22 – 26.26 ngg^{-1} and 7.51 – 27.41 ngg^{-1} respectively. The percentage recoveries from solid phase and Soxhlet extractions ranged from 69 – 104 % and 70 – 112 % respectively. It was concluded that the presence of all the congeners in both water and sediment posed a pollution risk to the river in which the drains discharge and requires further monitoring and necessary preventive measures.

Keywords- Gas chromatograph – mass spectrometer, polybrominated diphenyl ethers, sediment, city drains

L07

Dissipation of Chlortetracycline in the Aquatic Environment: A generalized Multi-Phasic Pseudo-Zero Order Rate Law

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Abstract

The kinetics of the dissipation of chlortetracycline in the aquatic environment was studied over a period of 90 days using microcosm experiments and distilled water controls. The distilled water control experiments, carried out under dark conditions as well as exposed to natural sunlight, exhibited biphasic linear rates of dissipation. The microcosm experiments exhibited triphasic linear rates of degradation both in the water phase (2.7×10^{-2}, 7×10^{-3}, 1.3×10^{-3} µgg^{-1}day^{-1}) and the sediment phase (3.4×10^{-2}, 6×10^{-3}, 1×10^{-3} µgg^{-1}day^{-1}). The initial slow rate of dissipation in the dark control (3×10^{-3} µgg^{-1}day^{-1}) was attributed to a combination of evaporation and hydrolysis, while the subsequent fast rate (1.8×10^{-3} µgg^{-1}day^{-1}) was attributed to a combination of evaporation, hydrolysis and microbial degradation. For the sunlight exposed control, the initial slow rate of dissipation (1.5×10^{-3} µgg^{-1}day^{-1}) was attributed to a combination of evaporation, hydrolysis and photolysis, while the subsequent fast rate was attributed to a combination of evaporation, hydrolysis, photolysis and microbial degradation (5.1 x 10^{-3} µgg^{-1}day^{-1}). The initial fast rate of dissipation in the water phase of the microcosm experiment is attributed to a combination of evaporation, hydrolysis, photolysis and microbial degradation, while all subsequent slow rates in the water phase, and all rates of degradation in the sediment phase are attributed to microbial degradation of the colloidal and sediment particle adsorbed antibiotic. A multi-phase zero order kinetic model is presented that takes into account (a) dissipation of the antibiotic via evaporation, hydrolysis, photolysis, microbial degradation, and adsorption by colloidal and sediment particles, and (b) the dependence of the dissipation rate on the concentration of the antibiotic, type and count of microorganisms, and type and concentration of colloidal particles and sediment particle adsorption sites within a given aquatic environment.

Keywords: Chlortetracycline, dissipation, zero order kinetics, microbial degradation, adsorption, hydrolysis, photochemical degradation.

L 08

Ionic Liquid Based Dispersive Liquid-Liquid Microextraction for the Determination of Sulfonylurea Herbicides from Wine Samples by Capillary HPLC-DAD

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Abstract

Sulfonylurea herbicides (SUHs) are used worldwide for the control of many grasses and most broad-leafed weed species. SUH products are the second most common kind of herbicides after the glyphosates and more than 30 products have been commercialized. In this work a sensitive capillary high performance liquid chromatography coupled with diode array detection (capillary HPLC-DAD) method has been developed for the quantification of four SUHs from wine samples. The separation was achieved in 24 min, using a Luna C_{18} column (150 mm × 0.3 mm I.D., 5 µm particle size) at 25 °C, with a binary mobile phase consisting of eluent A (water) and eluent B (acetonitrile), both containing % acetic acid. Moreover, a new sample treatment, namely, vortex-assisted ionic liquid dispersive liquid–liquid microextraction (VA-IL-DLLME), has been proposed for extraction of SUHs in the wine samples. IL, 1-hexyl-3-methylimidazolium hexafluorophosphate ([C_6MIM][PF_6]), which was used as extraction solvent, was dispersed into the sample solution using methanol, assisted by a vortex mixer. Various parameters influencing the extraction efficiency, such as type and amount of IL, type and volume of disperser solvent, sample pH, salting-out effect, vortex and centrifugation time were studied. Under the optimum conditions, the limits of detection and quantification of the proposed method were in the ranges of 3.2–6.6 and 10.8–22.0 µg kg^{-1}, respectively; lower than the maximum residue limits set by the EU for wine grapes and the default value of 10 µg kg^{-1} established for matrices not included in the regulation. The developed VA-IL-DLLME-capillary HPLC method is simple, rapid, cheap and environmentally friendly and could be successfully utilized for the determination of SUHs in wines and other similar samples for routine quality control.

Keywords: Ionic liquid; Dispersive liquid–liquid microextraction; Wine samples; Sulfonylurea herbicides; Capillary HPLC-DAD.

L 09

Heavy Metals in Water Collected from Water -harvesting Ponds (Haffirs) , Gedarif State, Eastern Sudan

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Abstract

Water quality is of great concern. The heavy metals (HMs) levels in the water-harvesting ponds (haffirs) water may cause serious health problems, including cancers. This study investigated the concentration of 13 HMs in haffirs water in Gedarif State, Eastern Sudan where the inhabitants completely dependent on them (drinking, washing, bathing, irrigation, etc.). Three locations and types of haffirs will were selected for this study, and 24 water samples were collected in plastic bottles were collected from July 2015 to Feb. 2016 ; preserved by adding of 2-3 drops of nitric acid. These samples were subjected to analysis for Cu, Fe, Zn, Mo, Ni, Cr, Pb, Co, V, Sr and Cd, Mn, Ti by using Inductively Coupled Plasma optical emission (ICP-OE). The obtained concentrations were compared with drinking water quality limits given by the WHO. This indicated that haffir water is highly toxic for haffir water samples were found to be enriched and polluted which may as consequence of human and animal activities and Municipal waste. Around 200 m from the stream (khour) in this area. Significant differences were detected between haffirs at ($p < 0.05$). The results for the three haffirs regarding Pb were ranging between 1.08-.269 ppm), for Cu from 0.462 - 1.49 ppm), Zn from 0.021- 0.148ppm, Fe from 2.5- 9.16 ppm), Co 0.0018ppm), Cd 0.0009 ppm) , Mn^{+2} from 1.13- 2.191ppm), Ni from .0076- 0.085ppm, Mo from 0.054 - 0.51ppm) , Sr from 0.4 - 4.37 ppm), V from 0.017- 0.029 ppm), and Ti from (0.004. - 0.007 ppm, Cr from 0.0013.0-0.0031 ppm. Pb ,Fe, Mn, V ,Ti and Sr were higher than their permissible limits (PLs) according to WHO (2004) for the three haffirs.

Keywords: *water harvesting ponds, heavy metal, water contamination, Gedarif, Sudan.*

L 10

Determination of Residue Levels of DDT and its Metabolites in *Khat* and Cabbage Samples using QuEChERS Sample Preparation Method

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Abstract

A simple and selective quick, easy, cheap, effective, rugged and safe (QuEChERS) extraction technique coupled with gas chromatography mass spectrometric detection (GC-MS) was developed and validated for simultaneous determination of 1,1,1-trichloro-2,2-di(4-chlorophenyl)ethane (p,p'-DDT) and its main metabolites 1,1-dichloro-2,2-bis(4-chlorophenyl) ethylene (p,p'-DDE) and 1,1-dichloro-2,2-bis(4-chlorophenyl) ethane (p,p'-DDD) in cabbage and *Khat* samples. Parameters that primarily affect the extraction efficiency of the analytes were optimized. The significance of the use of cleanup was investigated and its optimum amount was found to be 6 mg PSA and 12 mg C_{18}. The optimum values for acetonitrile volume and pH of the sample was found to be 3 mL and 7, respectively. The linearity of the analytical response was acceptable with correlation coefficients of greater than or equal to 0.992. The precision associated with the analytical method, expressed as %RSD were lower than 8.6 and 9.1% for the intraday and interday precision, respectively. The limit of detection (LOD) and limit of quantification (LOQ) of the proposed method for cabbage sample were in the range of $2x10^{-5}$–$4x10^{-5}$mg/kg and $9x10^{-5}$–$14x10^{-5}$mg/kg respectively. The LOD and LOQ of the proposed method for *Khat* sample were in the range of 2x10^{-5}–6x10^{-5} mg/kg and 7x10^{-5}–19x10^{-5} mg/kg, respectively. The recoveries of the method were ranging from 97.16 to 107.99 for cabbage and 72.1 to 90.55 for *Khat* sample. The analytical applications of this method indicates the presence of p,p'-DDE, p,p'-DDD and p,p'-DDT in both cabbage and *Khat* samples. The amount of p,p'-DDE, p,p'-DDD and p,p'-DDT in cabbage were found to be 0.004, 0.01 and 0.01 mg/kg, respectively. The p,p'-DDE, p,p'-DDD and p,p'-DDT in *Khat* were found to be 0.01, 0.03 and 0.07 mg/kg, respectively. The results indicate that there should be continuous monitoring of DDT and its metabolites residues in cabbage and *Khat* samples which in turn is helpful to assess the potential risk of these products to consumers' health.

Keywords: *QuEChERS, Extraction method, GC-MS, Cabbage, Khat*

L 11

Levels of Mercury in Soil, Vegetables and Rice in the Vicinity of Small Scale Gold Mining Along Lake Victoria Regions in Tanzania

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Abstract/Concept Note

Small-scale gold mining is one of the source of environmental contamination that generates large quantities chemical wastes such as heavy metals that are pronounced to cause burden to the ecosystem. The most common methods used in small-scale gold mining are mercury amalgamation and cyanidation leaching. Mercury and its forms (species) are more persistent than cyanide and are reported to be carcinogenic and neurotoxic. Mercury and its forms enter the food chain as a result of their uptake by biota and undergo both bio-concentration and bio-magnification. Tanzania is endowed with abundance of gold and this has fueled the rise of small scale gold mining in many regions such as Mwanza, Geita, Mara, Manyara, Singida, Dodoma, Morogoro, Mbeya, Iringa, Rukwa and Kagera. Despite the efforts on mercury studies which have already been done, there are some areas with active small scale mining activities which have not yet been investigated to the best of our knowledge. This triggers a need to investigate on the levels of mercury and its forms in soil, vegetables and rice at Nyarugusu, Mgusu, Mwabomba, Bingwalifu, Nyakafuru, Shenda and Ishokelahela villages located in Mwanza and Geita regions. Samples will be collected within 2 km from the point sources. Systematic sampling procedures will be used for soil samples while random sampling for vegetables and rice samples. Samples will be prepared and subjected to Direct Mercury Analyzer (DMA) and Inductive Coupled Plasma Mass Spectrometry (ICP-MS). The findings from this study are expected to provide awareness to the government, researchers and public at large on levels of mercury in small-scale gold mining, which in turn will also fuel a search for eco-friendly alternative technique for gold extraction.

L 12

Levels of Mercury, Cyanide, and their Salt Complexes in Tailings, Water and Maize Crops around Chunya District Gold Mining Areas

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Abstract/Concept Note

Gold mining is an industry that deals with the gold extraction where mercury and cyanide are among chemicals that are used during the process of its recovery, which are then released to the environment as wastes in different chemical forms (salts). Mercury, cyanide and their salts pose serious threats to the environment, public health and life at large. They can cause a number of adverse effects on reproduction, immune system, liver, kidney, convulsions and cardiovascular in organisms, to mention a few. Researches on mercury, cyanide and their salts in different large scale gold mining areas such as Buzwagi, Geita and Kahama gold mining have been conducted, however, not much have been done on small scale gold mining such as Chunya district. Thus, this study aims to investigate the levels of mercury, cyanide and their salt complexes in tailings, water and maize crops around Chunya district mining areas. Samples will be collected at different distances from the point sources. Preparation of the samples including homogenization and digestion will follow standard procedures. Qualitative and quantitative analysis of the samples will be determined using Atomic Absorption spectrometer (AAS), Inductively Coupled Plasma - Optical Emission Spectrometry (ICP-OES) and Direct Mercury Analyser (DMA).

Findings from this study will add information to a number of epidemiological analysis that examine exposure to mercury and cyanide. It will also sensitize and raise awareness to the public. Furthermore, it will stimulate more research in this field.

L 13

Modification of sisal fibres for Textiles Applications

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Abstract

The current increased sustainable environmental awareness and the growing demand for fibres and innovative fabrics has attracted many researcher's attentions towards alternative natural fibres for textile applications. Significant efforts are constantly applied to find new sources of natural fibres that would replace the petroleum-based synthetic fibres. Among many known natural fibres, sisal is categorized as a versatile substitutive fibre with outstanding textile properties such as high tensile strength, abrasion resistance, exceptional durability, high dye uptake and abundant availability suggesting that there is a good potential for them to be used in textiles for clothing manufacturing; however, they have not received the attention that they deserve owing to their coarse and stiff quality nature. Therefore, this study aimed at investigating the potential applicability of sisal fibres (regular and first cut sisal fibres) for textiles applications.

A chemical method for modification of sisal fibres in order to produce soft, fine and pliable fibres for apparel end uses were developed and optimized in this study. The qualities of optimally treated and untreated fibres were characterized in terms of their physico-chemical properties i.e. tenacity, elongation, fibre fineness, length, chemical composition, thermal stability, Infrared spectra, moisture content/regain, dye take up, colour fastness to washing in comparison to other cellulosic fibres such as cotton that are already in use in the textile industries. Experimental results indicated that the optimally treated sisal fibres are finer, softer significant lower content of non cellulosic substances and improved elongation than untreated sisal fibres. The fibres showed good dye take up in dyeing with both reactive and vat dyes. Colour fastness to washing was satisfactory in the case of most of the dyes used in this study. The result of this study may offer a possibility of developing sisal fibres into textile apparel practical applications.

Keywords: Sisal fibres, natural fibres, textile, properties, applications

L 14

Occurrence of Lipid Oxidation Products as other Contaminants in Foods

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Abstract

Lipid oxidation products are ubiquitous in foods and there are a number of factors that determine the levels that occur. Although the levels of some products are low, there are other compounds which occur in high amounts. Lipid oxidation severely compromises the quality of foods and limits their shelf-life. Lipid oxidation may occur by enzymatic mechanism, autoxidation or photooxidation, however in all the mechanisms it is believed to proceed by formation of hydroperoxides as the primary products. The hydroperoxides break down to secondary products like aldehydes, ketones, alcohols, hydrocarbons, volatile organic acids, and epoxy fatty acid compounds. Vegetable oils and all foods that contain lipids are susceptible to oxidation, but especially affected are oil seeds, foods which are dehydrated, those subjected to high temperatures or cooked and subsequently stored, e.g. dehydrated eggs, cheeses and meats, foods fried in frying oils, and cooked (uncured) meats. Lipid oxidation may represent a key barrier to international trade, especially to food items where the lipid oxidation products can be detected. Specific examples of compounds which are of health concern include lipid peroxides, malondialdehyde, hydroxylated α,β unsaturated aldehydes (4-hydroxy-2-hexenal (HHE) and 4-hydroxy-2-nonenal (HNE)), 2-butenal, epoxy fatty acids, and several cholesterol oxidation products. Deleterious changes in foods caused by lipid oxidation include loss of flavour, development of off-flavours, loss of colour, loss of nutrient value and functionality, and the accumulation of toxic compounds which may be detrimental to the health of consumers. Coronary artery disease (CAD) may be in part caused by the consumption of lipid oxidation products. Here we describe analytical methods that have been developed to analyze for these compounds and how the data can be used to carry out exposure assessment studies.

L 15

Investigation on Coconut Shells as Feedstock for Fine Chemicals' Raw Materials Production

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ABSTRACT

As the human population increases, and the industrial success in the developing countries are rising, the universal needs for energy as well as fine chemicals for industries also increase. Vanillin has the greater ranges of applications in industrial scale, such as in food-stuff industries, perfumery industries, pharmaceutical industries etc. Also furfural has several ranges of uses, in which it acts as fuel hydrocarbons and fuel intermediate also as a chemical precursor for pharmaceutical and agrochemical industries. Just like other lignocellulosic biomass, coconut shells also consist of cellulose, hemicellulose and lignin. In this study the Green production of vanillin and furfural has been employed by the use of catalysts. Vanillin was produced from the alkaline catalytic oxidation of lignin by using copper catalyst, whereas furfural has been produced from hemicellulose by using chromium catalyst. Finally detection of the vanillin and the furfural so produced, as well as their concentrations in the product were analyzed by High Performance Liquid Chromatography (HPLC), in which the retention time of vanillin and furfural were similar to those of their standards. The retention time of vanillin was 1.68 min whereas that of furfural was 3.2 min. Moreover, the FT-IR spectrum of furfural was exactly similar to that of its standard.

Key words: Coconut shells; Lignocellulose; pharmaceutical chemicals; green production; lignin; Hemicellulose catalytic oxidation; vanillin; furfural; FT-IR spectrum; High Performance Liquid Chromatography.

L 16

Occurrence and Distribution of Organochlorine Pesticide Residue Levels in Water, Sediment and Aquatic Weeds in the Nyando River Catchment, Lake Victoria, Kenya

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Abstract

Samples of water, sediments and aquatic weeds were collected from 26 sites in the Nyando River catchment of the Lake Victoria basin in 2005–2006. The objective was to investigate levels of organochlorine pesticides that have either been banned or are restricted for use in Kenya. The pesticides investigated were lindane, aldrin, endosulfan, endrin, dieldrin, DDT, heptachlor and methoxychlor. These pesticides had previously found wide applications in public health and agriculture in Kenya for control of disease vectors and crop pests respectively. Results showed that mean concentrations were highest for methoxychlor (8.817 ± 0.020 µg l^{-1}) in water, sediments (92.893 ± 3.039 µg kg^{-1}), and weeds (39.641 ± 3.045 µg kg^{-1}), the weeds also tended to accumulate aldrin (15.519 ± 3.756 µg kg^{-1}). The results show that the pesticides are still in use and are detected in the catchment. Stringent management and public awareness measures are required to enforce the ban on the organochlorine pesticides in order to safeguard the environment and ecosystems of Lake Victoria.

Keywords: Agrochemicals, environmental pollution, farming, Winam Gulf

L 17

Treatment of Used Petroleum-Based Lubricating Oil for Recycling Purposes

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Abstract

The major environmental contamination in the world today is due to hydrocarbons such as used petroleum-based lubricating oils. They contribute to greenhouse effect and global warming, deplete the ozone, increase occurrences of cancer and respiratory disorders, reduce the photosynthetic ability of plants and damage the ecosystems. A small spillage of used petroleum-based lubricating oils can cause significant pollution. Used petroleum-based lubricating oils contain a number of additives as well as contaminated impurities and residues. Based on these drawbacks of petroleum-based lubricating oil on the environment and its scarcity, price stability, and increasing dependence on this product for many industrial applications, the need to recycle used petroleum-based lubricating oil for possible reuse has risen attention. This study therefore employed two treatment methods namely; acid-local clay and acid to treat "castrol" and "total" used petroleum-based lubricating oils with the purpose of improving their qualities for reuse. The test carried out on the treated petroleum-based lubricating oil include viscosity density, and ash, water and, metal contents. The results revealed that recycling methods used in this work were able to improve the characteristics of the used petroleum-based lubricating oils after treatment. The acid-local clay method proved to the more effective method of treatment compared to acid. It contributed to the removal of the possible oxidation and polymerization products, water, dusts and wear metals that dissolved

and suspended in the used oils, thus the characteristics of treated samples were close to the fresh petroleum-based lubricating oils.

Key words: Recycling; Used petroleum based-lubricating oil; Pollution; acid-local clay treatment

L 18

Heavy Metals Accumulation in Mussels from River Benue, Nigeria

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Abstract

Mussels from the River Benue were analyzed for their heavy metals content in order to provide public health information on them as they are widely consumed in the area. Bioaccumulation factors of these heavy metals and the possibility of using the mussels as biomonitors of heavy metal buildup in the River Benue were also considered.

A total of fifty (50) mussels were sampled; their length, breadth and weight of were measured as well as their moisture content. Subsequently, wet oxidation method of sample digestion was applied to the de-moisturized residues and the digests used for heavy metals determination using Flame Atomic Absorption Spectroscopy (FAAS) and Cold Vapour Analysis fro mercury. Similarly, the shells of the mussels were digested and the metal analysis performed on the digests. Data obtained were analyzed using SPSS, one-way ANOVA and Pearson correlation.

Mean values of heavy metals content of mussel soft tissue in mg/kg were found to be Zn(4.14), Cu(18.7), Pb(0.478), Co(10.6), Cr(0.515), Cd(0.471), Fe(20.4), Hg(0.3189), Ni(0.578) and Mn(401). Mean values for heavy metal content of the mussel shell samples in mg/kg were Zn(18.6), Cu(19.7), Pb(5.31), Co(5.61), Cr(2.82), Hg (0.0415), Cd(4.14), Ni(4.90), Fe(20.7) and Mn (23.7). The statistical analysis of the results showed weight as an important factor in relation to accumulation of heavy metals and indicated that the sources of the metals are most probably the same. The levels of heavy metals determined in the soft tissue were found to be within the permissible limit of international standards such as WHO 1993, FAO 1983, EOS 1993, GHK 2011 and FEPA 2003 except for Cr and Mn that exceeded the recommend limits, for food materials.

Mussel shell showed higher degree of metal accumulation than the soft tissue for Zn, Cu, Pb, Cd, Cr, Fe and Ni, with Pb, Cr, Cd and Mn particularly high. Bioaccumulation of the heavy metals determined was clearly indicated as the heavy metal levels were observed to increase in a steady manner with size of the mussel which is directly proportional to the age that connects to time, confirming them as good bio monitors of the heavy metals build up. Bioaccumulation factors, compared to concentrations in the water, of 52.5, 335, 2.30, 1.40, 9.10, 27.1 and 2217 were obtained for Zn, Cu, Pb, Cr, Cd, Fe and Mn respectively in mussel tissue and 237, 352, 25.7, 7.40, 79.7, 27.6 and 131.3 respectively in mussel shell. These findings do not suggest immediate public health hazard associated with consumption of the mussels, but clearly show them as possible bio-indicators of heavy metal pollution in the aquatic environment and may be used for effective monitoring of the buildup of heavy metal pollutants in our inland freshwater water bodies.

L 19

Application of Microbial Fuel Cells in the Degradation of 2,4,5,6-Tetrachloroisophthalonitrile (Chlorothalonil)

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Abstract

Pesticide's persistence in the environment due to the relatively slow degradation mechanism leads to their bio-accumulation which in turn has adverse impacts on human health. Bio-remediation involves utilization of microbes from nature to the breakdown of organic molecules. The purpose of this study is to investigate the potential of microbes in degrading chlorothalonil. Aerobic-anaerobic combined conditions in an H-shaped double chamber microbial fuel cell (MFC) were employed for the breakdown of chlorothalonil. Decomposing tomatoes were used as the major substrate with their proximate properties being analyzed using standard method. Glucose loaded with different concentrations of chlorothalonil was introduced to the cells on day 10 when voltage production had stabilized. The voltage and current generated were monitored using a digital multi-meter while pesticide concentrations were obtained using a UV-Vis spectrophotometer. The highest voltage readings were obtained on day 9 of degradation, with values ranging from 0.463 to 0.537 V. The current ranged from 0.002 to 0.076 mA. Higher voltage and current values were recorded in solutions with lower pesticide concentration. The obtained degradation level was highest in 10 g glucose at 95.95 and 98.75% for day 10 and 20 respectively. The lowest breakdown was observed in the cells without glucose at 10.54 and 31.04% on day 10 and 20 respectively. The results demonstrate that MFC technology can be employed in mineralization of chlorinated pesticides as an alternative for incineration and photo-degradation.

Keywords: *Bio-remediation, chlorothalonil, MFC, microbes, power, voltage.*

L 20

Bioaccessibility of Tetracycline Antibiotics to Higher fauna in the Aquatic Environment: Effect of Speciation

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Abstract

The persistence of tetracycline antibiotics oxytetracycline (OTC), doxycycline (DC) and chlortetracycline (CTC) was investigated over a period of 90 days using simulated aquatic microcosm experiments. The concentrations of the antibiotic were monitored both in the water phase and in the sediment phase of the microcosm experiment. Aquatic bioaccessibility to higher fauna, defined as the fraction of the substance in the water phase over the mean concentration of the substance in a given aquatic system, was calculate and plotted as a function of time for each antibiotic. This definition of bioaccessibility means that if the substances is wholly in solution in the water phase, Bac = 2, and Bac = 1 when $C_w = C_s$, i.e., when the substance is evenly distributed between the water column and the sediment phase. The definition thus provides a basis for classifying environmental pollutants into low and high bioaccessibility pollutants for which *Bac* = 0 – 1 and *Bac* = 1 – 2 respectively. The definition assumes that the organic substance residing within the sediment in not bioaccessible to higher fauna, but becomes bioaccessible following sediment-to-water column equilibrium partitioning. Data are presented showing that the aquatic bioaccessibility of CTC starts at 1.23 on day zero, increases to 1.37 on day 4, and then levels off to an almost constant value 1.29 – 1.33 thereafter. The aquatic bioaccessibility of OTC starts low at 1.09 on day zero, and then rises to peak at about 1.44 on day 48, then drop steadily to a value of 1.07 on day 90. The bioaccessibility of DC, on the other hand, starts high 1.55 and steadily rises throughout the period of the study to end at 1.77 on day 90. The results suggest that OTC and CTC exhibit moderately high aquatic bioaccessibility (1.0 – 1.5), while DC exhibits extremely high aquatic bioaccessibility (1.5 – 2.0). Possible causes for the difference in the behaviour of the aquatic bioaccessibility of different tetracyclines are discussed.

L 21

Utilization of Rice Husks as a Low-Cost Adsorbent for Removal of Recalcitrant Cationic Dye from Waste Water: Kinetic and Equilibrium Studies

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Abstract

Adsorption of malachite green (MG) onto rice husks (RH) was investigated. Malachite green was used as a model dye for adsorption. Characterization of the adsorbent was performed using scanning electron microscope (SEM), Thermogravimetric analyzer (TGA), Powder X- Ray spectrophotometer and Fourier transform- infrared (FTIR) spectroscope. Batch experiments were conducted and the effects of various experimental factors on the adsorption of the dye such as pH, initial dye concentration, agitation time, ionic strength and contact time were studied. The maximum adsorption of the dye was achieved at pH 7 with optimal removal of 92.3%. Adsorption process was found to increase with time and the optimum contact time was 100 minutes. The adsorption data was fitted into two adsorption models: Langmuir and Freundlich isotherms. The data fitted well into Langmuir mathematical model with a monolayer adsorption capacity of 6.5 mg/g. The kinetic data followed pseudo-second- order model with a determination coefficient of 1. This work has revealed that rice husks has a great potential to be utilized as a low-cost adsorbent for the removal of pollutants such as malachite green dye from wastewater hence availing more water for reuse.

Keywords: Adsorption, Malachite green, Rice husks, Isotherm, Kinetics

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L 22

The Prevalence of Selected Pharmaceutical and Personal Care Chemicals in Fish and Benthic Invertebrates from Lake Victoria, Uganda

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Abstract

In recent years, the environmental occurrence of pharmaceuticals and personal care products (PPCPs) has been a source of growing concern. The vast increase in production and usage of PPCPs due to urbanization in areas of Lake Victoria basin has contributed to their prevalence in surface water, a problem that has been exacerbated by existing water treatment facilities that are not designed to eliminate these compounds from waste streams. While comprehensive toxicological studies are not yet available, an increasing body of literature has shown that PPCPs of all classes can impact aquatic wildlife, bacteria, and/or mammalian cells at low concentrations.

In this study, we have identified PPCPs in fish and benthic invertebrates (*quora*) from Lake Victoria, Uganda using liquid chromatography−tandem mass spectrometry (LC−MS/MS). Sulfamethoxazole, salicylic acid, and bisphenol A were the mostly frequently detected PPCPs at low ng L^{-1} levels. Overall, the results show that the PPCP contaminants in fish and benthic invertebrates (*quora*) from Lake Victoria, Uganda may not be of serious concern although more research is needed to evaluate the acute toxicity of the PPCP contamination to the survival of the fish and benthic invertebrates.

L 23

Polycyclic Aromatic Hydrocarbons (PAHs) Compositions in Soils, Vegetation and Combustion Residues from Kiwira Coal mining area in Tanzania

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Abstract/Concept Note

Environmental pollution due to Polycyclic Aromatic Hydrocarbons (PAHs) generated during coal utilization has a profound public health impact when enter the environment due to their toxic effects. A number of studies have associated the exposure to PAHs with genotoxicity, carcinogenicity, teratogenecity, cytotoxicity and other effects in organisms. In Tanzania,coal-mining activities are executed in Ngaka-Songea, Mchuchuma-Njombe and Kiwira-Mbeya. The types and levels of PAHs from coal mines in Tanzania have never been investigated to the best of our knowledge. This study therefore aims to investigate on composition of PAHs present in vegetations, soils and combustion residues from Kiwira coal mining in Mbeya.The samples will be homogenized and subjected to soxhlet extraction or sonication using dichlomethane/n-hexane as extracting solvents. The extracts will be centrifuged and the supernatant obtained will be concentrated in a rotary evaporator. Clean up of the concentrated extracts will be done, then subjected to qualitative and quantitative determination of PAHs using GC-MS.Results from this study will provide useful information to researchers, health planners, policymakers and general public about the levels of PAHs in soils, vegetation and combustion residues from Kiwira coal mine which might be a reflection of other coal mining areas in Tanzania.Hence,the study will be used to raise awareness and sensitize the public about possible effects of PAHs.

L 24

Utilization of Cashew Nut Shell Liquid (CNSL) as Starting Material for the Synthesis of Dihydroisocoumarins

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Abstract

Mellein-type 3,4-dihydroisocoumarin (*i.e.*, 8-methoxy-3-tridecyl-3,4-dihydroisocoumarin or 8-methoxy-3-tridecylisochroman-1-one), and its precursors, namely, methyl 2-methoxy-6-pentadecylbenzoate, methyl 2-methoxy-6-pentadecanoylbenzoate and (*E*)-methyl 2-methoxy-6-(pentadec-1-enyl)benzoate were synthesized from anacardic acid as a starting material obtained from Cashew Nut Shell Liquid (CNSL) in an overall yield of 78%. The transformation of anacardic acid to the final product involved protection of the reactive phenolic and carboxylic acid groups through methylation followed by hydrogenation so as to saturate the mono-, di- and tri-unsaturated C_{15} chains of anacardic acid. Subsequent benzylic oxidation and reduction of the keto functional group with concomitant dehydration of the alcohol led to the formation of (*E*)-methyl 2-methoxy-6-(pentadec-1-enyl)benzoate, which after deprotection of the carboxyl group followed by lactonization, gave the mellein-type 3,4-dihydroisocoumarin.

Keywords: Semisynthesis, 3,4-dihydroisocumarin, Anacardic acid, Cashew Nut Shell Liquid (CNSL)