

**UNIVERSITY OF NAIROBI  
COLLEGE OF BIOLOGICAL AND PHYSICAL SCIENCES  
SCHOOL OF PHYSICAL SCIENCES**

**DEPARTMENT OF CHEMISTRY**

**ANNUAL REPORT**

**2013**

## 1.1 INTRODUCTION

The Department of Chemistry is located in Department of Chemistry Building, Chiromo Campus, Off-Riverside Drive. It is in the School of Physical Sciences, College of Biological and Physical Sciences. It handles about 1800 undergraduate students each academic year, about thirty (30) Master of Science and eight (8) Ph.D students each year. These students are handled by 48 academic staff in the areas of Physical, Organic, Inorganic, Environmental, Analytical and Industrial Chemistry. To beef the academic members are 25 technologists, 1 senior Administrative Assistant and two (2) secretaries. The Detergent Unit also employs an additional four (4) casuals which gives a total of 80 staff.



Chemistry Building

The Department offers the following undergraduate programmes: Bachelor of Science in Chemistry, Bachelor of Science in Environmental Chemistry, Bachelor of Science in Industrial Chemistry and Bachelor of Science in Analytical Chemistry. In addition, the Department also services various schools and faculties as follows: Agriculture, Design, Engineering, Medicine and Pharmacy.

We also offer postgraduate programmes leading to Master of Science in Chemistry, Master of Science in Industrial Chemistry, Master of Science in Analytical Chemistry, Master of Science in Organic Chemistry, Master of Science in Inorganic Chemistry and Master of Science in Environmental Chemistry.

## 1.2 PROGRAMMES OFFERED

The Department offers the following undergraduate degree programmes:

### 1.2.1 Undergraduate Programmes

B.Sc. Industrial Chemistry

B.Sc Chemistry

BSc Analytical Chemistry

BSc Environmental Chemistry

In addition the Department also offers undergraduate service courses to the College of Health Sciences (School of Pharmacy), College of Architecture and Engineering (Mechanical and Manufacturing Engineering, Civil and Construction Engineering, Environmental and Biosystems Engineering) and College of Agriculture and Veterinary Sciences (Food Science and Technology, Agriculture).

### **1.2.2 Postgraduate Programmes**

M.Sc. in Chemistry

M.Sc. in Environmental Chemistry

M.Sc. in Analytical Chemistry

M.Sc. in Industrial Chemistry

M.Sc. in Organic Chemistry

M.Sc. in Inorganic Chemistry

The Department also offers Ph.D in chemistry covering all areas (organic, inorganic, physical, environmental, analytical and industrial).

In addition to our day programmes the Department offers module II evening programs at both the undergraduate and post-graduate levels.

## **1.3 NUMBER OF STUDENTS ENROLLED IN UNDERGRADUATE AND POSTGRADUATE PROGRAMMES**

### **1.3.1 Undergraduate programme enrollment**

Programme	Number of students
BSc. Analytical Chemistry ODL	14
BSc Industrial Chemistry ODL	11
BSc Chemistry	24
BSc. Analytical chemistry	<b>13</b>
BSc. Industrial chemistry	<b>127</b>

### 1.3.2 Postgraduate programme enrollment

#### 1.3.2.1 MSc

Programme	Number of students
M.Sc. Chemistry	49
M.Sc. in Environmental Chemistry	18
M.Sc. in Analytical Chemistry	15
M.Sc. in Industrial Chemistry	3
M.Sc. in Organic Chemistry	-
M.Sc. in Inorganic Chemistry	-

#### 1.3.2.2 Doctor of Philosophy in Chemistry (PhD)

Programme	Number of students
Ph.D. in Chemistry	13

### 1.3 INTERNATIONAL STUDENTS

The department hosts a number of foreign students undertaking postgraduate programmes. They are as follows:

	Reg no	Name	Programme	Home Country
1	I56/80611/12	Marco Makungu	MSc Chemistry	Tanzania
2	I56/79318/12	Uphrosine Ujeneza	MSc Industrial Chemistry	Ethiopia
3	I56/69593/11	Fozia Ali Adem	MSc Chemistry	MSc Chemistry
4	I56/69599/11	Denis Akampurira	MSc Chemistry	Uganda
5	I80/	Assefa Yoseph Atilaw	PhD Chemistry	Ethiopia

6	I80/85101/12	Tsegaye Deyou	PhD Chemistry	Ethiopia
7	I80/82021/11	Abdissa Negera	PhD Chemistry	Ethiopia
8	I80/82102/09	Ivan Gumula	PhD Chemistry	Uganda

## 1.4 Research activities

### 1.4.1 M.Sc

Student	Title of research	Supervisor (s)
Kerandi, Anne Moraa.	Investigation on Genotoxicity of Solar Disinfected (SODIS) Water.	Prof Wandiga
Pembere, Anthony M	Investigation of Heavy Metals in Vegetables Grown in the Agricultural and Industrial Areas of Webuye and Mumias	Prof Jumba, Dr Oduor
Okanga, Boventure.	Determination of the Alcoholic Content of Various Spirits: Denatured and Undenatured Among Selected Small Scale Production Units with Respect to Excise Legislation in Kenya	Dr Benson Wamalwa
Karani, Christopher	Industrial Production of Sodium Hydroxide and Chlorine Gas from locally available Materials	Prof Kamau
Riungu, Emily	Municipal Wastewater Treatment with Anodizing Solid Waste	Dr H. Njenga and Prof L. Njenga
Tonkei, Wilson	Development of an Electrochemical Sensor for the Detection of Heavy Metals in Waste Water.	Dr Aluoch and Prof Shiundu
Murimi J. Mbugua.	To improve on lead acid battery manufacture in a more environmental friendly manner	Prof Kamau G. and Dr Guto P.

Judith Ngugi Joseph	Chemical analysis of borehole and shallow well water in arid and semi-arid regions of Kenya.	Prof Lydia Njenga and Dr Kithinji J.P.
Rael Obong'o Kasera	Determination of effectiveness of untreated and edta-treated <i>Luffa cylindrica</i> in removal of $Cr^{3+}$ and $Cu^{2+}$ from waste water.	Prof Shiundu P.M. and Dr Austin Aluoch
Ndiritu, Cecilia W.	Mobility of Heavy Metals, Microorganisms and Hydrodynamics of a Section of Nairobi River	Prof Kamau G. Prof Mwaura, Dr Kithinji J.P.
Kundu, Bevin N.	Comparison of Burning effectiveness of Liquid Biofuels and their Blends with Kerosene as Alternative Fuel for Lighting and Cooking	Dr Onyari J.M. Dr Kithinji J.P.
Masenge, Edna M.	Total Petroleum Hydrocarbons in Sediments and Water in Ngong and Mathare River	Prof Wandiga S.O. Prof Shiundu P.M.
Muya, Catherine N.	Electrocatalytic Decomposition of Organochlorine Pollutants	Prof G. Kamau Dr Peterson Guto
Everlyne Kasima N.	Efficiency of municipal waste water treatment plants in Kenya: A case study of Mombasa Kipevu Treatment Works	Dr A.O. Yusuf Dr D.K. Kariuki Dr D. Abong'o
Mbewa, Tom Joseph	Heavy Metal Analysis of Thermoplastic Paints in the Kenyan Market and the Environmental Implications of Application as road Marking Paints	Prof Kamau G. Dr F. Oduor Dr Kariuki D.K.
Ogange, Elphas O.	The Role of Fertilizer Usage and Agrochemical Effluents on the	Dr F. Oduor Dr Kariuki D.K.

	Persistence of Algae Bloom on Kenyan Shores of Lake Victoria	
Awas, Erick Okoth	A Comparative Study of the Toxicity, Protective and Cell Defense Induction Capacity of Flavones from Kenyan Plants and Lipophilic Semi-Synthetic Derivatives	Prof Midiwo, Dr Mwaniki and Ndakala
Njeru, Daisy Nyawira	Phytochemical Investigation of the Root of <i>Desmodium Ramosissimum</i> for Antiplasmodial Principles	Dr Derese and Prof Abiy
Ogalo, Linet	Use of Electro-Analytic Methods in the Development of Biosensor for Detection of Bisphenol A.	Dr Mbui D.
Everlyne Kasima	Effectiveness of the Kipevu Treatment Works	Dr A. Yusuf , Dr. D.K. Kariuki, Dr D. Abongo
Ochieng Fredrick Nyateng	Assessment of pesticide and polychlorinated biphenyls residue Levels in Fish from Kericho and Upper Nyando of River Nyando drainage basin in Kenya	Prof Wandiga S.
Muraga, Joseph	Determination of Dissolved Ions and Microbial Coliforms in Ground Water in Selected Areas in Athi River Basin	Prof Wandiga S.
Makokha, John Wanjala	Utilization of Titanium Oxide in formulation of Refractory Clay Bricks	Dr Kariuki D.K.
Victor Nthusi Kyalo	Assessment of Organochlorine, PCB,s and Organophosphate Pesticide Residues in Fish from	Prof Wandiga S.

	Lower Nyando Drainage Basin	
--	-----------------------------	--

### 1.4.2 Ph.D

Student	Title	Supervisor(s)
Madadi O. Vincent	Studies of pesticide and macronutrient interaction dynamics in water-sediment/soil systems	Prof. Shem O. Wandiga Prof. Paul M. Shiundu
Godfrey A. Wafula	A Study of atmospheric fine particulate matter and their toxic components in Nairobi and its environs	Prof. Shem O. Wandiga Prof. Paul M. Shiundu
C.W. Mirikau	A computerized model for the identification and location of water polluting industries in Nairobi	Prof. G.N. Kamau Prof. I.O. Jumba
Mrs. Marina Mukabi	Development, characterization and industrial application of conductive polymers	Prof. Duke Orata Dr. Hellen Njenga
Ms. Joyce G. Njagi-Kithure	Distribution of diazinon and chlorpyrifos in selected aquatic matrices from the upper Tana River in Kenya	Prof. S.O. Wandiga Prof. I.O. Jumba
Mrs. Ruth Odhiambo	Synthesis of bionucleating macrocycles incorporating thiolato and polyether compounds fused to 1,10-phananthroline as sensors for soft heavy metal	Prof. S.O. Wandiga Dr. Austin Ochieng'
Farida Hussein Were	Assessment of levels of selected heavy metals and their effects on the health of industrial health workers in Nairobi and Athi River, Kenya	Prof. Geoffrey Kamau Prof. P.M. Shiundu Dr. C.M. Muturi
Immaculate Achieng'	Evaluating the efficacy of selected lignocellulosic materials of Kenyan origin in the adsorption of textile dyes and inks from aqueous industrial effluents	Prof. P.M. Shiundu Dr. A. Aluoch Dr. B. Wamalwa



Beatrice Irungu	Bioprospecting for antiplasmodial compounds from some albizia, turea and zanthozylum species in Kenya	Prof. Abiy Yenesew
-----------------	---	--------------------

## 1.5 INTERNATIONAL LINKS AND COLLABORATIONS

The Department has the following new links:

### 1.5.1 IOM-UoN linkage programme

Cooperation with Department in to study the effectiveness and sustainability of solar lanterns in reducing sexual and gender-based violence among IDPs in Somaliland and Puntland. Funding amounts to US \$8000.

### 1.5.2 Third World Academy of Sciences (TWAS)-UoN

The purpose of this grant is to strengthen the capacity of the department to undertake research in the field of physical chemistry by funding the purchase of specialized equipment. The funding amounts to US \$12,575.

### 1.5.3 The State University Of New York, Binghamton –UoN linkage

Collaboration in University of Nairobi postgraduate students' training by Binghamton University.

## 1.6 LIST OF RESEARCH PUBLICATIONS 2013

1. Naziriwo B. and Wandiga S. (2013): Seasonal variations of phytoplankton species in Lake Victoria and the influence of iron and zinc ions on the dominant species identified during 2006-2007 studies, *Lake and reservoirs: Research and Management*, **18**, 259-273. (published in UK)
2. Machumi F., Midiwo J.O., Melisa R.J., Shabana I.K., Babu L.T., Jin Z, Larry A.W. and Ilias M. (2013): Phytochemical, antimicrobial and antiplasmodial investigations of *Terminalia brownii*, *Natural Product Communications*, **8** (6), 761-764 (published in UK)
3. Kerubo L., Midiwo J.O., Derese S., Langat M.K., Akala H.M., Waters N.C., Peter M., and Mathias H.(2013). Antiplasmodial activity of compounds from the surface exudates of *senecio roseiflorus*, *Natural Product Communications*, **8** (0), 1-2. (published in UK)
4. Milugo T.K., Kerubo L., Ochanda J.O., Owuor B.O., Wamunyokoli F.A., Oyugi J.O., and Ochieng J.W.(2013). Antagonistic effect of alkaloids and saponins on bioactivity in

the quinine tree: Further evidence to support biotechnology in traditional medicinal plants, *BMC Complementary and Alternative Medicine*, **13**, 285.

5. Chinwe O.I., Charl J.J., Kenneth I.O., Natasha W., Njomo N., Nazeem J., Baker B.G., and Iwuowa E.I. (2013). Novel Iron-cobalt derivatised lithium iron phosphate nanocomposite for lithium iron battery cathode , *Int J. Electrochem. Sci*, **8**, 753-772.
6. Ndunda B., Langat M.K., Wanjohi J.M., Midiwo J.O. and Kerubo L.O. (2013). Alienusolin, a new 4 $\alpha$ -deoxyphorbol ester derivative, and crotonimide C, a new glutarimide alkaloid from the Kenyan *Croton alienus* , *Planta Med*, **79**, 1762-1766.

### 1.7 CONSULTANCIES UNDERTAKEN BY STAFF

Client	Parameter	Staff involved
Public Complaints Committee	Analysis of water Samples	Mr Wafula
NEGST	Fluoride content in borehole water	Dr Yusuf
Kenya Wine Agency	Heavy Metals in Water	Mr Wafula
Ivce Aqua EPZ Ltd	Infra-Red Analysis	Mr Wafula
National Oil Corporation	Chromatographic analysis	Dr Madadi
SGS Kenya Ltd	Vitamin Analysis	Dr Madadi
Booth Extrusion	Moisture Content in samples	Mr Wafula
Osho Chemicals	Malathion analysis	Dr Madadi
Ministry of Higher Education	Alcohol content in Alvaro Drink	Dr. Madadi/Dr Yusuf
KEWI	Laboratory training in AAS, HPLC etc	Dr Yusuf, Mr J. Nganga, Mr Katiku, Mr Mirikau, Ms Muia, Mr Njoroge, Mr Katembu, Mr Rop,
Mura	Identification of active ingredient in a pesticide	Mr Wafula/Dr Yusuf
KEMRI	NMR	Dr Abiy/Dr yusuf
Anonymous	Quantity of ethanol in a sample	Dr Madadi/Dr Yusuf
Allan Paul	Calorific value and viscosity	Dr Yusuf/Mr Wafula

### 1.8 NUMBER OF STAFF AND THEIR DESIGNATIONS

Professors	6
Associate Professors	7
Senior Lecturers	12
Lecturers	15
Tutorial Fellows	3

Assistant Lecturer	1
Graduate Assistants	3
Principal Technologist	1
Chief Technologist	1
Senior Technologist DEF	12
Technologist ABC	9
Technical Assistant II	1
Documentalist	1
Senior Administrative Assistant	1
Secretary	2
<b>TOTAL</b>	<b>75</b>

### 1.9 NUMBER OF GRADUANDS IN VARIOUS PROGRAMMES 2013

	Diploma	Bachelors	Postgraduate Diploma	Masters	Doctorate	Total
Number	-	13	-	8	2	<b>23</b>

### 1.10 PAPERS PRESENTED AT CONFERENCES

	Title of paper	Date presented	Venue
<b>1</b>	Alienusolin, a new deophorbol ester derivative and crotonimide C, a new glutarimide alkaloid from the Kenyan <i>Croton alienus</i>	October, 2013	Kottayam, Kerala, India
<b>2</b>	Prediction of soil physiochemical properties in Mount Kenya using MIR-PLSR	26-27 August 2013	ICRAF Campus, Nairobi, Kenya
<b>3</b>	Traffic and mineral dust impact on air quality in Nairobi, Kenya	19-23 August 2013	Geneva, Switzerland
<b>4</b>	Prediction of soil properties: An experiment using Mt. Kenya forest soils	23-27 September, 2013	Osaka, Japan

## 1.11 OTHER ACTIVITIES

### 1.11.1 Promotion

**Dr John Onyari was promoted from senior lecturer to associate professor.** Four lecturers were also promoted to senior lecturer. The four senior lecturers are: Dr. Albert Ndakala, Dr. Martin Njogu, Dr. John Wanjohi and Dr. Fredrick Odour.



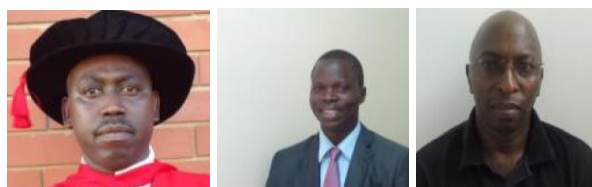
Prof Onyari Dr Oduor

Dr Wanjohi

Dr Njogu

Dr Ndakala

Other staff promoted from tutorial fellow to lecturer were: Dr. E. Korir, Dr. Vincent Madadi and Dr. N. Njomo. Congratulations.



Dr Korir

Dr. Madadi

Dr. Njomo

### 1.11.2 Donation of Chairs



New look Reading Room

A Good Samaritan donated forty chairs estimated at about Kshs. 120,000. An advance batch of twenty chairs was delivered by Science Workshop on 15/11/2013 and the rest will be delivered shortly. The first batch of twenty chairs were taken to our Reading Room to make reading in our Library more enjoyable to both students and staff.

### 1.11.3 Donation of 400 MHz NMR



200MHz NMR to be replaced by 400MHz

The Department of Chemistry, University of Gothenburg in collaboration with International Science Program (ISP) donated a 400MHz NMR machine to our Department so as to engage in active research. This will replace our 200 MHz NMR that is now fourteen years old. The 200MHz machine cannot process HMBC, HMBQ which the new machine will be able to perform. We are indeed thankful to the Vice-Chancellor who agreed to cater for quenching, packing, transportation, installation, training and other related charges to the tune of Kshs 10million. You will be informed as and when it arrives.

#### 1.11.4 Staff On Leave Of Absence

NAME	TITLE	STATUS
Prof. Raphael Munavu	Professor	At CRA
Dr Evans Kituyi	Snr Lecturer	At IDRI
Prof. Paul Shiundu	Professor	At PUK
Dr. Wenwa A. Odinga	Snr. Lecturer	In U.S.A. , Los Angeles

#### 1.12. OUTREACH AND COMMUNITY SERVICE ACTIVITIES

1. Prof. J.O. Midiwo: NAPRECA Executive secretary; External examiner, Maseno University
2. Dr. D.K. Kariuki: KEBS Water Quality committee; NEMA Hazardous and Toxic Materials committee member; WRMA Threshold Pollution in Waste Water Committee.
3. Dr. B.M. Wamalwa: Board member of Japan Government scholarships
4. Prof. Wandiga S.O.: Chancellor, Egerton University; Pan African Chemistry Network Chairman, Regional Chapter; UNEP/GEF-UoN Project coordinator, UNEP POPs project coordinator
5. Dr. A.O. Yusuf: External examiner JKUAT; IDB Scholarship Selection Committee Board Member.