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YEARS
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Institute of Chemistry Ceylon - 2016

CHEMISTRY

IN SRI LANKA



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Founded in 1971, Incorporated by Act of Parliament No. 15 of 1972

Successor to the Chemical Society of Ceylon, founded on 25th January 1941

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Theme for the year -

Ethics and Responsibilities of Professional Chemists for the National Development

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Outline of our Institute

The Institute of Chemistry Ceylon is a professional body and a learned society founded in 1971 and incorporated by act of Parliament No. 15 of 1972. It is the successor to the Chemical Society of Ceylon which was founded in 1941. Over 50 years of existence in Sri Lanka makes it the oldest scientific body in the country.

The Institute has been established for the general advancement of the science and practice of Chemistry and for the enhancement of the status of the profession of Chemistry in Sri Lanka. The Institute represents all branches of the profession and its membership is accepted by the government of Sri Lanka (by establishment circular 234 of 9-3-77) for purposes of recruitment and promotion of chemists.

Corporate Membership

Full membership is referred to as corporate membership and consists of two grades: **Fellow (F.I.Chem.C.)** and **Member (M.I.Chem.C.)**

Application for non-corporate membership is entertained for four grades: **Associate (former Graduate) (A.I.Chem.C.)**, **Licentiate (L.I.Chem.C.)**, **Technician (Tech.I.Chem.C.)** and **Affiliate Member**.

Revision of Membership Regulation

All Special Degree Chemists can now apply directly to obtain **Associate (Graduate) Membership**. Three year B. Sc. Graduates (with an acceptable standard of Chemistry) can

- (i) directly become **Licentiate**
- (ii) obtain corporate membership in a lesser number of years.

Tech.I.Chem.C.

Those who have passed the DLTC examination or LTCC examination or have obtained equivalent qualification and are engaged in the practice of Chemistry (or chemical sciences) acceptable to the Council are entitled to the designation Tech.I.Chem.C.

Members/Fellows are entitled to the designation of **Chartered Chemist (C.Chem.)** on establishment of a high level of competence and professionalism in the practice of chemistry and showing their commitment to maintain their expertise.

All corporate members (Members / Fellows) are entitled to vote and become Council/ Committee members whether Chartered Chemists or not.

Membership Applications

Any application for admission to the appropriate class of membership or for transfer should be made on the prescribed form available from the Institute Office.

Current Subscription Rates

Fees should be paid on 1st of July every year and will be in respect of the year commencing from 1st July to 30th June

Fellow	Rs. 1500
Member	Rs. 1500
Associate	Rs. 1200
Licentiate	Rs. 1000
Technician	Rs. 500
Affiliate	Rs. 1000
Membership for Life	Rs. 15000

Entrance Fee

All the grades	Rs. 1000
Processing Fees*	Rs. 500
Processing Fee for Chartered Chemist designation	Rs. 1000
Institutional Members	Rs. 2500

*per application for admission/transfer to any grade

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CHEMISTRY IN SRI LANKA

Chemistry in Sri Lanka is a tri-annual publication of the Institute of Chemistry Ceylon and is published in January, May and September of each year. It is circulated among the members of the Institute of Chemistry and students of the Graduateship/DLTC course and libraries. The publication has a wide circulation and more than 1000 copies are published. Award winning lectures, abstracts of communications to be presented at the annual sessions, review papers, activities of the institute, membership news are some of the items included in the magazine.

The editor invites from the membership the following items for publication in the next issue of the Chemistry in Sri Lanka which is due to be released in September 2016.

- Personal news of the members
 - Brief articles of topical interests
 - Forthcoming conferences, seminars and workshops
 - Latest text books and monographs of interest to chemists
- All publications will be subjected to approval of the 'Editorial and Publicity Committee' and the Council of the Institute of Chemistry Ceylon.*

Further, prospective career opportunities for chemists, could be advertised in Chemistry in Sri Lanka at a nominal payment. The editor welcomes from the members suggestions for improvement of the publication.

Guest Editorial

Ethics, Values and Responsibilities of Chemists in National Development



Emeritus Professor Upali Samarajeewa
Past President, Institute of Chemistry Ceylon

Ethics (or morals) in science has become a topic of discussion in the society today. This is linked to the outcomes of modern discoveries in science, and concerns on their effects of life and the environment arising from the practice of science. When we think of ethics, we think of rules that distinguish between what is right and wrong. The concepts of right and wrong are inculcated in to our minds at home when we are in our childhood, and by different religions we believe in, as we grow and become mature. All humans recognize some common ethical norms, but they tend to interpret, apply, and balance the norms in different ways, in the light of their own senses of values, life experiences and personal expectations.

Chemistry plays a vital role today in applying modern technologies in agriculture, medicine engineering and many other fields, with more and more chemicals becoming components in food, medicine and the environment. This brings in an increased responsibility in the practice of chemistry for the social welfare. The chemists as professionals need to strive to improve their usefulness in issues of social welfare, through high standards of ethics applied to education, research, social responsibilities as a part of their obligations to chemical science, to colleagues and more importantly to the public. The future of chemistry, and continued acceptance of it as an important component helping in the development of the mankind becomes meaningful to public only if chemistry succeeds in retaining the trust as a social force working towards public good, and a source of reliable information generated through honest practices, following the accepted norms and principles.

In the practice of chemistry, whether in research or in other routine applications, there is a moral obligation to generate knowledge honestly, without fabrications, falsifying and misrepresenting the data, avoiding errors and adhering to truth and only truth. Adherence to ethical standards in practice of chemistry - whether in teaching, research or outreach activities - promoting the values essential for collaboration, trust, mutual respect, accountability and fairness are key features necessary in furthering the subject chemical sciences. The ethical standards also address the protection of intellectual property rights, guidelines for authorships, patenting, data sharing and rules in peer reviewing in practice of science including chemistry.

Chemists also play a major role in building the nation as teachers at all levels. The teacher-student relationships operate with complete trust and dependency on the teacher. Ethical lapses by the teachers, which mostly comes as favoritisms with expectations in return in whatever forms from both boys and girls, can do much damage to the dignity of the teaching profession and to the individuals.

The code of conduct for chemical professionals established by the American Chemical Society identifies the responsibilities of the chemists towards the public, the science of chemistry, the profession, the employer, the employee, the students, the colleagues and the environment as distinct entities.

In the light of the current day approaches to life with each person interpreting the ethics, values and responsibilities, in their own terms linked with their personal agenda, it is important for the chemists as a group to address the ethic related issues in the national interest and develop a code of conduct to maintain professionalism.

Cover Page

The cover page photograph shows the Graduate Chemists after the 12th Convocation of the College of Chemical Sciences, Institute of Chemistry Ceylon, held at Eagles Lakeside Banquet & Conventional Centre on 27th January 2016. This was the 33rd batch and 98 students were formally awarded Graduate Chemist status and thereby increasing the overall production to a total of 1173. More formal photographs of the Convocation are on inner back cover page.

Institute of Chemistry Ceylon

Forty Fifth Annual Sessions and Seventy Fifth Anniversary Celebrations 2016

Inauguration of the 45th Annual Sessions, Institute of Chemistry Ceylon

Wednesday, June 15th 2016
Centre for Banking Studies, Rajagiriya

8.00-9.00 am	Arrival of Members and Guests (<i>Refreshments will be served</i>)
9.00 am	Ceremonial Procession of the Council Members and Past Presidents
9.05 am	Inauguration by lighting of the Oil Lamp and playing the National Anthem
9.10 am	Welcome Address by Mr. K R Dayananda <i>President, Institute of Chemistry Ceylon</i>
9.15 am	Presidential Address
9.45 am	Address by the Guest of Honor Mr. D C Dissanayake <i>Secretary, Ministry of Higher Education and Highways</i>
10.00 am	Address by the Chief Guest Emeritus Professor E R Jansz <i>Past President, Institute of Chemistry Ceylon</i> <i>Former Director, Ceylon Institute of Scientific and Industrial Research</i>
10.15 am	Presentation of Awards, Prizes and Certificates Institute of Chemistry Ceylon Awards ▪ Dr. C L De Silva Gold Medal - Prof. E D de Silva ▪ Professor M U S Sultanbawa Award for Research in Chemistry 2015 - Prof. (Ms.) S Ekanayake ▪ Kandiah Memorial Award for Applied Chemistry - Ms. A G A W Alakolange ▪ Kandiah Memorial Award for Basic Chemistry - Ms. N S Bopage ▪ Kandiah Memorial Graduateship Award - Ms. D Thanabalasingam ▪ Distinguished Service Awards - Prof. Upali Samarajeewa, Prof. Tuley de Silva Graduateship Examination in Chemistry - Scholarships, Prizes and Awards All Island Interschool Chemistry Quiz Prizes Felicitation of Students of College of Chemical Sciences in recognition of outstanding achievements
10.40 am	Dr. C L de Silva Gold Medal Award Lecture
11.30 am	Vote of Thanks Mr. M R M Haniffa <i>President Elect, Institute of Chemistry Ceylon</i>
11.35 am	Close of Ceremony
12.30 pm	Annual General Meeting – 2016 at Adamantane House (<i>for Corporate Members only</i>)

Chief Guest at the 45th Annual Sessions Emeritus Professor E R Jansz, PhD, DSc (*Honoris Causa*)



Professor Errol Radcliffe Jansz, Biochemist and Bio-organic chemist, is a Professor Emeritus of the University of Sri Jayawardenapura. He was awarded the D.Sc. (*Honoris Causa*) at the convocation on 7th February 2012. He obtained his B.Sc. Honours degree in Chemistry from the University of Sri Lanka in 1966 and Ph. D. in Biochemistry from the Dalhousie University, Canada in 1972.

He served the Ceylon Institute of Scientific and Industrial Research (CISIR) from 1967 to 1993 where he carried out research in many areas of Biochemistry including enzymology and plant microbial biochemistry. In 1985 he was appointed as the Director (CEO) of the CISIR and had the distinction of being the youngest ever Director to take the office, a post he held until 1990. He was the Chief Executive of the CISIR as well.

His research effort has yielded 4 Gold medals and many other awards and over 130 publications in peer reviewed journals. He has supervised 30 successful research degrees and trained many others, including technicians, in his fields of Chemistry and Medicine. He was cited by numerous Biographies, notable the “Marquis Who's Who of the World” from 1997 to 2012. He was rated in 2011 as one of the top 10 scientists and top 100 intellectuals globally, and listed for the “Iconic Einstein Award” by the International Biographical Centre, Cambridge. He has been a Sri Lankan delegate at many International conferences including UNESCO, UNIDO, ESCAP and APCTT.

Emeritus Professor Jansz joined the Chemical Society (predecessor of the Institute of Chemistry Ceylon) in 1966. He held several prestigious positions in the Institute. He was one of the Joint Secretaries of the Institute from 1972 to 1974 and the President of the Institute in its Golden Jubilee year (1991). He served the Institute as the Chairman, Admission and Ethical Practices Committee and the Chairman, Education Committee. He has been a Fellow of the Institute since 1977. He also served as the Coordinator of the Laboratory Technicians Training Course (LTTC) (1974-1975) and was a member of the LTTC sub-committee. He was a lecturer for this course for 20 years. He was actively involved as a lecturer in the Graduateship Education programme of the Institute from its inception in 1979. Professor Jansz was awarded with the “Distinguished Service Award” by the Institute in 1997.

Guest of Honour at the 45th Annual Sessions Mr. D C Dissanayake



Mr. D C Dissanayake joined the Sri Lanka Administrative Service (SLAS) in 1984 and served as Assistant Controller, Department of Rubber Development (1984-1990), Assistant Secretary, Ministry of Public Administration and Provincial Councils (1992), Consultant, Sri Lanka Institute of Development Administration (SLIDA) (1993-1995), Assistant Secretary, Prime Minister's Office (1995-1998), Director (Information Technology), Tertiary and Vocational Education Commission (TVEC) (1998-2002), Senior Assistant Secretary/Director (Policy and Planning), Ministry of Commerce and Consumer Affairs (2003-2004), Senior Programme Head (Re-engineering Government Programme and Administration and Operations), Information and Communication Agency of Sri Lanka (2007- to date), Additional Secretary, Ministry of Highways and Investment Promotion (2015), and Ministry of Higher Education and Investment Promotion (2015). He is a Special Grade officer at SLAS and currently he is the Secretary of the Minister of Higher Education and Highways.

Mr. Dissanayake graduated with a B.A. Honours degree (Second Class Upper Division) from the University of Sri Jayawardenapura. He has followed a certificate course in Public Administration at the SLIDA in 1985. He obtained MSc from the Asian Institute of Technology, Bangkok, Thailand in 1991. His MSc research was on “Unemployment problem and employment promotion through self-employment projects”.

He has involved in many other research projects including “Information collection and analyses for labour market information bulletin”, “Annual skilled labour requirements of the industries located in BOI areas”, “Vocational education plan for information technology sector” “Evaluation of ADB funded School rehabilitation project”, and “Evaluation of farmer training project”. He is a member of the Computational Society of Sri Lanka.

Theme Seminar on
**“ETHICS, VALUES AND RESPONSIBILITIES OF CHEMISTS
IN NATIONAL DEVELOPMENT”**

16th June 2016

Venue: Sri Lanka Foundation Institute, Independence Square, Colombo 07.

Programme

09.00 h	<i>Registration followed by refreshments</i>
10.00 h	<i>Welcome speech</i> Mr. K R Dayananda , <i>FICChemC, CChem,</i> <i>President, Institute of Chemistry Ceylon</i>
10.05 h	<i>Keynote address:</i> An overview of ethics and responsibilities of chemists in a rapidly changing world. Mr. Mevan Pieris , <i>FICChemC, CChem,</i> <i>Former President, Institute of Chemistry Ceylon</i> <i>Former President, Plastics & Rubber Institute.</i>
10.50 h	Ethics, Values and Responsibilities of Chemists: Education. Professor Ajith Abeysekara <i>Emeritus Professor of Chemistry, University of Sri Jayewardenepura</i> <i>Consultant Link Natural Products Pvt. Ltd.</i>
11.35 h	Ethics, Values and Responsibilities of Chemists: Information handling and patenting. Professor Vijaya Kumar , <i>MICChemC, CChem,</i> <i>Emeritus Professor of Chemistry, University of Peradeniya.</i>
12.20 h	Lunch
13.30 h	Ethics, Values and Responsibilities of Chemists: Research. Professor Veranja Karunaratne , <i>FICChemC, CChem. FRSC, FNASSL,</i> <i>Senior Professor of Chemistry, University of Peradeniya</i> <i>Associate Director, Science & Strategic Relations(SLINTEC).</i>
14.15 h	Ethics, Values & Responsibilities of Chemists: Social Conduct. Mr. Rizvi Zaheed <i>Managing Director, Hayleys Agriculture Holdings</i>
15.00 h	Panel discussion
15.45 h	Vote of Thanks
16.00 h	Tea

Sponsored by



Technical Sessions

Venue: P P G L Siriwardene Auditorium, Adamantane House, Rajagiriya

Time : 2.00 p.m. – 4.50 p.m.

Date: 15th June 2016

Time	Title	Authors
Kandiah Memorial Award for Basic Chemistry		
2.00 -2.30 pm	Investigation on wound healing activity of bark of <i>Ficus racemosa</i> and “Seetodaka” oil using Scratch Wound Assay (SWA)	N S Bopage
Kandiah Memorial Graduateship Award		
2.30-3.00 pm	Chemistry and bioactivity of secondary metabolites produced by an endophytic fungus <i>Nigrospora oryzae</i> from a popular medicine plant <i>Coccinia grandis</i>	D Thanabalasingam
Kandiah Memorial Award for Applied Chemistry		
3.00-3.30 pm	Chemistry and bioactivity of <i>Flacourtia inermis</i> fruits	A G A W Alakolanga
Prof. M U S Sultanbawa Award for Research		
3.30-3.50 pm	Determination of essential heavy metal levels of Fe, Zn and Cu in hair samples of anemic patients due to iron deficiency and chronic disorders	N D Kumarage, N S Amarasinghe, C D Jayaweera, H J M B R Jayaratne, M M Gunathilaka, L S Liyanage, P T Wijesena and M H J D Ariyaratne
3.50 - 4.10 pm	<i>In vitro</i> antioxidant, antiglycation and α -glucosidase inhibitory activities of the ethyl acetate soluble fraction of water extract of <i>Artocarpus heterophyllus</i> Lam. leaves	K S S P Fernando, A M Abeysekera, M I Choudhary, A K E Goonathilake, C Padumadasa, V M Thadani and U G Chandrika
4.10 – 4.30 pm	Megastigmanes from Leaves of <i>Artocarpus heterophyllus</i> Lam.	K S S P Fernando, A M Abeysekera, M I Choudhary, A K E Goonathilake, C Padumadasa, V M Thadani, A Adhikari, M Rehman and U G Chandrika

Technical Sessions Day 2: 17th June (Friday) 2016 (8.30 am onwards)

Chairperson: Mr. M R M Haniffa, Dean, College of Chemical Sciences,

Time	Title	Authors
8.30 – 8.50 am	Isolation of compounds with radical scavenging activity from <i>Daldinia eschscholzii</i> inhabiting the lichen <i>Parmotrema</i> sp. in Sri Lanka	M A T P Manthirathna, R Kandiah, D S Gunasekara and P A Paranagama
8.50-9.10 am	Preliminary study on development of herbal mosquito repellent formulations	M S N Ranasinghe, L S R Arambewela and S Samarasinghe
9.10-9.30 am	Antioxidant status and breast cancer	H M K Akalanka, K G Amarathunga and S Ekanayake
9.30-9.50 am	<i>In-vitro</i> inhibition of polyphenol oxidase in <i>Annona muricata</i> and <i>Musa acuminata</i> by ginger and cinnamon oil	M B S Weerawardana, P A Paranagama and T Gobika

Time	Title	Authors
9.50-10.10 am	Evaluation of <i>In-Vitro</i> anti-inflammatory activities of <i>Mangifera indica</i> extracts of flesh, peel and seed in Sri Lanka	A Kuganesan, T Gobika, A N Navaratne and P A Paranagama
10.10-10.40 am	Tea break	
Chairperson: Professor Sagarika Ekanayake, Department of Biochemistry, Faculty of Medicine, University of Sri Jayewardenepura		
10.40-11.10 am	Molecular docking studies of human K- RAS protein coumarin derivatives	U L A S Perera and C S Udawatte
11.10-11.30 am	Study of binding of coumarins to DNA gyrase	S M Abdullah and C S Udawatte
11.30-11.50 am	Adsorptive removal of Cu(II) and Pb(II) in aqueous solutions using bael (<i>Aegle marmelos</i>) Flowers	S Hasanthika and A Perera
11.50-12.10 pm	Synthesis, characterization and DNA intercalation studies of a novel plumbagin-based copper (II) metal complex	C Padumadasa, K L N Perera and E M N Sankalpanie
12.10-12.30 pm	Study of fluorescence quenching properties of 5-hydroxy-1,10-phenanthroline in the presence of heavy metal ions in acetonitrile	M D P De Costa and W A C P Wansapperuma
12.30-12.50 pm	Traditional poly herbal formula inhibits AGE formation and scavenges nitric oxide <i>in vitro</i>	M G D T Karunaratne, P K Perera, C S Udawatte and S C D Fernando
12.30-1.30 pm	Lunch	
Chairperson: Mr. E G Somapala, Past President, Institute of Chemistry Ceylon Retired Government Analyst		
1.30- 1.50 pm	Synthesis, characterization and BSA binding studies of novel zinc ferene complexes	N Abeydeera, S Rasakulendran, T Abeywikrama, C Nanayakkara, I C Perera and T Perera
1.50- 2.10 pm	Contents of heavy metals; cadmium, chromium and lead in selected rice varieties (<i>Oryza sativa</i> L.) grown under different agricultural management systems in Sri Lanka	N M C M Navarathna, R Parthipan, K A S Pathiratne, D S M De Silva and W M D A B Wickramasinghe
2.10-2.30 pm	A computational study of coumarin derived inhibitors for Human Topoisomerase I	A G Guruge, C S Udawatte and S Weerasinghe
2.30– 2.50 pm	Experimental and theoretical investigation of Cu(I) catalyzed reaction between bromobenzene and benzylamine	K N D Seneviratne, D P Dissanayake and D T U Abeytunga
2.50-3.10 pm	Sawdust as a low-cost natural adsorbent for removal of Cd (II) from aqueous solutions	A Balachandran and C S Udawatte
3.10-3.30 pm	Comparison of binding of sphingosine derivatives to sphingosine kinase 1 using molecular docking	D M S P Disanayake, D P Dissanayake and D T U Abeytunga



Dr. C L de Silva Gold Medal - Prof E D de Silva, C.Chem., F.I.Chem.C.

Professor E Dilip de Silva is a Senior Professor and Chair in Organic Chemistry at the University of Colombo. He received his BSc Special Degree in Chemistry with Honours from the University of Colombo in 1975. He earned his PhD degree in Organic Chemistry from the University of Hawaii at Manoa, USA in 1982. He won awards for Excellence in Research and as an Outstanding Teaching Assistant at the Department of Chemistry, University of Hawaii at Manoa, USA from 1979- 1980. Professor de Silva has been a Senior Lecturer in the University of Colombo and later an Associate Professor in the Open University of Sri Lanka until he was appointed to the Chair of Organic Chemistry at the University of Colombo in 1997. Prof. de Silva has also served as a visiting Assistant professor in Chemistry, University of British Columbia, Canada, visiting Scholar, Department of Medicinal Chemistry, University of Utah, Salt Lake City, USA and visiting Academic, Department of Chemistry, University of Canterbury, Christchurch, New Zealand. He was awarded the "Professor P P G L Siriwardene Memorial Gold Medal" by the Institute of Chemistry Ceylon in 2007. Professor de Silva has also been the recipient of the GRC Research Award from the SLAAS. He also spent his sabbatical leave at the College of Chemical Sciences as a Visiting Professor in Chemistry.

Abstract of the Dr. C L De Silva Gold Medal Award

Exploring plant associated fungi of Sri Lanka for biologically active metabolites

Professor E D de Silva

Department of Chemistry, University of Colombo, Colombo 03

Fungi are a fascinating group of eukaryotic organisms and are known to be prolific producers of numerous biologically active secondary metabolites. Until, recent times, the fungi of Sri Lanka have remained almost completely uninvestigated in this respect. We have recently initiated a program to investigate plant-associated fungi, both mutualistic and parasitic, for the presence of biologically active natural products that may prove to be useful as medicinal and agricultural agents.

Endophytic fungi reside in the internal tissues of healthy plants and are widespread in nature inhabiting almost all plants. In our program to investigate endophytic fungi for their antimicrobial producing capacity, we have selected host plants occupying varied ecological niches of Sri Lanka. These plant include endemic and endangered plants and are listed below.

- *Anoectochilus setaceus* (Vernacular name: Wanaraja) collected from a tropical rain forest setting in the Kanneliya Forest Reserve.
- The cactus *Opuntia dillenii* an invasive plant thriving in the environmentally harsh South-Eastern arid zone of Sri Lanka.
- *Calamus thwaitesii* Becc. (Veval in Sinhalese) a rattan, belonging to the family Palmae (Arecaceae) collected from Udugampola.
- *Nymphaea nouchali* (Nil Manel in Sinhalese)

a vulnerable aquatic plant native to Sri Lanka collected from the Gampaha District.

- The mangrove-associate plant *Premna serratifolia* collected from 'Kadol kale' mangrove forest in Negambo
- The medicinal weed plant *Cyperus rotundus* collected from the Colombo District.

Our investigations included the isolation of the endophytic fungi associated with each plant and the determination of their antimicrobial producing ability. Next the fungus with the most promising activity from each plant was grown on large scale and bioassay guided chromatographic separations were done to isolate the compounds responsible for the bioactivity. In all 8 antimicrobial compounds were isolated and their structures were elucidated. Seven of them proved to be known compounds with the eighth, solanolic acid, isolated from *Cyperus rotundus* having a novel structure exhibiting a new carbon skeleton and potent antimicrobial activities. Our work on the pathogenic fungal species, *Penicillium purpurogenum*, isolated from the infected fruits of *Averrhoa bilimbi* led to the isolation and characterization of 14 highly functionalized novel natural products which among them exhibited 04 new carbon skeletons. We have named these metabolites which belong to a novel class

of highly rearranged meroterpenoids as “Dhilirolides” based on the the Sinhala name “Dhilira” for fungi to reflect their fungal origin. In a labelling study using doubly ^{13}C -labelled acetate, we have elucidated the biosynthetic pathway to these fascinating compounds, dhilirolide A to dhilirolide N. Among them, Dhilirolide L showed significant feeding inhibition and sub-lethal developmental disruption at low concentrations in the cabbage looper *Trichoplusia ni*, an important agricultural pest.

Our pioneering work on the chemistry of plant-associated fungi has been highly productive. Among the 22 compounds isolated and characterized, 15 are new to science and embrace 5 new natural product carbon skeletons. Some of them have shown potent bioactivities and may be useful as lead compounds in the development of new pharmaceuticals and insecticides useful in agriculture.

Kandiah Memorial Awards - 2016

Three Kandiah Memorial Awards are made annually to commemorate Professor A Kandiah, the first President of the Chemical Society of Ceylon. Professor Kandiah served in the University of Ceylon from 1933 and was the Professor of Chemistry at the University of Ceylon from 1934 until his death in 1951.

The Kandiah Memorial Awards for Basic Chemistry and Applied Chemistry are awarded for the best research contribution in Chemistry carried out by a postgraduate student registered at a Higher Education Institute and for work carried out in Sri Lanka with the exception of special analysis (less than 20% of findings) that cannot be done in the country.

- The Kandiah Award for Basic Chemistry is made for research predominantly in Basic Chemistry (Organic, Inorganic, Physical & Analytical).
- The Kandiah Award for Applied Chemistry is made annually for research in related areas such as polymer, food, biochemistry, biotechnology etc. where interdisciplinary research is involved, provided that chemistry has a central role & comprises at least 50% of the content.
- The Kandiah Memorial Graduateship Award is awarded to the best piece of research in the chemical sciences carried out by a Graduate Chemist of the Institute of Chemistry Ceylon registered with a Higher Educational Institute for a postgraduate degree.

Abstract of Kandiah Memorial Award for Basic Chemistry - 2016

Investigation on wound healing activity of bark of *Ficus racemosa* and “Seetodaka” oil using Scratch Wound Assay (SWA)

N S Bopage

Department of Chemistry, The Open University of Sri Lanka, Nawala, Nugegoda

Different plant parts including latex and the plant preparations have been used in the Ayurveda and in the indigenous system of medicine in Sri Lanka for wound healing. Only a few of them have studied for their efficacy or for their mechanism of action. The present study was designed to identify the potential wound healing active fractions and/or substance/s from the plant *Ficus racemosa* and “Seetodaka” oil, a plant preparation which are being used for wound management in Sri Lanka. Wound healing potential of the extractives and fractions were evaluated using Scratch Wound Assay (SWA) on Baby Hamster Kidney (BHK 21) and Madin-Darby Canine Kidney (MDCK) cell lines as an *in-vitro* model. Antibacterial assay was carried out using Kirby - Bauer disc diffusion method. Dichloromethane and hexanes extracts of *F. racemosa*

which showed wound healing activity on SWA were subjected to bioactivity directed fractionation using column chromatography followed by preparative thin layer chromatography to isolate compounds responsible for the wound healing activity. Lupeol and β -sitosterol showed significant wound healing activity on BHK 21 and MDCK cell lines (>80%) in par with the positive control, asiaticoside at a concentration of 25 μM . The optimum concentration of each compound required for the maximum wound healing has been determined as 30 μM and 35 μM for lupeol and β -sitosterol, respectively on both cell lines. It was also found that there is no noticeable synergistic effect between these two compounds while an additive effect has been observed. It is also established that lupeol acetate act as a pro-drug by undergoing hydrolysis into

lupeol in the vicinity of cells. The presence of lupeol acetate may be an added advantage in using *F. racemosa* in the wound healing process because of its ability of releasing lupeol in a low concentration at the site of the wound. In an attempt to study the structure activity relationships (SAR), it was revealed that 3-OH is an essential feature of the lupane skeleton for its wound healing activity, while increase of the hydrophilic nature at C-28 may be detrimental to its activity.

“Seetodaka” oil is traditionally prepared by boiling a mixture of aqueous extracts of rhizome of *Curcuma longa*, leaves of *Azadirachta indica* and roots of *Asparagus racemosus* with coconut milk. It is

evident that hexanes fraction of “Seetodaka” oil have potential wound healing activity. Among the extracts and the fractions of the constituent plant materials of this oil, hexanes fraction of *A. racemosus* which contained β -sitosterol and the EtOAc fraction of *C. longa* are responsible for the enhancement of wound healing on both BHK and MDCK cell lines. It was also found that there is no noticeable synergistic effect between two fractions while an additive effect has been observed. The antibacterial activity of constituents present in *A. indica* provide and accelerates the wound healing process by the reduction of wound contaminations.

Abstract of Kandiah Memorial Graduateship Award - 2016

Chemistry and bioactivity of secondary metabolites produced by an endophytic fungus *Nigrospora oryzae* from a popular medicinal plant

Coccinia grandis

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Endophytic fungi are considered as a good source to produce important secondary metabolites with interesting bioactivities. Some endophytic fungi have the ability to produce the same compounds that are produced by their host plant. A well-known example is the production of Taxol from *Taxus brevifolia*. The objective of the present research study is to investigate the chemistry and bioactivity of secondary metabolites produced by a popular medicinal plant *Coccinia grandis* (local name: Kowakka). *C. grandis* is used to control diabetes in Sri Lanka and India. Endophytes were isolated from the leaves of *C. grandis* by following the standard methods. The fungus was identified as *Nigrospora oryzae* through molecular means. Fungus was allowed to ferment in potato dextrose broth (PDB) medium. After four weeks of fermentation, the medium was extracted with EtOAc/H₂O and the crushed residual mycelium was extracted with EtOAc. TLC analysis indicated that the EtOAc extract from the PDB medium exhibited the same pattern of spots as that from the mycelium. Hence, the two EtOAc extracts were combined and screened for bioassays. Significant activities were observed for antifungal activity against *Cladosporium cladosporioides* by the TLC bioautography method, antioxidant activity (IC₅₀ 462 ppm), brine shrimp toxicity (IC₅₀ 190 ppm) and phytotoxicity (shoot inhibition at IC₅₀ 653 ppm and root inhibition at IC₅₀ 339 ppm). Chromatographic separation of the combined

EtOAc extract over silica gel, Sephadex LH-20 and PTLC yielded two phenazine derivatives as phenazine-1-carboxylic acid (**1**) and phenazine-1-carboxamide (**2**) which were identified by detailed analysis of ¹H NMR, ¹³C NMR, FABMS data and by comparison with the reported data. This is the first report of the isolation of *N. oryzae* as an endophytic fungus of *C. grandis* and the identification of the phenazine derivatives **1** and **2** as the secondary metabolites of the fungus. Phenazine production from a fungal source is reported for the first time. Compound **2** was active in the brine shrimp toxicity assay (IC₅₀ 98 ppm). Compounds **1** and **2** displayed phytotoxicity (IC₅₀ 121 ppm and IC₅₀ 99 ppm for inhibiting root and shoot elongation, respectively). No significant activities were observed for **1** and **2** on antioxidant and alpha amylase inhibition. Compound **2** isolated in high yield (1 g / 4 L) showed strong antifungal activity against the plant pathogen *C. cladosporioides* (4 µg/spot) by TLC bioautography method. Antifungal activity of **2** against *C. cladosporioides* is reported for the first time. Further large scale production of compound **2** by fermentation of this *N. oryzae* strain can be used as a starting material for the synthesis of useful phenazine derivatives. It would be interesting to further investigate other parts, in particular roots and fruits of *C. grandis* as a possible source of endophytic fungi which produce environmentally friendly fungicides that may be useful for the protection of agricultural crops.

Chemistry and bioactivity studies of *Flacourtia inermis*

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Flacourtia inermis Roxb. (Lovi) (Flacourtiaceae) is a moderate sized tree cultivated in Sri Lanka for its fruits known as *Lovi*. Fruits are dark red when ripe with a sweet, sour and astringent taste. Fruits are grown in home gardens and the excess crop is wasted. This study was carried out in order to evaluate the economic potential of the fruit crop. Extracts of *F. inermis* fruits were fractionated using chromatographic techniques and subjected to several bioassays in order to assess the nutritional and pharmacological value of these fruits and fruit extracts.

Ethyl acetate, methanol and n-butanol extracts of both the plant material and fruits, were subjected to the following assays to assess bioactivities; DPPH (2, 2'-diphenylpicrylhydrazyl) radical scavenging assay, brine shrimp lethality assay (cytotoxicity), lettuce seeds germination assay (phytotoxicity) and TLC bioautography with *Cladosporium cladosporioides*. (antifungal activity) The same plant extracts were subjected to α -amylase inhibition assay against porcine pancreatic α -amylase enzyme using starch as the substrate and dinitrosalicylic acid as the indicator; lipase inhibition assay against *Candida rugosa* lipase enzyme using *p*-nitrophenylbutyrate as the substrate and α -glucosidase inhibition bioassay against *Saccharomyces cerevisiae* α -glucosidase using *p*-nitrophenyl- α -D-glucopyranoside as the substrate.

The EtOAc extract of *F. inermis* fruits showed high enzyme inhibitory activities, cytotoxic and antioxidant

properties, and was subjected to bioactivity guided fractionation based on the α -amylase assay. The active compound was isolated and identified as *S*-malic acid; $[\alpha]_D -1.8$ (c 0.38, H₂O). The IC₅₀ values for α -glucosidase, α -amylase and lipase activities were 58.15 ppm (IC₅₀ Acarbose 13.83), 96.40 (IC₅₀ Acarbose 19.85) and 69.03 (IC₅₀ Orlistat 55.13) ppm respectively. The IC₅₀ value for antioxidant activity based on the DPPH radical scavenging assay was 6.20 ppm (IC₅₀ Ascorbic acid 22.27 ppm). The total polyphenol content of *F. inermis* fruits was determined as 1.28 g/ 100 g of fresh fruits by the Folin-Ciocalteu method using gallic acid as the standard and anthocyanin content was determined to be 0.107 g/ 100 g of fruits as cyanidin-3-glucoside equivalents, using a pH differential method. LC-MS/MS analysis of the methanol extract of *F. inermis* fruits revealed the presence of many chlorogenic acids derivatives including monocaffeoylquinic acids (*Mr* 354), dicaffeoylquinic acids (*Mr* 516), feruloylquinic acid (*Mr* 368), methylcaffeoylquinates (*Mr* 368), caffeoylshikimates (*Mr* 336), flavanoids and flavanoid-glycosides. The presence of *S*-malic acid, a valuable combination of antioxidants, polyphenolic compounds including anthocyanins, chlorogenic acids and flavanoids indicated that *F. inermis* fruits, an under exploited fruit crop in Sri Lanka, have the potential to be used in health foods and in nutritional supplements.

Graduate Chemists Welfare Fund

This fund has been established with effect from 1-1-2012. The principal benefits towards CCS Graduate Chemists would be,

- I. To provide partial assistance towards international travel of those proceeding abroad for PG degrees (once a life time). Assistance for
 - Active Graduate Chemists : Rs. 60,000
 - Passive Graduate Chemists : Rs. 30,000
- ii. To provide partial assistance towards registration fees in respect of IChemC /CCS events such as international Conferences.
- iii. To provide assistance towards registration fees for IChemC /CCS training seminars etc.
- iv. To provide partial assistance towards activities of the Alumni Association.

Note : Depending on the demand, Graduate Chemists who maintain positive contact and participate in IChemC/Alumni activities will get preference for the above mentioned assistance scheme.

Technical Sessions : A - 01

Determination of essential heavy metal levels of Fe, Zn and Cu in hair samples of anemic patients due to iron deficiency and chronic disorders

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Iron deficiency anaemia is one of the most common forms of anaemia abundant in all regions of the world.¹ The role of iron in haemopoiesis has been studied widely and trace metals such as Cu and Zn have certain functions in normal haemopoiesis.^{2,3} There had been very few studies related to impact of these metals in the process of haemopoiesis and development of anaemia. Higher concentrations of elements in hair are an indication of their bio accumulation over a long period of deposition.⁴ Analysis of iron in blood is commonly used in order to determine the cause of anemia however analytical methods are not available to diagnose the anemic condition caused by other trace elements.

The study was designed to assess the levels of essential trace elements in hair samples of anemic and control subjects in Sri Lanka, and to correlate the level of these elements with the occurrence of anemia. The effects of age and sex on the levels of essential elements in the hair samples were also investigated.

Scalp hair samples were collected from 65 anemic patients and 50 controls with age range 20 to 80 years of both genders in the hematology clinic of National Hospital of Sri Lanka after screening through by a questionnaire. The elements Cu, Zn and Fe in the hair samples were measured by flame atomic absorption spectrophotometry (iCE 3000) after wet acid digestion. The proposed analytical method was validated using hair samples of control subjects.

A detection limit of 0.019 ppm, 0.044 ppm and 0.015 ppm were obtained for Cu, Fe and Zn, respectively. Overall percentage of recovery studies of each element was Fe 97.40%, Cu 99.00% and Zn 97.20%. Statistical analysis were conducted to determine statistical significance differences between concentrations of elements reported in the hair samples of both anemic patients and controls at 5% level of significance. Overall mean concentration of Zn (294.3 ± 33.4 mg/kg), Fe (487.6 ± 76.8 mg/kg) and Cu ($57.4 \pm$

9.7 mg/kg) were found in control subjects and Zn (135.2 ± 80.9 mg/kg), Fe (118.7 ± 51.1 mg/kg) and Cu (18.6 ± 8.3 mg/kg) were found in anemic subjects. The above results indicate significantly lower concentration of Cu, Zn and Fe in anemic subjects compared to control subjects ($p=0.000$). According to the results, the hair element content highly depends on the health status of the human body. The levels of all the elements analyzed were statistically higher in male subjects compared to female subjects ($p=0.000$). Overall element concentration of Cu (58.7 ± 9.7 mg/kg), Zn (295.7 ± 30.0 mg/kg) and Fe (486.7 ± 51.6 mg/kg) were found in male and Cu (56.6 ± 9.5 mg/kg) Zn (293.3 ± 35.5 mg/kg) and Fe (485.7 ± 86.3 mg/kg) were found in female subjects. Results reflect a wide variation in essential trace element concentration of Cu, Zn and Fe in human hair in male and female. It could be due to individual differences in exposure to the environment and different occupations. The mean element levels of Cu, Zn and Fe were higher in control subjects compared to anemic in all age groups ($p=0.000$). The changing metabolic processes inside the human body with increasing age may be responsible for different element concentrations among different age groups.

There is a clear evidence of the deficiency of copper and zinc levels to anemic condition in human body other than iron. In addition, the trace element concentrations were highly dependent on age and sex. It can be concluded that the results in this study confirmed the usefulness of hair element analysis in screening tests for the assessment of the cause of anemia in male and female subjects.

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Technical Sessions : A - 02

***In vitro* antioxidant, antiglycation and α -glucosidase inhibitory activities of the ethyl acetate soluble fraction of water extract of *Artocarpus heterophyllus* Lam. leaves**

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Artocarpus heterophyllus Lam. commonly known as jackfruit belongs to the family Moraceae. Diabetes mellitus is a global health problem where every seven seconds one person dies and 11% of worldwide healthcare expenditure is used to treat diabetes and its complications.¹ In traditional medicine of Sri Lanka the water extract of *A. heterophyllus* senescent leaves is used to reduce the blood sugar level. This extract has been shown to significantly lower the fasting blood sugar level and markedly improved glucose tolerance in Sprague-Dawley rats as well as normal human subjects and diabetic patients.²⁻³ The ethyl acetate soluble fraction of the water extract of senescent leaves of *A. heterophyllus* (named as EA/W) has been shown to possess higher hypoglycemic greater than that of tolbutamide, a sulphonyl urea drug commonly used for treatment of hyperglycemia.⁴

In this study the EA/W was tested for its *in vitro* antioxidant activity, antiglycation activity and α -glucosidase inhibitory activity. The EA/W was tested for its antioxidant activity using 2,2-Diphenyl-1-picrylhydrazyl (DPPH) radical scavenging assay, the antiglycation activity using Bovine Serum Albumin (BSA) – methylglyoxal (MGO) fluorescent based assay and α -glucosidase inhibitory activity using α -glucosidase enzyme inhibition assay⁵.

In the DPPH radical scavenging activity EA/W showed moderate radical scavenging activity with an IC₅₀ value of 29.3 $\pm$ 0.7 μ g/mL while gallic acid had an

IC₅₀ value of 23.5 $\pm$ 0.4 μ g/mL. In the α -glucosidase inhibition assay EA/W showed an IC₅₀ value of 1.9 $\pm$ 0.6 μ g/mL while the standard drug acarbose showed an IC₅₀ value of 0.5 $\pm$ 0.01 μ g/mL. The antiglycation activity was low, giving an inhibition of 44% at 0.5 mg/mL, compared with the standard rutin gave an inhibition of 85% in 1 mM (0.6 mg/mL).

These results indicate that the hypoglycemic activity of *A. heterophyllus* senescent leaves, may be partly due to α -glucosidase inhibiting activity. Further its antioxidant activity and antiglycation activity (even though lower than rutin) may contribute to reducing the complication arising due to diabetes mellitus.

Acknowledgement: Financial assistance by University of Sri Jayewardenepura (Research grant No: ASP/6/PR/2008/05)

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Technical Sessions : A - 03

Megastigmanes from Leaves of *Artocarpus heterophyllus* Lam.

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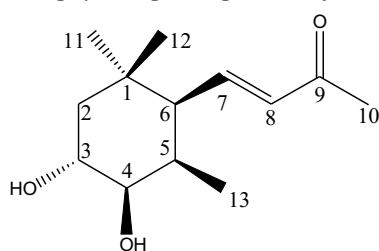
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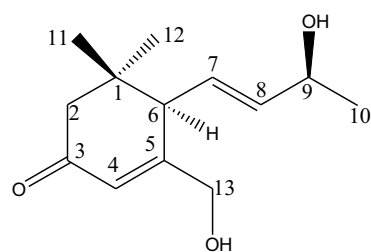
Artocarpus heterophyllus Lam. (family Moraceae) commonly known as jackfruit is a rich source of secondary metabolites such as flavonoids, stilbenes, triterpenes, chalcones, xanthenes and sterols.¹ Most of the compounds reported have been from the root, wood and twigs.¹⁻⁴ Thus the chemistry of the leaves of *A. heterophyllus* is still to be fully explored. In Sri Lanka traditional medicine the water extract of *A. heterophyllus* senescent leaves are used to reduce the blood sugar level. We have shown earlier that the hypoglycemic activity of ethyl acetate soluble fraction of the water extract of senescent leaves (EA/W) was greater than that of tolbutamide, a sulphonyl urea drug commonly used for treatment of hyperglycemia.⁵

Two megastigmane derivatives were isolated from an active fraction arising from chromatography of EA/W on sephadex LH-20. The structures of the compounds (1 and 2) were elucidated using ¹H NMR, ¹³C NMR, ¹³C NMR DEPT, HSQC, HMBC, COSY, NOESY, IR and UV spectroscopy and FAB MS spectrometry. Neither of these have been reported from the *A. heterophyllus* species previously.



Compound 1

3, 4-dihydroxy-7-ene-megastigman-9-one



Compound 2

13-Hydroxy-3-oxo-α-ionol

This is the first report of megastigmanes from *A. heterophyllus*.

Acknowledgement: Financial assistance by University of Sri Jayewardenepura (Research grant No: ASP/6/PR/2008/05)

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Technical Sessions : A - 04

Isolation of compounds with radical scavenging activity from *Daldinia eschscholzii* inhabiting the lichen *Parmotrema* sp. in Sri Lanka

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Bioactive natural products are potential leads for novel pharmaceutical agents. Isolation and characterization of bioactive compounds from nature and unraveling their biological activities plays an important role in developing novel therapeutics. Endolichenic Fungi (EF), one of the ecological groups of fungi, still remains almost unexplored as a rich source of bioactive compounds.^{1,2} The purpose of this study is to isolate bioactive secondary metabolites from the EF *Daldinia eschscholzii* inhabiting the lichen *Parmotrema* sp. in Hakgala Botanical Garden, Sri Lanka. EF *Daldinia eschscholzii* was cultivated on 48 large Potato Dextrose Agar (PDA) plates. After one week of incubation at room temperature, mycelia were cut in to small pieces along with the PDA medium and secondary metabolites were extracted into ethyl acetate (5 L). Radical scavenging activity of the crude extract was tested using DPPH assay carried out according to the method described by Chatatikun and Chiabchalard³ with slight modifications. Standard antioxidant, Butylated Hydroxy Toluene (BHT) was used as the positive control and methanol was the negative control. Since the crude extract showed high radical scavenging activity ($IC_{50} = 77.9 \pm 5.1 \mu\text{g/mL}$) it was partitioned with hexane, chloroform (CHCl_3) and aqueous methanol. All three fractions showed activity in the DPPH assay, nevertheless the activity was lower than that of the standard BHT ($IC_{50} = 38.2 \pm 4.0 \mu\text{g/mL}$). Chloroform fraction with the highest activity ($IC_{50} = 63.8 \pm 4.8$

$\mu\text{g/mL}$) was further fractionated using bio-assay guided fractionation (silica gel, sephadex column chromatography and preparative TLC). Two pure compounds were isolated from CHCl_3 fraction and radical scavenging activities of the isolated compounds were evaluated. Compound 1 did not show any activity in DPPH assay. Compound 2 showed high radical scavenging activity with IC_{50} value of $10.2 \pm 5.8 \mu\text{g/mL}$. The activity was higher than that of the standard BHT. Characterization of the compounds is still in progress using ^1H -, ^{13}C -, 2D-NMR and MS.

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Technical Sessions : A - 05

Preliminary study on development of herbal mosquito repellent formulations

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The present study reports the studies directed towards the development of safe and efficient herbal mosquito repellent formulations obtained by mixing

hexane extract of *Azadirachta indica* seeds, hexane/ethanol extract of *Vitex negundo* leaves, essential oils from *Ocimum sanctum* leaves, *Curcuma*

longa rhizomes and *Citrus sinensis* peels and essential oils of *Cymbopogon nardus* leaves, *Eucalyptus globulus* leaves and *Syzygium aromaticum* buds purchased from the market. 1 ml of 10% (v/v%) extract /essential oil containing ethanol solutions prepared using each plant extract / essential oil was tested for mosquito repellent activity using arm-in-cage method. A volunteer's forearm rubbed with 1 ml test solution was exposed to 20 mosquitoes and the number of mosquitoes that aligned or biting the arm was recorded in each minute for five minutes. Analysis was carried out as a triplicate and mosquito repellent activities were

found to be in the order: *C. nardus* and *E. globulus* (100%) > *O. sanctum* (97.94%) > *S. aromaticum* (95.81%) > *C. sinensis* (93.75%) > *C. longa* (89.56%) > *V. negundo* (85.44%) > *A. indica* (81.25%). Outdoor and indoor field trials on mosquito repellent gel and mosquito repellent spray prepared containing 16% (v/v%) active ingredients were conducted separately on two days from 5 am to 11 am by application on volunteers' legs. 100% mosquito repellency up to six hours was observed for the gel and the spray for outdoor and indoor field trials.

Technical Sessions : A - 06

Antioxidant status and breast cancer

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The effect of antioxidants and breast cancer (BC) has been studied with inconclusive results. Thus the objectives of the study were to assess the serum total antioxidant status (TAS) and uric acid (UA) concentration of newly diagnosed breast cancer patients and to compare with the age matched apparently healthy females.

Consent was obtained from newly diagnosed BC patients (n=150) and apparently healthy women in the same age group (n=75). Serum UA concentrations were measured using Kone 20XT biochemical analyzer and serum TAS was analyzed as Trolox equivalents using ABTS [2,2'-azinobis (3-ethylbenzothiazoline-6-sulfonic acid)] free radical scavenging assay. Ethical approval for the study was obtained (631/12, 28/14).

Mean serum UA concentration of BC patients and healthy females were 200±57 µmol/L and 256±72 µmol/L respectively. BC women had UA levels closer to the lower reference margin and was significantly lower (p=0.000) when compared with apparently healthy women. BC women having UA less than 194 µmol/L (cutoff value studied via ROC curve with 92% sensitivity and 63% specificity, p=0.000, 95% CI 0.68-0.83) showed a 2.2 risk (95% CI, 1.7, 2.8) of having BC compared to healthy women. Mean serum TAC of BC patients and healthy females in Trolox equivalents were 6.25(±1.35) and 6.09(±1.31), respectively and not significantly different (p>0.05). Neither serum UA nor TAC concentrations significantly differed (p>0.05) according to the menopausal status among BC and

healthy women.

Even though TAS studied via ABTS free radical scavenging assay is not indicative of BC risk, having serum UA less than 194 µmol/L indicate twice (2.2) the risk of BC compared to apparently healthy females among the study sample.

Acknowledgements

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***In-vitro* inhibition of polyphenol oxidase in *Annona muricata* and *Musa acuminata* by ginger and cinnamon oil**

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Most of fresh vegetables and fruits available in the retail markets undergo a physiological disorder in its appearance and coloration, which indeed discourages consumer purchase. This is because some of the main attributes considered by consumers when making choices of food are flavor, texture, appearance and its nutritional value. Out of which appearance signifies a major role. A loss of millions of dollars yearly to the food industry had been due this pronounced color reaction called enzymatic browning which is driven due to the catalytic activity by an oxidoreductase enzyme, polyphenol oxidase (PPO). The enzyme oxidizes the phenolic compounds which are widely available in fruits and vegetables as substrates to quinones, which could react with proteins in its surrounding to generate black pigments, called melanins, which are highly UV-active compounds.¹ Enzymatic browning cannot take place as the phenolic compounds present in the cell vacuoles are separated from polyphenol oxidase which is present in the chloroplasts in the cytoplasm. Once the tissue is damaged as a result of slicing, or cutting, the phenolic compounds get released to the cytoplasm, where the formation of melanin occurs.² *Annona muricata* (Katuanoda) and *Musa acuminata* (Ash plantains) is a fruit and a vegetable, respectively, consumed by Sri Lankans widely due to their high nutritional values, medicinal properties and economical importance.

The objective of the present study was to evaluate and determine the effective natural anti-browning inhibitors that could prevent PPO activity in the selected fruit and vegetable. Enzyme extracts from *A. muricata* (Katuanoda) and *M. acuminata* (Ash plantains) were prepared by homogenizing with analytical grade acetone which was evaporated before the addition of the buffer. The pH of each enzyme extract was maintained at 7.0 using a phosphate buffer and was incubated at a temperature of 35 °C. The extracts of inhibitors were prepared using powdered ginger rhizomes and essential oils from the bark of *Cinnamomum zeylanicum*. Water extracts of ginger were prepared and the essential oil from Ceylon cinnamon bark was extracted using steam distillation

method. Since the essential oil is not soluble in water, 0.1 µl of cinnamon bark oil was mixed with 0.1 µl of Triton X-100 emulsifier and 5.00 ml of water.

The effect of each inhibitor on the PPO activity was investigated using catechol (0.1 moldm⁻³) as the substrate and two samples of enzyme extracts prepared. The dosages of the prepared Cinnamon bark oil, and ginger (2 samples) used to measure the activity was 0.0035 g/ml, 0.091 g/ml and 0.087 g/ml respectively. The measurements of the inhibitory activity was obtained at a wavelength of 525 nm using the UV-visible spectrophotometer.^{3,4,5}

The results evaluated thus revealed that the percentage inhibition observed with cinnamon bark oil, and ginger for *A. muricata* was 51.97 %, and 60.90 % respectively. The effects of cinnamon bark oil, and ginger extract on PPO activity of *M. acuminata* were 49.51 %, and 48.10 %.

The experimental findings thus revealed that *C. zeylanicum* bark oil was a more effective inhibitor for PPO enzyme present in *M. acuminata* and ginger was effective for PPO enzyme present in *A. muricata*. Overall both the inhibitors were proven to be more effective towards the activities of PPO enzyme present in both samples. These inhibitors can thus be corroborated as effective, natural, non-toxic, anti-browning extracts, which when added to the above fruit and vegetable will increase the shelf life and also the acceptance of the product by the consumers.

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Evaluation of *In-Vitro* anti-inflammatory activities of *Mangifera indica* extracts of flesh, peel and seed in Sri Lanka

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The main objective of this study was to evaluate the anti-inflammatory potential efficacy of mango peel, pulp and seed kernel. In the present study three mango varieties 'Willard', 'Karuthacolomban' and 'Vellaicolomban' were collected from Jaffna district during April to July, 2015 to carry out the extraction processes. Ethyl acetate extracts of flesh, peel and seed kernel of three mango varieties were assessed for *in vitro* anti-inflammatory studies using two assays, which include Nitric oxide scavenging assay (NO)¹ and Human Red Blood Cell (HRBC) membrane stabilization assay². L-ascorbic acid and aspirin were used as standard for NO and HRBC assays, respectively. According to the NO radical scavenging assay results of the peel extract obtained from 'Vellaicolomban' (IC₅₀-47.99±2.56 µg/mL) showed the highest radical scavenging activity. Among nine extracts, the seed kernel extract from 'Karuthacolomban' (IC₅₀-128.19±5.27 µg/mL) showed significantly higher anti-inflammatory activity in HRBC membrane stabilization assay than the

standard, aspirin (IC₅₀ - 481.39 ± 8.11 µg/mL) ($P \leq 0.05$). This result demonstrated that seed kernel extracts from 'Karuthacolomban' shows the potential to reduce inflammation than aspirin. Finding of the present investigation showed that the mango peel and the seed kernel exhibit good anti-inflammatory activity than that of the flesh. Thus, this study gives an idea that the seed extract and the peel extract of mango can be used to design a potent anti-inflammatory drug which can be used to cure inflammation.

Acknowledgement: Financial assistance by College of Chemical Sciences of the Institute of Chemistry Ceylon the research grant (14/01)

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Molecular docking studies of human K-Ras protein coumarin derivatives

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RAS proteins play a significant role in signal transduction pathways, including cell-surface receptors, control of cell proliferation, differentiation and apoptosis. They exist in equilibrium between an active (RAS-GTP) and an inactive (RAS-GDP) state. Mutations in RAS genes can lead to the production of permanently activated RAS proteins and they are found in 20% - 25% of all human tumours and up to 90% in certain cancers.¹ Molecular docking simulations were carried out to investigate the binding of 7 coumarin derivatives. Binding at different sites were investigated

as K-RAS has been found to exhibit different inhibitory sites for different molecules. A mutant K-RAS were used as the receptor. The molecular docking was carried out using UCSF DOCK 6.6², AutoDock Vina³ and GEMDOCK⁴.

The results showed that coumarin derivatives were successfully docked to K-RAS (Figure:2) and they exhibited very promising results with the mutated KRAS. Moreover, most of the test ligands exhibit comparable scores to the experimental drug (SCH-54292). The insights gained from the study have great

potential for design of novel drugs with negligible or mild^{5,6} for KRAS related cancers.

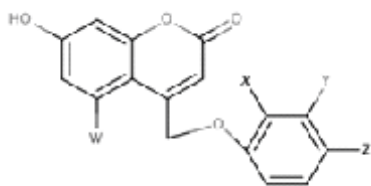


Figure 1: Structure of primary ligand

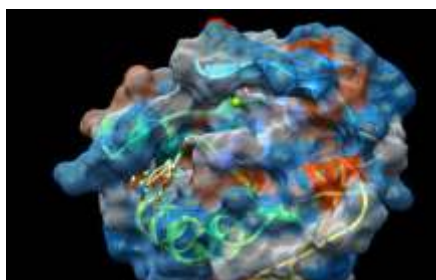


Figure 2: Ligand C7 bound to K-RAS

Technical Sessions : A - 10

Study of binding of coumarins to DNA gyrase

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The bacterial type II topoisomerase, DNA gyrase are validated targets for clinically used coumarin based antibacterial drugs. Due to the limitation of these DNA gyrase inhibitors, which has arisen as a result of the evolution of drug-resistant bacteria by mutations. Research is being carried out employing Structure Based Molecular Docking (SBMD) to use derivatives of coumarins to target the active site of the DNA gyrase. For this purpose Molecular docking was performed using AutoDock Vina¹ and UCSF DOCK 6.6² to dock coumarin derivatives onto DNA gyrase of two different species: *E.coli* (Figure 1) and *mycobacterium tuberculosis* (Figure 2). The Calculations were done using coumarin derivatives consisting of a few differences from the parent structure (Figure 3). The results obtained with AutoDock Vina clearly stated that almost all the coumarin derivatives had reasonably strong interaction with the DNA gyrase of the two species. The results were compared with that of Novobiocin (Figure 4). Following AutoDock Vina, Dock 6.6 was run on the derivatives and DNA gyrase species using both flexible and rigid mode. In both modes the receptor was kept rigid, whereas the ligand was rigid in the rigid mode and flexible in the flexible mode. The results obtained from UCSF DOCK6.6 were

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compared with that of Novobiocin, a coumarin drug. Correlations between the results of each of the derivatives were observed through hydrogen-bonding interactions and calculated docking scores. These findings suggested that out of the coumarin derivatives used 4-(2,4-Dinitro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one and 4-(2,4-Dinitro-phenoxy-methyl)-7-hydroxy-chromen-2-one have produced the best ligand receptor orientation for both the DNA gyrase species. These derivatives used are structurally unrelated to previously identified gyrase inhibitors and represent potential scaffolds for the optimization of novel antibacterial agents.



Figure 1: DNA gyrase of *E.coli*



Figure 2: DNA gyrase of *M. Tuberculosis*

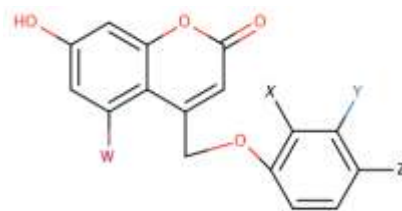


Figure 3: Parent structure of the Coumarin derivative

Table 1: Results of Coumarin derivatives

Ligand ID	Ligands used and their differences with respect to primary ligand		DNA GYRASE					
			<i>Mycobacterium Tuberculosis</i>			<i>E.coli</i>		
			DOCK6 Grid Score (kcal/mol)		Vina (kcal/mol) (Flexible)	DOCK6 Grid Score (kcal/mol)		Vina (kcal/mol) (Flexible)
			Rigid	Flexible		Rigid	Flexible	
L1	W	METHYL GROUP	-30.638	-34.542	-6.100	-33.729	-35.339	-7.500
L2	W, Z	METHYL GROUP, CHLORINE.	-29.987	-34.384	-6.600	-33.093	-35.383	-7.800
L3	W, X	METHYL GROUP, CHLORINE.	-32.537	-33.309	-7.300	-32.160	-37.104	-8.200
L4	Y	CHLORINE	-31.891	-34.358	-6.800	-34.412	-34.260	-7.800
L5	Z	NITRO GROUP	-33.326	-36.799	-6.600	-34.460	-38.341	-8.300
L6	Z	METHOXY GROUP	-33.259	-34.166	-6.700	-39.247	-39.982	-7.900
L7	X, Z	NITRO GROUP, NITRO GROUP	-36.416	-43.679	-6.800	-37.968	-46.476	-8.300
L8	W, Y	METHYL GROUP, CHLORINE	-34.835	-35.782	-6.900	-33.189	-35.782	-8.400
L9	W, Z	METHYL GROUP, NITRO GROUP	-32.711	-33.991	-7.100	-34.698	-33.991	-7.700
L10	W, Z	METHYL GROUP, METHOXY GROUP	-30.589	-32.818	-6.900	-35.007	-32.818	-7.800
L11	W, X, Z	METHYL GROUP, NITRO GROUP, NITRO GROUP	-37.459	-35.787	-6.700	-43.249	-35.787	-8.100

Table 2: Results of Novobiocin

NOVOBIOCIN					
<i>Mycobacterium Tuberculosis</i>			<i>E.coli</i>		
Dock 6.6 Grid Score (kcal/mol)		Vina (kcal/mol) (Flexible)	Dock 6.6 Grid Score (kcal/mol)		Vina (kcal/mol) (Flexible)
Rigid	Flex		Rigid	Flex	
-44.937	-49.967	-7.200	-46.256	-52.010	-8.200

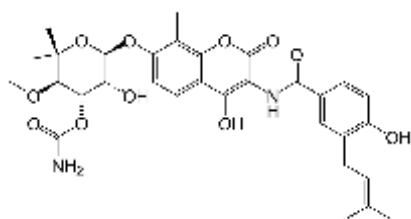


Figure 4: Structure of Novobiocin

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Adsorptive removal of Cu(II) and Pb(II) in aqueous solutions using bael (*Aegle marmelos*) flowers

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Rapid development of industries and environmental pollution has simultaneously risen to an undesirable extent in the modern world. Water pollution by heavy metals has been recorded as a critical issue in the global context since they persist in the environment without degradation. Phytoremediation was experimented as a cost effective and environment friendly alternative for the previously used heavy metal treating methods like membrane filtration and chemical coagulation. Use of natural biological origins, the use of green plants to heavy metal removal from soil and waste water is known as "Phytoremediation", including phytoextraction *etc.* Biosorption is known as a potent and ecofriendly alternative technique for heavy metal removal from water using natural or dead biomass such as tea factory waste, saw dust *etc.*

In the present study batch mode adsorption was carried out to investigate the biosorption of Cu(II) and Pb(II) on dried bael flowers (*Aegle marmelos*) from aqueous solution by varying contact time, initial metal concentration, dose of adsorbent, temperature, and initial pH of the metal solution. Bael flowers were crushed, sieved, washed and oven dried to prepare the adsorbent.

Adsorption of Cu(II) reached constant around 120 minutes at 50 ppm initial concentration. Variations observed in Pb(II) adsorption trend might be due to the involvement of different mechanisms of adsorption. When dried bael flower adsorbent dosage increased, percentage removal of Cu(II) reached to maximum around 0.500 g whereas Pb(II) adsorption was not much affected by changing adsorbent dosage. Maximum adsorption of Cu(II) observed at pH in the range of 4 - 7 and Pb(II) adsorption was not affected much by initial pH at the adsorbent particle size 250-500 μm and 0.500 g adsorbent dosage. Percentage removal of Cu(II) decreased when temperature was varied from 20 $^{\circ}\text{C}$ to 60 $^{\circ}\text{C}$ which indicates the exothermic nature in adsorption mechanism. Scanning Electron Microscopy (SEM) analysis visualized uneven and irregular nature on dried bael flower

surface. Fourier Transform Infrared spectroscopy (FTIR) studies indicated the presence of functional groups like hydroxyl and -C-O-C groups in dried bael flowers which can probably involve in metal adsorption.

The sorption processes of Cu(II) and Pb(II) were best described by pseudo second order kinetics. Langmuir isotherm had a good fit with the experimental data for Cu(II) with 0.98 of correlation coefficient (R^2) and maximum adsorption capacity obtained from the Langmuir model was 22.88 mg g^{-1} (amount of Cu(II) per 1g of adsorbent) at 30 $^{\circ}\text{C}$. According to pseudo-second order model equilibrium adsorption capacity was 8.32 mg g^{-1} which is approximately equal to the experimental value at 30 $^{\circ}\text{C}$. Neither isotherm was very successful with Pb(II) and maximum experimental adsorption capacity was around 10 mg g^{-1} at 30 $^{\circ}\text{C}$. For Pb(II) equilibrium adsorption capacity obtained from pseudo-second order model was 14.41 mg g^{-1} at 30 $^{\circ}\text{C}$.

Free energy change in Cu(II) adsorption process was -10.82 kJ mol^{-1} and for Pb(II) -10.85 kJ mol^{-1} at 30 $^{\circ}\text{C}$, which indicates the adsorption processes on dried bael flowers are favorable and spontaneous. For Cu(II) adsorption, calculated negative enthalpy change attributed to exothermic process and negative entropy change indicates the decrease in randomness of metal ions at the solid-liquid interface. COD (Chemical Oxygen Demand) analysis indicates that the amount of organic matter leached to water by dried bael flower is low.

Synthesis, characterization and DNA intercalation studies of a novel plumbagin-based copper (II) metal complex

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Plumbago indica L., called “Rathnital” in Sinhala is a plant belongs to the family Plumbaginaceae, which is widely used worldwide for its medicinal properties. In Sri Lanka it is extensively used in traditional medicine and Ayurveda. The major secondary metabolites in the roots of these plants are naphthoquinones of which plumbagin (2-methyl-5-hydroxy-1,4-naphthoquinone) is predominant.¹ Previous studies claim that plumbagin exhibits highly potent biological activities most importantly anticancer activities.¹ Although plumbagin has been shown to be more toxic to cancer cells, it has also been shown to be toxic to normal cells at high concentrations. Plumbagin, in addition to possessing the common problems associated with natural compounds such as inefficient systemic delivery, poor bioavailability and reduced oxidative stability, is also volatile.¹ Therefore, design of a “hybrid drug molecule” of plumbagin by combining it with appropriate metals and other ligands may provide an opportunity to overcome these problems in its use for cancer treatment.

Plumbagin was extracted from *P. indica* roots using hexane.² After recrystallization using hexane plumbagin was obtained as orange coloured needles (0.36 g, 0.72 %). In GC/MS studies, the gas chromatogram showed a single peak and corresponding mass spectrum with a molecular ion at m/z 188. IR and UV spectroscopic results and melting point (76-78 °C) were in accordance with published data and confirmed that plumbagin has been successfully isolated.³ The synthesis of the Cu (II) metal complex was carried out using plumbagin (PLN) and phenanthroline (PHEN) as ligands in methanol.⁴ The crude obtained after the slow evaporation of the reaction mixture was recrystallized using methanol to yield the pure metal complex as dark red crystals (0.254 g, 68.85%). In the IR spectrum of the metal complex, C=O stretchings of PLN were observed at 1660 and 1621 cm⁻¹ (C=O stretching at 1621 cm⁻¹ has shifted from 1641 cm⁻¹ due to complexation) and C-H stretchings of PHEN were observed at 848 and 785 cm⁻¹ (shifted from 719 and 623 cm⁻¹ due to coordination of

PHEN nitrogen atoms with the metal).⁵ UV absorption studies also indicated the presence of both PLN and PHEN ligands in the metal complex. Most importantly, EI-MS (molecular ion at m/z 430) confirmed that [Cu(PLN)(PHEN)]NO₃ has been synthesized (Figure 1).

In DNA binding studies using E-gel imager UV transilluminator, the fluorescence produced by ethidium bromide bound DNA gradually decreased in the presence of increasing concentrations of the metal complex and was not observed at and beyond 400 μM of the metal complex (Fig. 2). Ethidium bromide is a well-known DNA intercalating ligand. Our studies indicate that the synthesized metal complex is able to successfully intercalate to DNA replacing ethidium bromide. These findings may lead to the possible use of plumbagin as a “hybrid drug molecule” for the treatment of human cancers.

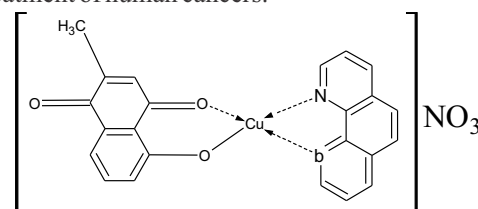


Figure 1. [Cu(PLN)(PHEN)]NO₃ complex



Figure 2. Effect on fluorescence intensity of ethidium bromide bound human DNA on varying concentrations of [Cu(PLN)(PHEN)]NO₃. (left to right: NG 2 – ethidium bromide only, NG 1 – DNA and ethidium bromide, ethidium bromide bound human DNA on varying concentrations of metal complex 25, 50, 100, 150, 200, 300, 400, 500, 600, 700 μM)

Acknowledgements: The mass spectral services provided by the Chemistry Research Laboratory of University of Oxford, United Kingdom is greatly appreciated.

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Technical Sessions : A - 13

Study of fluorescence quenching properties of 5-hydroxy-1,10-phenanthroline in the presence of heavy metal ions in acetonitrile

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Absorption and emission spectra of 5-hydroxy-1,10-phenanthroline, **1** in acetonitrile shows that maximum absorption and emission at 268 nm and 403 nm, respectively. The divalent cations of Fe, Co, Cd, Pb and Mn showed the complex formation with 5-hydroxy-1,10-phenanthroline with a single isobestic point in the absorption spectra. However, divalent cations of Ni, Cu and Zn did not show complex formation. According to the gathered emission spectra, Fe(II), Cd(II), Co(II) and Pb(II) were seemed to form fluorescence active complexes with **1**.

The Stern-Volmer plot of **1** in the presence of Fe(II), Co(II), Cd(II), Pb(II) and Mn(II) indicated the presence of both static and dynamic quenching by the same quencher.^{1,2} However in the emission study no such complex formation was observed with Mn(II) and this is due to the non-fluorescent nature of the complex formed. In the presence of Ni(II) and Zn(II), it indicated the dynamic quenching of fluorescence of the **1**. In the presence of Cu(II) the study implies the presence of accessible and inaccessible fluorophores to divalent copper ion.¹ The divalent cations of Fe, Co and Cd showed the formation of 1:3 complexes whereas Pb and Mn showed the formation of 1:2 complexes.³

The static and dynamic quenching constants and formation constants were calculated for different metal ions. Out of all metal ions of interest, it illustrates the strongest static quenching towards the Fe(II) ions.

The ratiometric study of **1** revealed greater sensitivity towards Fe(II) with a minimum detection for 0.35 $\mu\text{mol dm}^{-3}$ of metal ion concentration. With other metal ions it is a considerable concentration which showed such deviation, i.e. for Cd(II), Co(II), Pb(II) the concentrations were 2.55, 1.80, and 2.87

$\mu\text{mol dm}^{-3}$, respectively. This illustrates more sensitivity of compound **1** towards Fe(II). According to fluorescence study the ratiometric sensing of Fe(II) using **1** appeared to be more reliable and accurate than the static or dynamic quenching sensing.

However, the interference study by the other metal ions on the unbound and Fe(II) bound 5-hydroxy-1,10-phenanthroline indicates considerable interference from other metal ions. Co(II) and Pb(II) ions specified the quenching of both bound and unbound forms indicating the occurrence of dynamic quenching. Whereas Cd(II), Ni(II) and Mn(II) showed fluorescence enhancement of unbound form and diminishment of bound form indicating a shift in the equilibrium of formation of Fe(II) bound complex more towards the reactants. Cu(II) and Zn(II) ions illustrated a vast decrease in fluorescence intensity of bound form with a insignificant change of unbound form indicating the occurrence of dynamic quenching on bound form only.

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Traditional poly herbal formula inhibits AGE formation and scavenges nitric oxide *in-vitro*

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Nitric Oxide (NO) is known for its cytotoxic activity but in contrast to that NO also has a protective role in oxidative stress.¹ NO inhibits platelet aggregation and acts as a chain breaking antioxidant.² Drugs that are immune to the duality of NO could be the best choice of medicine in this regard. Glycation is a condition that takes place due to hyperglycemia and oxidative stress and forms advanced glycation end products (AGE). Activities such as NO scavenging and antiglycation are useful in suppressing wider range of diseases. Nawarathne Kalka (NK) is a poly herbal drug system used in traditional medicine in Sri Lanka and it possess both above mentioned activities. Yet only a few studies have been carried out on this medicament. Experiments were conducted with aqueous extract of NK. NO scavenging activity was performed with an aqueous Sodium Nitroprusside (SNP, 10 mM) solution as a NO generating source at physiological pH. Nitrites produced by oxygenated NO derived from SNP were diazotized with the N-(1-Naphthyl)-ethylene diaminedihydrochloride and sulphanilamide (Griess reagent). To study scavenging activity of NO, NK (10.3 - 658.0 µg/ml) was introduced and non-scavenged NO was coupled with Griess reagent, and was quantified by spectrometry at 540 nm after the incubation. Percentage inhibition (I%) was determined by,

$$I\% = \frac{\text{Absorbance of control} - \text{Absorbance of sample}}{\text{Absorbance of control}} \times 100\%$$

Suppression of the formation of AGEs was determined by a fluorescence spectroscopic method. Formation of AGEs were induced by incubating bovine serum albumin (BSA) with 500 mM fructose solution and allowing non enzymatic glycation to take place. Test samples contained BSA (5.0 ml), fructose (4.0 ml) and NK (1.0 ml). The percentage inhibition (%I) by the NK extract on AGE formation process was calculated by the following equation,

$$I\% = \frac{(F_C - F_{CB}) - (F_S - F_{SB})}{(F_C - F_{CB})} \times 100\%$$

where F_C - Fluorescence intensity of control, F_{CB} - Fluorescence intensity of control blank, F_S -

Fluorescence intensity of sample and F_{SB} - Fluorescence intensity of sample blank.

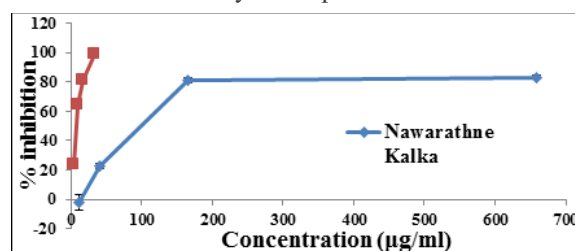


Figure 1: Dose response curves for % inhibition of nitric oxide

NK showed IC_{50} value of 99.3 ± 8.4 µg/ml in NO scavenging activity while its positive control showed IC_{50} of 7.3 ± 0.3 µg/ml showcasing moderate NO scavenging activity.

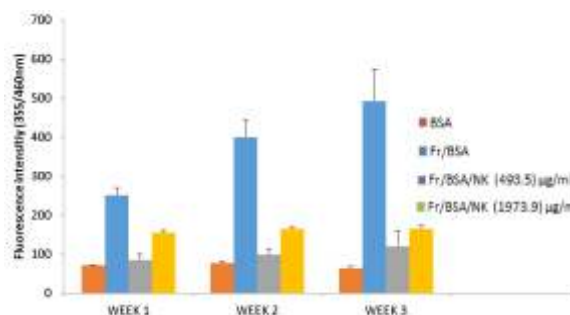


Figure 2: Inhibition of Fructose mediated AGE formation - Fluorescence intensities relative to the content of the sample mixtures for three successive weeks.

Fluorescence intensities in relation to fluorescent AGE in the fructose-BSA mixture decreased when NK was present. The decrease in fluorescence intensities was indicated in the form of IC_{50} of 116 ± 19 µg/ml, 124 ± 35 µg/ml and 84 ± 27 µg/ml for week 1, 2 and 3 respectively. Strong NO scavengers have the ability to suppress both cytotoxicity and protective role of NO by scavenging NO in large scale. NK as a moderate NO scavenger can be a good medication under some inflammatory conditions as it can be active at high

levels of NO while be inept to moderate or low levels of NO, thereby retaining the protective role of NO. The anti glycation activity of NK can complement the NO scavenging activity and be useful in treating many interrelated anti-inflammatory diseases.

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Technical Sessions : A - 15

Synthesis, characterization and BSA binding studies of novel zinc ferene complexes

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Most triazine derivatives show various biological applications. In this study two Zn(II) complexes were synthesized by using the commercially available ligand, ferene [3-(2-pyridyl-5,6-di(2-furyl)-1,2,4-triazine- p, p'disulfonicacid disodium salt]. The mono complex, Zn(ferene)Cl₂(**1**), was synthesized by reacting starting material (ZnCl₂ : Ferene) in a 1:1 ratio and the bis complex, Zn(ferene)₂Cl₂(**2**) was synthesized by reacting starting material (ZnCl₂ : Ferene) in a 1: 2 ratio, respectively (**Scheme 1**). Both the synthesized complexes are highly soluble in water, making them good candidates for bio assays. The synthesized complexes have been characterized by spectroscopic techniques. According to the UV- Vis spectra for all the complexes (**1** and **2**) a bathochromic shift has been observed (**Figure 1**). Also FTIR data provide evidence that Zn-N bonds are formed via triazine and pyridine N atoms. Accordingly the stretching frequency of N=N and C=N bonds of complexes have been shifted to the low frequency range in comparison with the free ligand. ¹H NMR spectra were obtained for both complexes and confirmed their purity. Thereafter, the binding studies of mononuclear zinc(II) complexes (**1** and **2**) and ferene ligand with bovine serum albumin (BSA) have been investigated by UV-Vis absorption spectroscopy. With increasing the concentrations of ferene and complexes (**1** and **2**), the maximum absorbance was increased without any shift in position of the curve. These results indicate the interaction with BSA changing the polarity of the microenvironment around tryptophan and tyrosine amino acid residue. The binding constants (K_b) for ferene, complexes **1** and

2 with BSA were calculated as $3.09 \times 10^4 \text{ M}^{-1}$, $12.30 \times 10^4 \text{ M}^{-1}$ and $16.84 \times 10^4 \text{ M}^{-1}$, respectively.

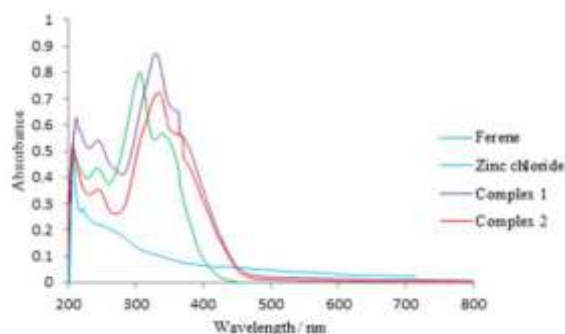
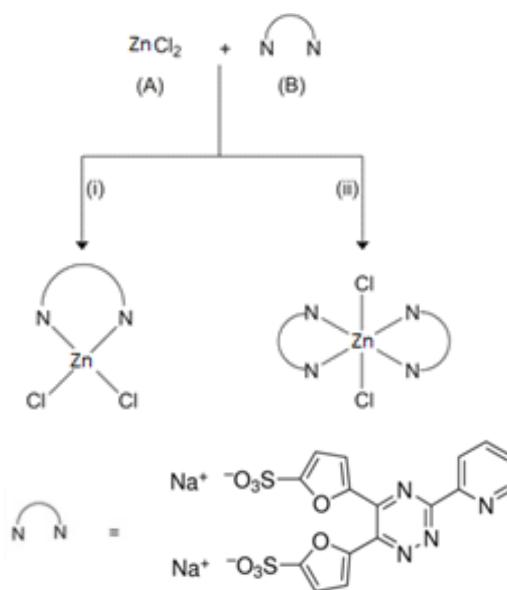


Figure 1. UV-Visible spectra of [ZnCl₂], ferene, complexes(**1**) and (**2**)



Scheme 1. Synthesis of ML₁Cl₂ and ML₂Cl₂ Reagents

and conditions

(i) A : B = 1 : 1 (methanol, 65 °C, 3 hrs)

(ii) A : B = 1 : 2 (methanol, 65 °C, 6hrs)

Acknowledgment

Financial assistance by Grant No ASP/06/RE/SCI/2013/08 provided by the University of Sri Jayewardenepura is gratefully acknowledged.

Technical Sessions : A - 16

Contents of heavy metals; cadmium, chromium and lead in selected rice varieties (*Oryza sativa* L.) grown under different agricultural management systems in Sri Lanka

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Rice is the staple food in Sri Lanka with a per capita consumption of about 108 kg of milled rice per year.¹ Presence of toxic metals/metalloids in rice above the threshold limit is detrimental to human life. Hence, systematic investigations leading to determination of toxic metals/metalloids in rice are important. In the present study, ten varieties of rice including traditional rice varieties (TRV) and newly improved hybrid rice varieties (NIHRV) were cultivated in two regions; one in Anuradhapura - Rambewa (an area where CKDu is prevalent) and the other; Kurunegala (an area where CKDu is not known to exist). The study was carried out under two different agricultural management systems; organic and conventional using split-plot design consisting of three replicates.

A total of 120 rice samples were collected from farming sites in these two regions of paddy plants at maturity stage. They were processed and microwave digested according to US EPA 3052 method and analyzed for the selected toxic metals; Cd, Pb and Cr using Hitachi ZA 3000 Polarized Zeeman graphite furnace atomic spectrometer.² Cd and Pb were analyzed in the presence of the matrix modifiers; Mg(NO₃)₂ and (NH₄)₂HPO₄ respectively. Certified reference material IRMM-804 RICE FLOUR was analyzed for validation of the analytical method. Method recoveries were in the range of 86 % to 121 %.

Cadmium content in rice samples analyzed (Bg 300, 366, 352, 358, 360, Suwandel, Madathawalu, Kuruluthuda, PachchaPerumal, KaluHeeneti) were in the range between 5.7 µg kg⁻¹ and 184.0 µg kg⁻¹ and it does not exceed the maximum allowed limit of 200 µg kg⁻¹ set by Codex Alimentarius commission.³ Further, compared to NIHRV, two selected TRVs; Pachcha

Perumal and Madathawalu showed low levels of trace metals at both regions under the two different agricultural management conditions. Cd contents in these two varieties were in the range 5.9 µg kg⁻¹ to 99.5 µg kg⁻¹. Pb was undetectable in all rice samples analyzed. Cr content were in the range of 13.8 µg kg⁻¹ to 290.8 µg kg⁻¹ which is approximately one tenth of the maximum allowed limit of 2000 µg kg⁻¹ set by Codex Alimentarius commission.⁴ The findings shows that the rice grown in two regions do not contain the above metals beyond the safe levels.

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A computational study of coumarin derived inhibitors for Human Topoisomerase I

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Human topoisomerase I (HtopoI), relieves the torsional strain in DNA during replication and transcription, and it is vital for cell proliferation. Htopo I is a validated target for anti-cancer agents.¹ Computational techniques are widely used to screen ligands for target proteins, and thereby predict drug leads for further laboratory studies. This study is focused on identifying coumarin based inhibitors of Htopo I using molecular docking and molecular dynamics simulations. Molecular docking processes were carried out for 25 coumarin derivatives and the reference molecule topotecan, a drug prescribed for lung and ovarian cancers,² using computational tools Avogadro, Chimera and DOCK6. The values obtained for binding affinity of coumarin derivatives to Htopo I were compared with that of topotecan, and the most compatible coumarin derivative was selected for further molecular dynamics (MD) simulations in order to investigate the stability of Htopo I-coumarin complex in the aqueous environment. All MD simulations were performed with GROMACS software with CHARMM27 force field in Ubuntu platform. MD simulations were carried out for the Htopo I-topotecan complex as the reference to compare the stabilities of the Htopo I-ligand complexes. Docking results indicate that coumarin derivative, CDER25 (Figure 1), has a binding affinity of -69.25 kcal/mol, which is comparable to the binding affinity of topotecan, which is -72.21 kcal/mol. Therefore, CDER25 complexed with Htopo I was subjected to the second investigation, molecular dynamics for 10 ns of simulation time. RMSD obtained from MD results (Figure 2) indicate that CDER25 was stabilized with time. Htopo I and DNA show a different behavior to that of the reference system at the beginning, but in the last 2 ns of simulation time it shows comparable behavior to the reference complex. This indicates the system is stabilized after the conformational change of the Htopo I and DNA. This conformational change may further facilitate the disruption of the function of Htopo I and indicates that CDER25 can act as an anti-cancer agent. Therefore, molecular docking and molecular dynamics

suggest that CDER25 is a promising lead compound for further studies.

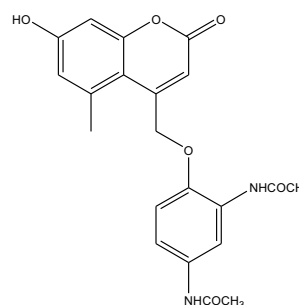


Figure 1: Structure of CDER25

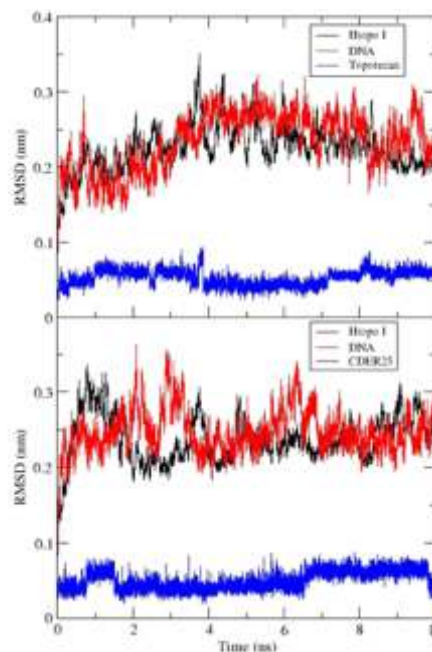


Figure 2: Root mean square deviations of Htopo I, DNA, topotecan and CDER25

Acknowledgement: Financial assistance by College of Chemical Sciences, Institute of Chemistry Ceylon (Grant no: 13/01)

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Experimental and theoretical investigation of Cu(I) catalyzed reaction between bromobenzene and benzylamine

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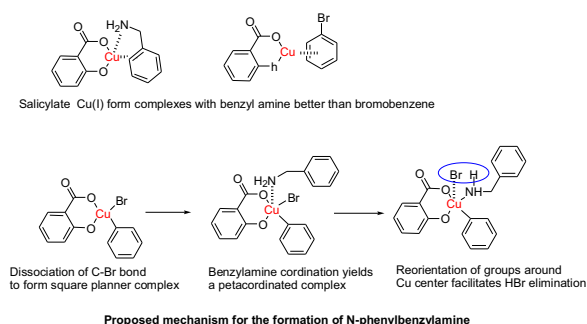
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Ullmann condensation is a powerful method of cross coupling of aryl halides with nucleophiles. Copper catalyzed arylation of N-nucleophiles with aryl halides, was developed by Fritz Ullmann and Irma Goldberg.¹⁻³ Although many experimental as well as theoretical investigations have been reported, there is no universal agreement about the mechanism of Ullmann reaction.¹⁻⁵ In a typical experiment, N-phenylbenzylamine was synthesized using a mixture of CuI (0.2 mmol), Na₂CO₃ (2.0 mmol), ligand (0.4 mmol), bromobenzene (2.0 mmol), and benzylamine (2.0 mmol) in 1.20 ml of dimethylsulfoxide (DMSO). Ortho phenylenediamine, oxalic acid and salicylic acid were used as ligands.

The percentage yields of the product obtained for ligands are; 2.2, 2.7, 9.8, 10.4 (ortho phenylenediamine), 2.7, 6.8, 7.2, 9.7 (salicylic acid) and 1.4, 2.6, 3.6, 5.1 (oxalic acid) at microwave powers 160 w, 320 w, 480 w and 640 w, respectively. The effect of the order of addition of bromobenzene and benzylamine was investigated using salicylic acid as the ligand.

This was investigated by first adding one of the reactants, exposing the reaction mixture to microwave radiation and then adding the second reactant and exposing the mixture to microwave radiation. It was observed that the order of addition of reagents has a significant effect on the product yield. When bromobenzene was added first, the product yield was 22.1% and when benzylamine was added first, the product yield decreased to 5.8%. When both the reactants were added simultaneously, a product yield of 10.3% was obtained.



These results suggest that the association of

bromobenzene with salicylate chelated Cu(I) first, is favorable for the reaction. *Ab-initio* calculations at B3LYP/6-31g(d) level of theory in DMSO were carried out in order to examine the important reaction intermediates and the mechanism using Gaussian 09 software package. Results of calculations on the interaction between bromobenzene and chelated Cu(I) showed that the benzene ring of bromobenzene forms a pi-complex with Cu(I) center and subsequently undergoes dissociation of the C-Br bond. Further, it was found that the interaction of benzylamine with Cu(I) is stronger than that of bromobenzene. The geometry of salicylate-Cu(I)-benzylamine is such that it sterically hinders the formation of the pi-complex of bromobenzene as shown in the figure above. When both, bromobenzene and benzylamine are present, they compete for Cu(I) causing aryl halide activation to slow down. Calculations showed that the breaking of C-Br bond in pi-complexed bromobenzene has a Gibbs energy barrier of 14.98 kJ mol⁻¹. Dissociation of the C-Br bond of bromobenzene results in the formation of a complex where, Br, C₆H₅ and salicylate are coordinated to copper and arranged in square planar geometry. Benzylamine is then coordinated to this complex to yield a penta coordinated complex. This process has a Gibbs energy barrier of 9.50 kJ mol⁻¹. The basic medium then removes and neutralizes HBr. This step is associated with a significant drop in Gibbs energy. The aryl group and benzylamine then couple to form the final product of the reaction.

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Sawdust as a low-cost natural adsorbent for removal of Cd (II) from aqueous solutions

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Water quality parameter is one of the hot topics discussed in the current world, contamination of water due to heavy metals are reported as priority pollutants, due to their mobility in natural water ecosystems and their toxicity. Contaminated water can be treated with an adsorbent before releasing it to the environment, instead of using commercially activated carbon use of the naturally available adsorbent is more economically friendly.

In Sri Lanka, sawdust is produced in large quantities. It is a relatively abundant, inexpensive material and is a by-product of cutting, grinding, drilling, sanding and slicing wood with a saw or other tools. The adsorption of cadmium (II) from aqueous solution by different types of sawdust such as jack (*Artocarpus heterophyllus*), rubber (*Hevea brasiliensis*), coconut (*Cocos nucifera*), albizia (*Albizia*) and rambutan (*Nephelium lappaceum*) were investigated as a function of initial metal ion concentration.

Adsorption efficiency increased when initial metal ion concentration was increased for all types of sawdust up to a certain extent. This may be due to the fact that as the concentration increases, more metal ions are available in the solution for the adsorption process.

Experimental results indicated that rambutan sawdust is the most effective adsorbent for the removal of Cd (II) from aqueous solutions. It was observed that the adsorption capacity decreases in the following manner, rambutan > albizia > jack > rubber > coconut. However, all types of sawdust used in this study can be used as low cost adsorbents for removing of Cd (II) from aqueous solution.

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Table 1: Adsorption capacity of Cd (II) by different sawdust

Initial [Cd ²⁺]/ppm	[Cd ²⁺] after adsorption/ppm					% adsorbed by sawdust				
	Jack	Rubber	Coconut	Albizia	Rambutan	Jack	Rubber	Coconut	Albizia	Rambutan
0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
0.50	0.00	0.03	0.22	0.00	0.00	100.00	94.00	56.00	100.00	100.00
1.00	0.00	0.03	0.17	0.00	0.00	100.00	97.00	83.00	100.00	100.00
2.00	0.20	0.33	0.21	0.00	0.00	90.00	83.50	89.50	100.00	100.00
3.00	0.04	0.01	0.25	0.00	0.00	98.60	99.60	91.66	100.00	100.00
5.00	0.25	0.19	0.39	0.83	0.00	95.00	96.20	92.20	84.30	100.00

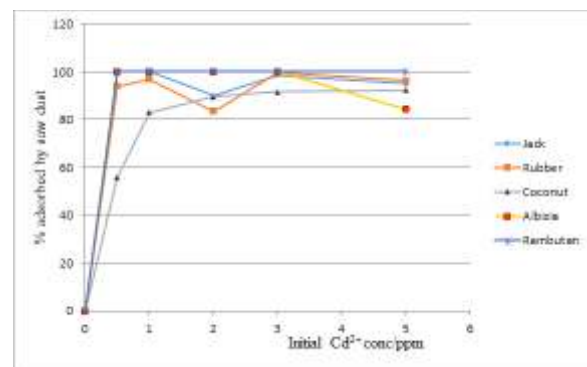


Figure 1: Comparison of adsorption of Cd (II) by different types of sawdust

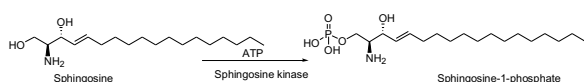
Comparison of binding of sphingosine derivatives to sphingosine kinase 1 using molecular docking

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Cell death and survival are known to be regulated by sphingosine and sphingosine-1-phosphate, respectively. As such, controlling the amounts of these two bioactive lipids has received attention in cancer research.^{1,2} Sphingosine-1-phosphate is generated by phosphorylation of sphingosine by Sphingosine kinase 1 (SK1).²



Action of sphingosine kinase on sphingosine

Therefore, finding suitable inhibitors that decrease SK1 activity is of interest. Such inhibitors can be synthetic or natural in origin.² Therefore, an investigation of the possibility of inhibiting SK1 using naturally occurring compounds such as sphingadiene and sphingatriene will shed some light on novel approaches to cancer therapy.³

Human sphingosine (d18:1 Δ^{4t}) and three human sphingosine derivatives [sphinganine (d18:0), sphingadiene (d18:2 $\Delta^{4t,6t}$), sphingatriene (d18:3 $\Delta^{4t,6t,8t}$)] were used in our theoretical investigation to examine their ability to bind with Sk1.

Crystal structure of SK1 was downloaded from Protein Data Bank (PDB ID: 3VZB.1). The enzyme SK1 consists of three chains A, B and C with identical amino acid sequences but with slightly different folding patterns. Sphingosine derivatives were docked on to the three chains separately using the software, AutoDock Vina from Scripps Institute, USA. All the water molecules and inhibitors were removed and polar hydrogens were added prior to docking.

All the sphingosine derivatives were subjected to geometry optimization using Hyperchem programme package (Hyperchem 8.0.6). Geometry optimization was conducted at HF/6-31G* level of theory. Geometry optimized sphingosine derivatives were used in the docking process. All the rotatable bonds of sphingosine derivatives were allowed to rotate during docking.

It was found that the binding of all the sphingosine

derivatives to the three chains of SK1 are thermodynamically favorable. It was also observed that the binding of sphingosine derivatives to SK1 becomes more favorable with increasing unsaturation. The enhancement of binding affinity with the increasing number of double bonds could be due to the absence of hydrogen atoms and thereby lowering of steric hindrance.

For an enzyme catalyzed reaction to be favorable, the binding of the substrate to the enzyme must be strong. In order to continue the catalytic cycle, the so formed product must be released easily. Therefore strong binding of a product to an enzyme may bring about an inhibitory effect on the catalytic cycle. In general, phosphorylated products of sphingadiene and sphingatriene bind to SK1 stronger than the phosphorylated product of sphingosine. Hence one can speculate that sphingadiene and sphingatriene may act as inhibitors for Sk1.

The study revealed that sphingatriene (d18:3 $\Delta^{4t,6t,8t}$) binds to all three chains of SK1 more stronger than the known inhibitor N,N-dimethylsphingosine. It was also observed that sphingadiene (d18:2 $\Delta^{4t,6t}$) binds to chains A and B of SK1 better than N,N-dimethylsphingosine. Hence it can be concluded that sphingatriene (d18:3 $\Delta^{4t,6t,8t}$) as well as sphingadiene (d18:2 $\Delta^{4t,6t}$) may have the potential to act as inhibitors to SK1 and thereby control the phosphorylation process.

The active site amino acids common to all three chains in SK1 were identified as Aspartic acid 178, Aspartic acid 81, Alanine 115 and Leucine 268.

References

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- (3) Abeytunga, D. T. U., 2015, *Mini-Reviews in Organic Chemistry*, **23** (2), 282-292.

Commemoration of the First Death Anniversary of Emeritus Professor JNO Fernando

The first death anniversary of the late Emeritus Professor JNO Fernando was commemorated on 1st and 2nd March 2016 at the Headquarters, Adamantane House, Rajagiriya. The bana programme presided by Venerable Professor Induragare Dhammaratana Thera, a Senior Lecturer at the University of Kelaniya and Chief Incumbent of the Jethawanaramaya Temple, Induragara, Dunagaha, was held on 1st of March. The almsgiving was held on 2nd of March at Sri Ganawansa Thripitaka Pirivena at Rajagiriya. In the afternoon, the Christian religious activities were conducted by the students of the College of Chemical Sciences just before the commemoration ceremony. The commemoration address was delivered by Professor Tuely De Silva, a Past President of the Institute. Professor Tuley De Silva highlighted the late Emeritus Professor Fernando's education and academic career, and the service he did for the augmentation of the Institute, the College and the tertiary Chemistry education in Sri Lanka. Professor JNO Fernando memorial Scholarship Fund was launched during this ceremony. Mrs. Mandrupa Fernando, family members, former colleagues of Professor Fernando, staff members and students participated at these programmes to pay tribute to the late Professor. *(for photographs see page 33, for Oration see page 34)*

Benevolent Fund Benefits for Members

i. **Long life benefits:**

Amount provided will be as follows:

a. Over 70 yrs : Rs. 12,000 b. Over 75 yrs : Rs.18,000 c. Over 80 yrs : Rs. 25,000.

ii. **Critical illness benefits:** up to Rs. 60,000

iii. **International travel for conferences** (with presentation of a paper):

a. Passive members : Rs. 30,000 (international travel only)

b. Active members : Rs. 60,000 (international travel and/or accommodation).

Any member who has paid membership fees for life (after 3 years of such payment) is entitled for these benefits. All members are advised to pay the membership fee for life and become beneficiaries.

Annual Dinner & Induction of New President

Annual Dinner & Induction of New President, **Mr. M RM Haniffa** will be held at Opulent River Face Hotel, Rajagiriya on **16th June 2016** at 7.30 p.m. Chief Guest at the Annual Dinner will be **Mrs. Mandrupa Fernando**. Tickets available at the Institute Office.

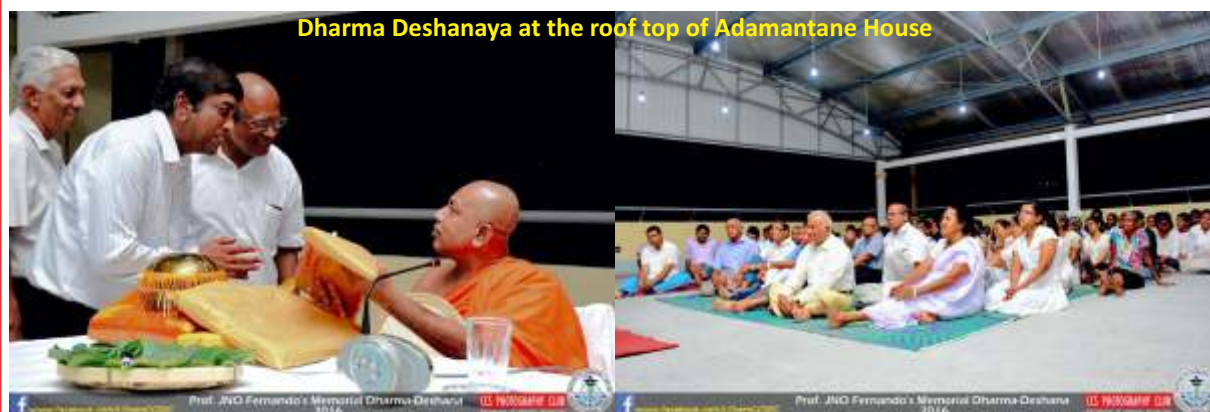
Launch of the New IChemC website

The launch of the new IChemC Website was held on **28th March 2016** at the PPGL Siriwardene Auditorium.

www.ichemc.edu.lk



Commemoration of the First Death Anniversary of Emeritus Professor JNO Fernando



Alms Giving on 2nd March 2016 at the Sri Gnanawasa Thripitaka Vidyayathanaya, Rajagiriya



Launch of Professor J N O Fernando Memorial Scholarship Fund



A Tribute to Professor JNO Fernando Augmentation of Tertiary Education in Chemistry in Sri Lanka

Deshabandu Emeritus Professor Tuley De Silva
Chancellor, Wayamba University of Sri Lanka

We are assembled here today to remember and celebrate the life of late Emeritus Professor **Jerence Nansel Oleap Fernando**, proud and loving husband and father, renowned academic, esteemed scientist, eminent science administrator, respected colleague, and good friend.

It is a great pleasure and honor to be invited to deliver the commemoration address at the first death anniversary of my friend and colleague late Emeritus Prof. JNO Fernando. I sincerely thank Mr. KR Dayananada the President of the Institute of Chemistry, Prof. Samitha Deraniyagala, Honorary Rector and the Academic staff of the College of Chemical Sciences for the invitation. I was wondering why I was chosen to deliver this first death anniversary commemoration oration. I could not find a plausible reason as there are others who have been much closer to JNO than me and many more that have rendered distinguished service to the Institute of Chemistry and the College of Chemical Sciences (CCS).

I accepted the invitation with trepidation and with a sense of duty to pay this tribute to a friend for whom I had a high regard. I satisfied myself by attributing a couple of reasons for me being selected. I happen to be the senior most Professor of Chemistry alive, who closely followed the activities of Prof. JNO and fully supported many of his activities and agreed to disagree on certain matters. Secondly it is always better to select a proponent with an open mind without prejudices to highlight Prof. Fernando's great contribution to the Institute, CCS and the nation.

The current practice at memorial orations is to refer concisely to the valuable qualities and contributions of the person commemorated and present a chosen topic in detail. Today, I decided to highlight the lifelong pioneering achievements and contributions of Prof. Fernando so as to remember him with a sense of gratitude and admiration for what he had done, and gain some inspiration from his life and professional work.

This tribute is for a person who was principally responsible for building this prominent Adamantane House and establishing the credentials of the College of Chemical Sciences for excellence in service, under the auspices of the Institute of Chemistry Sri Lanka.

JNO was a remarkable combination of a practical academic and a vibrant dynamic person, whose distinguished contribution to the augmentation of Tertiary Education in Chemistry in Sri Lanka will always be gratefully recognized and remembered. This College and its service of excellence will ever be his **perfect monument**.

Education and Academic Career

Oleap was born on 29th February of the Leap Year 1944 as the youngest of four siblings. Let me begin with an introduction to Oleap's educational and academic background.

Oleap Fernando was educated at Prince of Wales College Moratuwa and S. Thomas' College, Mt. Lavinia where he distinguished himself by winning many class prizes and becoming the first in the Island at the G.C.E. (O/L) examination. After his brilliant performance at the G.C.E. (A/L) examination, he opted to do a science degree at the University of Colombo. He topped the batch of Chemistry Special Honors degree students and was awarded the Bhikaji Framji Khan Gold Medal in 1966 for the best performance at the degree examination.

Prof. Fernando was then appointed as an assistant lecturer in Chemistry at the University of Ceylon, Peradeniya and later the University of Ceylon, Colombo. He was then sent to the Australian School of Nuclear Technology for a short training in radio isotopes. He won a Commonwealth Postgraduate Scholarship in 1968 and joined Imperial College of Science and Technology of the University of London for postgraduate research studies. He was awarded the degree of Doctor of Philosophy of the University of London in 1971.

Upon his return he was promoted as a lecturer in Physical Chemistry at the University of Colombo. He was then selected to the Chair in Chemistry at the Open University of Sri Lanka in 1979 and promoted as the Senior Professor in 1984. He was elected as the Dean of the Faculty of Natural Sciences from 1993 to 1999. Until retirement in 2009, he contributed to the development of the Department of Chemistry in particular and the Faculty as a whole where he initiated

action for new buildings, additional staff and equipment for the Faculty.

Professor Fernando was on the visiting staff at University of Jaffna (1979–1983), Ruhunu University College (1980), University of Papua New Guinea (1987), University of Colombo (1984–1998), University of Peradeniya (1990–1991), University of Sri Jayawardenepura 1975–1985, 1990–2013) and University of Kelaniya (1981–1993, 2001–2013).

His achievements outside the Institute of Chemistry Ceylon by themselves are significant and commendable.

I want to begin my relations with him by recalling my first meeting with him in 1972 where I established a fruitful association aimed towards the development of Chemical Sciences. I met him at the Sri Lanka Association for the Advancement of Science and we were members of the Councils of the Institute of Chemistry and the SLAAS since 1973. Whereas, I served these two scientific bodies on and off, JNO continued to serve these Councils for a long time contributing immensely for the advancement of Science and particularly Chemical Sciences. During these years I had the good fortune to be associated with him which enabled me to get to know his dedication and commitment to work and his capacity to undertake responsibilities which needed long periods for their accomplishment.

I have been closely associated with Professor Fernando at various times where I served with him as a member of the Councils of Institute of Chemistry Ceylon, SLAAS, National Academy of Sciences of Sri Lanka and the National Science Foundation. Given this experience of long relationship, I was able to form my perceptions of him, as an eminent chemist, a great leader, a distinguished academic and an efficient administrator.

Later I was associated with him in the activities of the Institute of Chemistry Ceylon where I worked with him to accomplish many useful outcomes. It is during this period that I realised his 100 % commitment to the activities of the Graduateship course in Chemistry.

Contributions to the Institute of Chemistry Ceylon

Professor Fernando joined the Institute of Chemistry Ceylon in 1973 and was immediately elected to serve on its Council and continued until he was elected as the Assistant Secretary in 1976 and General Secretary from 1978 – 1981. He was an active member of the Council who served with distinction. He was elected as the Vice President in 1982 and President

in 1984, the post he held for two years. As the founder Honorary Secretary for Educational Affairs Committee from 1981 - 1983 and thereafter as Chairman of the Educational Committee JNO made positive contributions to the development of the Graduateship course which started in 1979. He was the longest serving member of the Council of the Institute.

The name that was given in the Act of Incorporation No. 15 of 1972 'Institute of Chemistry Ceylon' was not changed to 'Institute of Chemistry of Sri Lanka' in spite of not having any legal impediments to do so, as Prof. Fernando did not agree with that change. This change when proposed on several occasions did not get his approval and we accommodated his wish as he may have had a special reason.

Professor JNO was a very active member of the Institute where he contributed his might as a Council member, Assistant Secretary, Secretary and the Vice President and President and steered the Institute to greater heights introducing many new ideas and activities for the benefit of the Institute and the members.

Approved Charity and tax exemption

Professor Fernando saw the possibility of getting the status of an approved Charity so that the Institute could be exempt from taxation and that donations made by institutions or individuals could be deducted from the assessable income of such institution or individual for income tax purposes. His untiring efforts in this direction whereby he had to provide all the information and filling up of forms succeeded when the Institute was declared as an approved charity by an Order published by the Hon'ble Minister of Finance in the Government Gazette No. 121 of 26.12.80. The Income received by the Institute has been exempted from the levy of income tax by Section 3 of the Inland Revenue Amendment Act No. 8 of 1988.

Dissemination of Knowledge

The Institute of Chemistry Ceylon conducts a range of professional, academic and knowledge dissemination activities every year. These include Special Lectures, Training Seminars and Workshops for which the participants pay and Orations, Exhibitions, Industrial visits and Social activities for the benefit of members. JNO introduced the Quiz Competition conducted annually by the Royal Australian Chemical Institute to Sri Lanka through our Institute in 1997. Since then we have been able to reach

many schools thereby improving their knowhow in chemistry. In addition the Institute also conducts Science Quiz competitions amongst school children to enhance their knowledge and to make them to be competitive. The series of inaugural lectures initiated by JNO for those taking up new appointments at the Institute has resulted in the upliftment of stature of the Institute.

Furthermore, the participation of foreign scientists at the theme seminars held during the annual session has increased enhancing the reputation of the Institute. This has been continued conducting regional /international seminars. As planned by JNO this activity reached a peak with the conduct of a fully organized international conference called CHEMTECH in 2007 as part of its 36th Annual Sessions. JNO accepted the responsibility of organizing a mammoth Exhibition and Trade Fair CHEMEX 2011 to celebrate the International Year of Chemistry so designated by the United Nations.

Graduateship in Chemistry Course

Prof. Fernando was discussing the problem of students who could not find placements in the Universities in Sri Lanka due to stiff competition for the limited number of places available. He came up with the idea that the Institute of Chemistry should start a graduateship course in Chemistry for them as the Institute already had been successful with the conducting of the Licentiate Laboratory Technology in Chemistry course since 1971. The Institute agreed and launched the Graduateship programme in Chemistry in Sri Lanka in 1979 with Professor JNO as the founder Coordinator. He was faced with the uphill task of finding accommodation and laboratory facilities, all of which were suitably found by Professor JNO with the ready assistance of his alma mater S. Thomas' College Mount Lavinia. As the Lectures were limited to weekends, Professor JNO obtained the necessary permission to get the academic staff from the Universities.

He was the main contributor to the development of the course content which was in par with the special degree in Chemistry at the Universities. This enabled him to convince the University Grants Commission to recognize the graduateship certificate to be equivalent to a special degree in chemistry in spite of objections by some Universities about the lack of a student research component. He maintained the standard of the examinations with moderators from UK who were chosen by the Royal Society of Chemistry. He

relinquished his duties as the Coordinator in 1983, and functioned as the Chairman of the Academic Board and the House and Finance Committee. Since then he directed the activities of the graduateship course to get the rightful place for the graduateship students to obtain the much needed recognition both locally and abroad.

Our Professional Graduate Chemists have been recognized and accepted for PhD/MSc degrees and for employment in many developed countries in the world and Sri Lanka though not possessing a formal university degree.

At the beginning, there was no office, no permanent staff, no infrastructure, no library and no funds to run the programmes. However, members of the Institute worked hard in rented premises and under trying circumstances, and produced the first batch of graduate chemists, which consisted of 4 graduates. The office of the Institute was initially located at the Vidya Mandiraya, the official headquarters of the SLAAS. As student numbers increased JNO managed the funds received for tuition so well and built up a balance that could be utilized to build our own headquarters. This was no easy task as Professor Fernando had to provide funds for the running of the Institute as well.

Professor JNO worked so hard to find a block of land and he managed to convince the government to allocate the land that we have been given on a long lease. This in fact was a result of his vision, leadership, determination, perseverance and the ability to convince the authorities of the UDA. He immediately worked with a building committee to get the plans approved and laid the foundation stone for the building in 2002. He closely followed the construction of the building which was completed in 2005 by demonstrating that he was a great builder. We are so grateful to Professor JNO for this achievement. The building was named the Adamantane House and all activities of the College as well as the Institute were shifted to this four storied building. As the educational activities of the College expanded, this space could not accommodate all activities. JNO then proposed that we extend the building using the land available. The extension to Adamantane House was completed in January 2014 proving the great mastery of JNO in building. Subsequently laboratories and halls were named after distinguished Sri Lankan chemists as proposed by Professor JNO and approved by the Council.

College of Chemical Sciences

During my tenure as the President of the Institute of Chemistry Ceylon, I had the opportunity to initiate

the establishment of the College of Chemical Sciences in 2001. Our obvious choice was Professor Fernando to be the founder Dean of the College which he accepted as an honorary position as he was still a full time Professor at the Open University. This position has now been upgraded to an Honorary Rector as chief executive head of the College with a Dean functioning as the academic head. The College of Chemical Sciences (CCS) presently is the educational arm of the professional body of Chemists in Sri Lanka - the Institute of Chemistry Ceylon which has been incorporated by an Act of Parliament No 15 of 1972.

Up to now nearly 1000 graduate chemists have passed out of the College who have obtained gainful employment and some have pursued higher studies at Universities in Sri Lanka as well as abroad. The current annual number graduating from the College of Chemical Sciences range from 75-90 Graduate Chemists which corresponds to as much as 45% of Sri Lanka's total output of about 180 Special Degree Graduates in Chemistry from the six conventional universities.

After his achievements at the CCS, JNO championed the cause for **producing Chemistry graduates at a much lower cost to government/UGC. He showed that** Graduate Chemists are produced by the CCS within 4 years of their admission that is without any delays. University system admits students after nearly an year's delay of the release of the A/L results. The cost incurred by a CCS student is presently around 400,000.00 rupees over the entire 4 year period as compared to the cost incurred by the University system of around Rs 1.5 – 2.0 million. This is about five times what is needed to produce such a student to a similar level at the CCS. The quality of the CCS Graduate Chemists is very well recognized as the question papers are moderated and answer scripts remarked by Professors in the UK under the coordination of the Royal Society of Chemistry. Our Graduate Chemists are recognized and accepted both for higher degrees and employment in Universities and other institutions in Sri Lanka and around the world.

JNO advocated unconventional ways as solutions to problems of increasing the University intake at a very economical cost. Let me quote from his submission to the Higher Educational authorities.

“The time has come when the educational authorities of Sri Lanka should think out of the box with a wider horizon and vision and look for similar unconventional opportunities in unconventional

institutions in unconventional ways in order to minimise its present problems in an unconventional manner at a very economical cost. This type of alternate mechanisms should satisfy all stake-holders in a very viable and pragmatic manner.”

His proposal of a mechanism to effectively deal with the problems associated with tertiary education at least in the field of Chemistry is still under consideration by the government. This type of augmentation of tertiary education with specific outcomes can be achieved without much difficulty.

JNO's solution for Growth of student numbers

The popularity of the graduateship course and the value and recognition of the certificate attracted large numbers of qualified students to seek admission to the CCS. The solution proposed by JNO to run an additional duplicated programme on week-days was accepted and implemented thereby increasing the output of professional graduate chemists.

Academic Staff

Professor JNO catalyzed the increase of the body of academics, demonstrators and office staff as required by the growth of student numbers and improvements in syllabi. He introduced the concept of inviting Professors on sabbatical leave to join as full-time staff and even introduced full time cadre positions as Professors and lecturers.

Awards

Professor JNO was very sensitive to low income students and good performers that he installed a scholarship system and a merit award system for the students to acknowledge their special achievements. These gold medals and awards have been donated by chemists and well wishers that every subject area examined is covered in addition to overall performance. This obviously has had an effect on the enhancement of performance of our students.

Australian National Chemistry Quiz Competition

The Australian National Chemistry Quiz conducted by the Royal Australian Chemical Institute was conducted in Sri Lanka for the seventeenth consecutive year in July 2013. Students in the Senior Division who answer all questions correctly are annually awarded scholarships to follow the entire Graduateship Programmes free of charge.

Timelines for student registration and paper marking

Timelines for student registration were introduced by Professor JNO under three dates, early bird, closing date and late registrations which enabled the College to collect the fees with least delay. This was not the case for setting of question papers and marking. Professor JNO insisted on definite days for these activities so that examinations were held as indicated and the results released without delays. I must say that he did not waver on these timelines.

Benevolent Fund Benefits

Professor JNO was concerned with the welfare and health of the members of the Institute and the graduate chemistry students. He initiated a Benevolent fund for the members and a Welfare Fund for the students which have served those in need so that they could discharge their duties without worries. This magnanimous gesture is yet another innovative idea of our friend JNO.

Publications

Professor Fernando was instrumental in initiating many publications by the Institute. These include Monographs on subjects in Chemistry and Applied Chemistry, Chemistry in Sri Lanka (a journal published every four months), newsletters and books on selected topics. Some are published under the patronage of the Institute whilst some are CCS publications. Though there are editors for these publications, JNO gives the final approval after a thorough scrutiny and meticulous editing of the publications. This clearly demonstrates his commitment to jobs in hand.

Undergraduate Research at the CCS

Professor JNO Fernando initiated an undergraduate research programmes at the College with the assistance of Professor S. Sotheeswaran in 2006. About 25-35 students are engaged in research projects at present and the first College research session was held in 2007. This will be advancement in the conduct of the course.

JNO as a Revered Teacher

Professor Fernando was a dedicated teacher, mentor and a guide to all of his students. As a teacher and a mentor, he had extraordinary wisdom and experience, which he always shared with his students and young chemists. He gave them sound guidance, direction and advice. He was a good friend during their difficult and struggling times.

CCS students, both past and present, will be ever grateful for the opportunity provided to follow the Graduateship course in Chemistry as the state universities could not accommodate all students who qualified to enter the Universities.

He was easily accessible for students who needed advice and help. He inculcated in them the motto: "Be confident in what you do. Do not ever give up. Any difficulties which you encounter should make you more determined to achieve your goals and to succeed at all odds."

Honors

Among Professor Fernando's many honors were his election as a Fellow to the National Academy of Sciences, award of the Distinguished services medal by the Institute and the naming of a laboratory after him at the CCS.

Royal Society of Chemistry

The Institute maintained a close relationship with the Royal Society of Chemistry. Professor Fernando had such a recognition for the RSC, he always proposed changes to our rules in keeping with the changes at the RSC. The classes of memberships always kept in line with those of the RSC. When the RSC proposed new requirements for awarding the Chartered Chemist status, we too changed ours to be consistent with that of the RSC. To accommodate the local requirements and certificates offered by the Institute JNO also introduced certain categories of non-corporate memberships such as Associateship, Licentiate and Technician memberships.

The Graduateship course received considerable backing, drive and encouragement from the RSC from its commencement. In fact JNO initiated the appointment of External examiners through the RSC and the stage wise recognition of the graduateship course so that our students could be admitted to the Associate category of the RSC in the first instance.

In fact RSC is on the verge of giving accreditation to our graduateship programme so that we could command a better recognition amongst a wider segment of professionals, researchers, academics, students and the general public here and abroad.

Affiliations

Students could opt after 2 years of successful completion of examinations to exit the programme and obtain an Advanced Diploma after Level 2; Advanced Diplomates who exit the programme can obtain a B.Sc.

Hons degree in Applied Chemistry from the Northumbria University, UK (after one more year of study in UK) OR a B.Sc. degree from the University of Cincinnati, USA (after two more years of study in the USA). Some other universities abroad also give similar credit exemptions.

Collaborations with Foreign Chemical Societies

Prof. Fernando was instrumental in building contacts with sister bodies overseas. The Institute is a founder member of the Federation of Asian Chemical Societies (FACS, established 1979). Two Executive Committee meetings of FACS have been held in Sri Lanka in 2004 & 2014. Institute became a full member of the International Union of Pure & Applied Chemistry, (IUPAC). It is in 200. Regular contacts are maintained with the Royal Society of Chemistry, UK, the Royal Australian Chemical Institute, the American Chemical Society and parallel professional bodies in other countries.

His services to the Church

Professor JNO's involvement in church activities was intense and productive. He was elected as a warden in 1973 and he was responsible for relieving the parish from a heavy and unjust taxation imposed on his church. In this connection the parish placed on record Oleap, particularly for the signal services rendered.

He also served as a Diocesan Councillor of the Diocese of Colombo and was elected to the Standing Committee of the Diocese. He served on the General Assembly of the Anglican Church of Ceylon from 1998 to 2007 and served on the Executive Committee from 2008 to 2009 when he participated in the preparation of the new constitution of the Church of Ceylon which was passed by parliament. He was elected as a trustee of the Incorporated Trustees of the Church of England in Ceylon from 2011 to 2014.

Finance management

JNO organized CCS finances in such an efficient way to create savings. He spent less than what we earned and invested the savings to bring in the best incomes without subjecting it to high risks after researching into investment opportunities. He avoided investments like stock and bonds that have a higher rate of return but often have a higher risk of losing the principal invested. The other ways improvised by JNO to collect funds included organizing of raffles, paid seminars and exhibitions. In other words JNO was a good finance manager who involved planning,

organising, controlling and monitoring financial resources in order to achieve Institutes objectives to make effective and efficient use of resources and prepare for long-term financial sustainability.

Although we had full trust of his honesty and integrity, we proposed that some financial regulations have to be enacted so that anyone taking over from him could follow without interruption. After long discussions I agreed to disagree with him as for may be very good reasons that he was not convinced.

Timelines for student registration were maintained with early bird, closing date and late registrations which enabled the College to collect the fees with least delay. This was not the case for setting of question papers and marking. Professor JNO insisted on definite days for these activities that examinations were held as indicated and the results released without delays. I must say that he did not waver on these timelines.

Organisational abilities

Organization is the ability to use one's time, energy, resources, etc. in an effective way so that one can achieve the things he wants to achieve. Prof Fernando displayed tremendous organizational skills for planning, time management, scheduling, coordinating resources and meeting deadlines. This was clearly evident in his successful organization of various functions and events of the College and the Institute. JNO always insisted on physical and mental organization and planning skills together with time management abilities. This was followed by allocating time periods for specific tasks to be completed within a specific time period. Key ingredients for JNO's success in the new educational program were self discipline effective time management and organization skills.

Dominant personality

JNO had a Dominant and a very confident personality who had a natural ability to gain the confidence of others which at times went as far as directing and controlling their actions and efforts. In such situations he did not mean to hurt or control others' work, but simply enjoyed being able to be in charge and get things done. He was born that way and took his own road. He had a strong willpower to succeed at any goal that he determined to undertake. As was the case such people prefer to lead than follow and be predisposed towards leadership and management positions. Prof JNO was also full of self confidence that he made others to sway into his side with solid arguments. His ability to

solve problems and take risks enabled others to look for him for direction and decision making. He provided the leadership, pushed staff toward decision making, maintained focus on the goals, and drove for tangible results.

Recognition of Prof. JNO by other scientific bodies

He made a tremendous contribution as a very active member of the Sri Lanka Association for the Advancement of Science over the past thirty years. He was elected as the General President in 2001 when he provided the leadership to this prestigious organization. He was also the Chairman of the Board of Trustees of the SLAAS.

He participated in the activities of the Organization of Professional Associations of Sri Lanka as a Forum member representing of The Institute of Chemistry. He also served as a Council member and treasurer of the Council of the National Academy of Sciences. He was also a member of the Board of Management of the National Science Foundation.

Let me now draw the attention of the CCS and the Council of the Institute to what I think are important to further development of the CCS by way of services.

Revision of syllabi

The CCS has somewhat been static in development of the syllabi to include the latest applied topics for chemists. In my opinion, we should be revising our syllabi every two to three years to be current in the dissemination of new knowledge.

Postgraduate Degrees by course work

The time is right for us to initiate postgraduate programmes at the level of Mastership certificates in Chemistry which could then be transferred to degrees after accreditation. Some subjects can be Biological Chemistry, Colour and Polymer Chemistry, Green Chemistry and Sustainable Industrial Technology, Green Chemistry, Energy and the Environment, Instrumental and Analytical Methods in Biological and Environmental Chemistry, Medicinal Chemistry and Structural Biology Materials for Energy and Environment, Molecular Modelling, Molecular Modelling and Materials Science and Pharmaceutical Science and Medicinal Chemistry.

Postgraduate Degrees by Research.

It is timely that the staff of the CCS applies for research grants from the National Science Foundation

and the National Research Council for project based applied research to get funding for research work as well as for students. This component of research by the permanent staff is essential for the development of a College to function as a University. These degrees can be designated as mastership or doctorships by research in Chemistry until accreditation is granted.

Accreditation to a University Status

There was no system or law to govern the establishment of a private University. The usefulness of such Institutions has been recognized and procedures are being drafted for this purpose. Professor JNO was not so keen to get accreditation in Sri Lanka but was keen to get foreign University affiliations. The time is now opportune to apply for accreditation which will enable us to expand our activities with some assistance from the government. Furthermore our graduate chemists will then get accredited University degrees in par with all Universities.

Opening for admission of foreign students

This will be a direct sequel to getting the accreditation. We have excellent academic staff drawn from all the Universities in Sri Lanka and other facilities we could open admission to foreign students which can be our contribution to earnings of foreign exchange. The professors doing research at the CCS could also attract foreign students so that our staff will be internationally recognized as well. Another opening for foreign students will be M.Sc. and M.Res. programmes that could be commenced.

Distant mode

Many Universities are engaged in distance learning courses to disseminate knowledge to students irrespective of age, who cannot afford a University education. This is another area for the CCS to venture into with facilities that can be shared with other institutions. There are similar units in other countries which are willing to collaborate on such projects.

Campus Sports grounds

Many extracurricular activities have been introduced and encouraged by the CCS. What is really missing is a sports ground so that CCS students can develop the skills they have achieved at their schools in other sports activities. I am sure that Prof Fernando would have thought about this requirement many a times and even tried to negotiate such land from the government. I am sure that the present Rector and Dean

will pursue this with vigor and perseverance to satisfy this necessity

Presidents List

Recently I had to go through the websites of some professional associations both in Sri Lanka and overseas. I was struck by the reference to the history of some associations where they have rightly recognized the services of past presidents by having a complete list. For that matter our sister association Royal Society of Chemistry too had the past presidents listed under the history of the Society. Our Institute is the oldest professional body started in 1941 with the distinguished Professor Kandiah as President but it may be an oversight that this part of the history is not on our website. I propose that we should acknowledge the role played by our past presidents and in fact have the list on a board displayed at the Institute headquarters.

Inspirations and exemplifications to be drawn from Professor Fernando's lifelong accomplishments

Professor Fernando was happy to undertake heavy workloads and welcome new challenges and risks without fear. We should try to emulate some of his character and personality traits that enabled him to succeed in life and serve the students, professionals and the nation with his long list of accomplishments. CCS filled a large part of JNO's life, where he loved what he did and was truly satisfied doing what he considered is great work. He was a chosen Leader and he earned great respect for his accomplishments. His determination and commitment to a relentless pursuit of his goal with a commitment to excellence enabled him to attain success at all times. We should remember the sacrifices he has made and honor and admire his services to the profession of Chemistry, Chemistry fraternity and the Nation. At the same time we could also draw inspiration from his way of life and accomplishments. His integrity, honesty, courage, dedication, perseverance, originality, creativity and above all conscientiousness, commitment and intrepidity are qualities that one should emulate to achieve success. Similarly for achieving lasting success in any activity one should have perseverance, imagination, determination, clear objectives, focus, optimism, hard work and passion. Some other personality characters that contributed to career success of Professor JNO include right attitude, enthusiasm, persistence, self-discipline, good ethical practices and the ability to have clear objectives in one's life. We should strive to develop these qualities

and be grateful to Professor JNO for demonstrating the path to success.

Role of Mandrupa

Any account of JNO's contributions can not be completed without acknowledging the active role played by Mandrupa. She was a force behind him giving all the encouragement and support. Let us thank her for all her efforts and providing unstinted support to make JNO's activities such a success.

Conclusion

This loss will generate a lasting respect in the minds of those who had the good fortune of sharing his company. He developed the college to command affection and loyalty and a lifelong inspiration of its graduates to strive to become someone better than they are.

For nothing he achieved was inevitable. He was a man who earned his place in history through hard work and prudence, and persistence and faith. He had an unparalleled influence on colleagues and subordinates.

His service with a definite vision and his sense of mission of looking beyond to the CCS, society and the nation, spanning a period of 40 years was unparalleled, highly distinguished, heavily productive with ever lasting memories. The extent of his accomplishments rightly earned the adoration of all who knew him.

These remarkable achievements of the CCS have been made in a few decades, and the driving force behind them was Professor Fernando. If not for his initiative, vision, dedication, persistence, hard work and sheer enthusiasm these successes would not have been possible. His leadership inspired those who worked with him.

JNO was a friendly gentleman of tremendous dedication and authority, very supportive and always full of self-confidence who put service before self. We will miss his friendship, vision, creativity, leadership, and companionship but he has left us with a grand legacy and an indelible impression that will not be forgotten.

Professor Fernando's involvement in science education and the development of the College has spanned for 40 years and I salute him for his unwavering enthusiasm and tireless pursuit to follow his dream and vision.

Thank you all for coming today, to honor and celebrate the life and remarkable accomplishments of Professor JNO Fernando. I know that you all miss JNO much; his unexpected demise was not foreseen by any

of us. It is hard to comprehend why tragic things like this happen to such good people. However, he has made an indelible contribution that will never be forgotten by his family, chemistry fraternity and friends.

So Mandrupa and family, JNO was an eminent chemist, distinguished academic, efficient administrator and above all the great builder of the College of Chemical Sciences who was a honest, sincere, outspoken leader respected by society and the

church for his distinguished services. He has created a vacancy that will be very hard to fill.

May I conclude with a quote by Margaret Chase Smith which aptly describes JNO's renowned services.

“Public service must be more than doing a job efficiently and honestly.

It must be a complete dedication to the people and to the nation.”

May his soul rest in peace

Twelfth Convocation of the College of Chemical Sciences

Convocation Address

Professionalism

Vidya Jyothi Professor Colvin Goonaratna *MBBS (Cey), FRCP (Lond), FRCP (Edin), PhD (Dundee, Scotland), Hon DSc (Col), FCCP (Cey)*
Chancellor, Open University of Sri Lanka
Chairman, Sri Lanka Clinical Trials Registry
Registrar, Ceylon Medical College Council

I appreciate that it is an uncommon privilege to be invited as the Chief Guest by the authorities of the Institute of Chemistry of Ceylon, for one of its Annual Convocations. So, I feel privileged today to participate as the Chief Guest at your Institute's 12th Convocation, and to deliver this Convocation Address.

In my reckoning the Convocation as an event actually belongs to the young women and men who will receive their graduateship and diploma certificates, and awards for excellence. I congratulate everyone of you very warmly, and wish for you bright and prosperous futures.

Talking about bright and prosperous futures for you, brings me straightaway to the topic I have chosen for my Convocation Address, namely, **Professionalism**. But before I take you with me along the difficult path to achieving true professionalism, allow me please, to fulfill two preliminaries. First, I thank the Academic and Non-Academic staff of the Institute of Chemistry Ceylon, and the College of Chemical Sciences for the excellent work they have done, and will continue to do in the future, in teaching, training and mentoring a select group of learners such as you are. Next I want to congratulate you the learners, with this slide.

Congratulations ! Best Wishes !!

- ❖ Be happy, very happy
- ❖ Be proud, modestly proud
- ❖ Be ready to serve, and ready to safeguard your integrity and your professionalism

Who are Professionals?

In Western European countries, only four groups of privileged people in the society during the Middle Ages were regarded as belonging to the “Learned Professions”. They were,

- i. Priests, clergy
- ii. Medical doctors (“Physicians”)
- iii. Lawyers
- iv. Senior teachers, especially Professors in higher institutions eg. Universities.

Other citizens, however skilled in various branches of learning, such as the sciences, mathematics or the arts, did not qualify them as members of the “Learned Professions”. If we “fast-forward” to contemporary times, a large number of categories are now claiming that they also are professionals. Their number includes marketeers, advertisers, fashion designers, IT chaps, hairdressers, bureaucrats, butchers, journalists, beauticians, and male and female sex workers – to mention just a few. You can add to this list several other categories of your choice, I am sure.

I want to take, as examples, two of the self-styled professions I have mentioned above, and their main activities, and their alleged expertise.

First, beauticians. To become a beautician no qualifications whatsoever are required by any law or statute. I am not aware of any code of ethics that beauticians have to adhere to. They do not require a licence, awarded by a legally recognised body, to start practising as a beautician. There is no regulation of their activities by a body with statutory powers. They can

apply any kind of lotion or cream or oil or powder of their own making, or others taken from the flood of cosmetic products which are present, not regulated by any statutory body. No acceptable scientific evidence is available to the public on the safety and efficacy of these cosmetic products, or of so-called beauticians. Despite all these deficiencies, our print and electronic media give these self-styled “experts” free publicity as a popular marketing procedure for their own media. And many thousands of women and even some men, go to them for “beauty therapy”.

The second group of people who consider themselves as “professionals” that I want to talk about are those in the advertising business. The main objective of all their activities seems to be to tell things about the products they advertise to increase sales, that fall just short of being legally culpable as falsehoods. Most of their commercial communications are emotive statements that are neither provable nor falsifiable. Consider the following examples.

- Love begins with “Blank Blank” soap. Try it for just two weeks!
- The fragrance that elevates romance of starlit nights.
- Choice of all young people is our new scientifically proven “slosh slosh” facewash.
- Diva – be yourself
- Complete oral hygiene with “blank” toothpaste
- Our reinforced toothpaste whitens teeth, and freshens breath

Think about these statements for a few minutes and answer just two questions for me. Are they scientifically verifiable? Are they scientifically falsifiable? They are neither. They are typical advertising slogans and gimmicks.

I reproduce here a cartoon which appeared in a local newspaper recently, that summarises the job of all people in advertising very well.



“I got caught lying, so they transferred me out of management and into advertising”

Sunday Times Dec 6, 2015

By now the issue I have raised ought be clear to you. The issue I have raised is that people engaged in various jobs in the State or Private Sector – and indeed some of them are self-employed – are claiming to be professionals. Are there some criteria we may use to separate true professionals form other workers? If we do not identify who true professionals are, the word will lose all meaning. Even more disconcerting, is the eventual degradation of the meaning and the concepts enshrined in the word “professionalism.”

I want to show you how independent opinion polls in various developed countries, such as USA, UK and other EU states, have assessed medical doctors over several years. Opinion polls of these people have held doctors in high regard when compared to all other professions. (Incidentally, politicians have consistently come at the lowest level in all opinion polls, and lawyers are not much better than politicians.)

Medical Doctors Belong To

- ✓ The most **respected** profession world-wide
- ✓ The most **trusted** profession world-wide
- ✓ The most **caring** profession world-wide
- ✓ The most **fulfilling** profession world-wide

This is what **all** opinion polls by print and electronic media and by other independent agencies worldwide tell us.

The purpose of showing you this slide is not to boast about the profession to which I belong, but to discuss with you how and why medical doctors, as a profession, regularly come “top-of-the-pops”, in all independent opinion polls. Medical doctors have earned these distinction over a period of several centuries. One of the earliest to lay down rules of ethical behaviour for doctors was the Greek Philosopher-Physician Hippocrates.

Primum non-nocere
(Hippocrates 460 – 357 BC)
First, do no harm

We take a long leap from Hippocrates to Dr William Osler, Professor of Medicine and Chief Physician at the famous Johns Hopkins hospital in Baltimore, USA. After having worked there for 17 years from 1889, he was invited to be Regius Professor of Medicine at Oxford University in England. He held this post from 1906 until his death in 1919. William Osler revolutionised systematic western medicine. He placed the patient and the hospital bed as the most

important seat of learning and teaching. He has been described by those who knew him and those who had learnt from him as expert clinician, great teacher, pathologist, prolific medical author, philosopher, and most quoted doctor. I place before you just three of his most famous quotes, so that you may appreciate his humaneness and his intensely professional approach. These quotes have done much to fashion modern doctors' thinking about ethics and professionalism. This is the first quote.

“Medicine is an art, not a trade; a calling, not a business; a calling in which your heart will be equally used as your head.”

(Dr William Osler)

This second quote places the patient as the principal focus of medical teaching, learning, service and research.

“Medicine should begin with the patient, continue with the patient and end with the patient”

(Dr Willaim Osler)

The third quotes is an essential practical advisory for all doctors, all nurses, and all patients.

*“To cure sometimes.
To relieve often.
To comfort always.”*

(Dr William Osler)

I have tried to show you, very very briefly of course, how western medical ethics and professionalism have developed over several centuries. Having done that, I want to come to one of the major issues I have raised earlier in my talk, which I reiterate here to jog the memory of those who may have forgotten it. That is, are there any criteria for assessing whether a group of working people should be regarded as “professionals”?

The very famous *British Medical Journal* published a list of items by which we may distinguish a true profession from those other occupations. This list pertains mainly to the medical profession, but I believe it can be adapted by others. Here is the list.

What is a Profession?

- * A clearly designated, rigorous and frequently updated body of knowledge, skills, attitudes and behaviours
- * A legally enforceable code of ethics
- * Trained (almost) entirely by their peers
- * Long period of apprenticeship supervised

mainly by peers

- * Assessed for licence to practice (almost) entirely by their peers
- * Peer regulation by a Council with statutory powers
- * A legally enforceable duty of care

In addition to that list, a distinguished physician from USA produced the list below, regarding the many roles that a good doctor may be called upon to play during a lifetime of service.

Doctors Ought To Be

- ✓ Learners: lifelong learners, contemplative learners
- ✓ Practitioners: efficient, competent, careful and compassionate practitioners
- ✓ Teachers
- ✓ Counsellors, healers
- ✓ Team players
- ✓ Team leaders
- ✓ Managers and Administrators
- ✓ Researchers

I have come now to the concluding part of my talk. The issues I have tried to emphasize are, that the once highly respected words “profession” and “professionalism” are under siege by many miscellaneous groups who do not deserve to be called professions by any criteria that will stand critical scrutiny, and that the concepts enshrined in the words “profession” and “professionalism” seem to have lost their meaning as a consequence of this siege.

I chose to examine the ideal defining features of the medical profession and their development over several centuries in response to public demand, only because I am a medical doctor and educator – certainly not because I think doctors are perfect examples of the ideal. In spite of many glaring and widely reported failings of omission and commission by some doctors and healthcare institutions both local and foreign, the medical profession has apparently won the hearts of people worldwide.

The famous London medical journal “*The Lancet*” examined this seeming paradox and came to the following conclusion.

*A profession serves best in which
people can place their trust.*

The Lancet

Thank you

Post JNOF at CCS – the period since 2nd March - an Overview

Professor S P Deraniyagala, *C.Chem.*

Honorary Rector, College of Chemical Sciences, Institute of Chemistry Ceylon

The convocation, 2015, was held for the first time at Eagle Lakeside Convention Centre on 19th February on a grand scale. It turned out to be a tremendous success. However, the joy was short lived as the shocking news of the death of the architect of this event, Professor JNO Fernando reached us 2nd March 2015, just over 10 days after the convocation ceremony. Many tributes have been paid, culminating in the launch of a special edition of our magazine, Chemistry in Sri Lanka dedicated to Professor JNO Fernando. This edition included all the letters of appreciation and other tributes paid by his close associates. In many matters associated with the College of Chemical Sciences (CCS), reference is continued to be made to the actions taken by the late Professor previously in order to make decisions by the present officials. He has left an indelible mark on all affairs of the Institute and its College and a void that is difficult if not impossible to fill. May I therefore be permitted to dedicate this convocation (the first one since its inception twelve years ago without Prof JNOF) to the late Professor. Let us all remember him for his dedication and loyal service to the CCS and IChemC.

The Graduateship Programme in Chemistry (GIC) commenced in 1979. The year 2016 saw the 38th intake which was formally inaugurated on 2nd January; the number of students registered is 150; concurrently 96 from the 33rd batch students are passing out this year at this convocation, giving a grand total of 1171 graduates so far. Simultaneously, I am proud to mention about the DLTC (diploma in laboratory technology) programme which has over 120 registering this year; this programme has shown an increased demand over the years and hence, a special word of thanks should go to Mr E.G. Somapala, the coordinator and his staff for a job well done.

Year 2016 marks the 75th year of the Institute of Chemistry (predecessor to the Chemical Society of Ceylon established in 1941). To mark this occasion, an exhibition and a symposium have been planned.

Adamantane House and roof top:

Space is continuing to be a problem for which immediate solutions are necessary. Detailed account of

the status of the building at Adamantane House was reported by the Rector last year (**Ref Souvenir - Eleventh Convocation**). We are able to accommodate around 150 students for examinations in the new building but when the numbers are larger, we are compelled to hire out class rooms at Presidents College. We are happy to mention that construction of the canopy on the roof top has given us some additional space.

We are optimistic that the negotiations to obtain UDA land at Malabe on lease will be successful and that, in my opinion, would hopefully bring about a dramatic change in the infrastructure facilities of the Institute as a whole. Land area between one and two acres is still being negotiated through the UDA; when this materializes, it is hoped that we could overcome the existing space shortage. It would require a great deal of commitment on the part of the IChemC community as a whole in order to have this dream fulfilled. A long term plan to be carried out in several stages is envisaged. Car park, Hostel, Cafeteria, sports facilities etc are some of the facilities that come to mind immediately in addition to the main facilities that are necessary for the academic programmes. I am sure the membership will rise to the occasion to make this complex or shall I say IChemC campus, possible. It is going to be quite unique and an achievement of which we can all be proud of.

Academic Staff

Two Senior Professors, Professor M.D.P. De Costa and Professor Srianthie Deraniyagala left during the course of the year, 2015, after serving one year with us at CCS; they were on sabbatical leave from the University of Colombo. On behalf of the CCS, I wish to express our gratitude to both of them for their services. In addition, Prof Costa also carried out the duties of the Dean/CCS during his stay at IChemC.

Professor K.A.S. Pathiratne joined the CCS as Senior Professor in March 2015 whilst Mr. M.R.M Haniffa joined us in August 20th the same year as a Visiting Senior Lecturer, spending a one year sabbatical from the Open University of Sri Lanka. He is concurrently serving as the Dean/CCS.

Senior Professor Sotheeswaran who has been in our staff for over years, is back with us (from 1st November 2015) after spending 6 months in Australia.

Senior Professor Priyani Paranagama (Chair Professor of Organic Chemistry, University of Kelaniya) joined us on 1st January on her sabbatical and is expecting to be with us till the end of 2016.

Teaching Assistants

Over the years, the Teaching Assistants (primarily selected from our own recent graduate chemists who have first or second class (upper) including those from the passing out batch) and a few graduates from other universities are playing a vital role in maintaining and running our academic programmes. They have formed a dynamic group of about 30, including some who work only part time whilst engaged in post graduate studies at other universities. Their work is wide ranging, including office work, lab and research work, seminar and workshop organization *etc.* The experience gained during the period of service has served them well as they move on to undertake job assignments else where or when they go for post graduate studies. Many have gone abroad to USA, Australia, UK *etc.* Space and time do not permit to give a full account of all those who have gone abroad. They form a core group of graduate chemists and we are hopeful that they will continue to serve the College in the future.

Administrative, library and lab staff

The staff led by our Registrar Mr NINS Nadarasa has continued to provide all necessary services starting from admission of new students, to organizing meetings, planning the academic calendar at all levels (a tough task carried out very efficiently and with a great degree of responsibility and dedication). Increase in activity brings with it increase in work load. In this respect, I must mention that the finance division has carried out all the tasks with considerable skill.

Our Joy and Happiness

We continue to hear from overseas about our post graduate students; their achievements and progress gives us immense joy and happiness and I consider it my pleasure to report about those who obtained their PhD's during the course of the year 2015
Dr. Lasantha Wickramasinghe - University of Missouri, USA
Dr. Tharushi Perera - University of Missouri, USA
Dr. Nirmal Peiris - University of Loughborough, UK
Dr. Piumi Abeyratne - Mississippi State University

Dr. Duminda Sampath Ranasinghe - Wesleyan University, USA

Dr. Rukshan Perera - University of Utah, USA

Dr. Akhila - Wayne State University, USA

We were also happy to welcome three of our post graduate students, Nuwan and Buddhini and Ashwin (from Rhode Islands) who paid us a visit on 21st December.

Research

Research and related activities have continued to increase over the last few years; this year, it has been mandatory for the students at L3/L4 to offer one or more from the area of literature survey, seminar presentations, research *etc.* Few of our senior staff has obtained grants offered by the College and their research is progressing with help from research assistants.

It may be relevant to mention that Dr Lakshmi Arambewela has donated Rs. 70000 towards a prize for undergraduate research; it is to be named as Dr Lakshmi Arambawela Prize for the best research project beneficial to the country. We wish to acknowledge with gratitude her donation which would definitely go a long way in encouraging research work.

Several abstracts submitted, both by graduate and undergraduates, to the ACS sessions in Bangladesh scheduled for November 2015; have been accepted; unfortunately, it has now been postponed to March 2016. In this regard, I wish to report that Professor Sotheeswaran will represent the IChemC at FACS (Federation of Asian Chemical Society) meeting scheduled at the same time in Bangladesh.

Co-curricular activities

Several Popular Talks (co-curricular lectures) were held during the course of year 2105.

Dr. Rathika and Dr. Udaya Jayasundara from our academic staff and three visiting staff members, namely, Dr. Wasantha Wickramasinghe (from the National Research Centre for Environmental Toxicology University of Queensland), Professor LMV Tillakaratne Chemistry [from the University of Toledo, USA] (former Professor of Organic Chemistry, University of Colombo) and Dr Rukshan Perera (Graduate Chemist who was on a visit to Sri Lanka to attend a conference organized by SLINTEC).

Monograph and CCS publications

Conformational Analysis - Professor S Sotheeswaran

and Dr Ireshika de Silva

Following Monographs were printed in 2015.

Marine Organic Chemistry - Professor Sotheeswaran
Following Monographs were reprinted in 2015.

Scientific Measurements & Calculations - Prof (Ms)
S A Deraniyagala

Inorganic NMR spectroscopy - Prof K D S Perera

Following Monographs/ CCS publications are ready to
be printed.

Chemistry in the Kitchen - Prof S Sotheeswaran
(monograph)

Molecular rearrangements in Organic Chemistry –
Dr C Padumadasa (CCS)

Following Titles of CCS publication have been
approved

Carbon Nanotubes - Dr Rathika Kandiah (CCS)

Drug Metabolism - Prof S A Deraniyagala (CCS)

Following Monographs have been approved for
reprinting

Silicones - a Class of Inorganic Polymers - Prof
Sudantha Liyanage

Training Seminars / Work shops

The following seminars were organized by the
CCS during the course of the year 2015. The titles are,
Chromatographic Techniques and their applications
Advanced level chemistry practical workshop for
teachers (2 days)

Cosmetics Chemistry

Scientific measurements in calculations

Genetechnology

Nanotechnology

Analytical Instrumentation

Certificate (stand-alone) courses

Several selected courses are now offered by the
CCS as standalone/certificate courses for those with
subject specific interests – working or planning to work
in a particular industry - but not registered as a regular
students of the CCS. Cosmetic Science, Food
Chemistry and Technology, Atomic Absorption, Green
Chemistry, nano technology being some of them. The
courses are held mainly during weekends or in weekday
evenings after 4 pm for 8-15 weeks duration to. The first
such programme involving food chemistry and
technology was offered in the year 2014.

Alumni Association

The Alumni association of the Institute was
established to support the parent institutional
organizations' goals, and to strengthen the ties between

alumni, the community, and the parent institutional
organization.

Dr. Piyal Ariyananda serves as the current
President of the Alumni Association. They have
provided additional strength and moral support to the
CCS and the IChemC. Some of the highlights are as
follows.

- **Nalu Ranga Gee II**, held at the Kularatne Hall,
Ananda College, on 28th of November 2015, a fund
raiser to establish the infrastructure facilities to the
science laboratory at President's College,
Rajagiriya in memory of late Professor J.N.O.
Fernando, the founder of the College of Chemical
Sciences.
- **Establishment of Career Guidance Unit (CGU)
in 2015.**

The main purpose of this unit is to develop and
enhance the career related skills such as
communication skills, leadership and teamwork
skills and managerial skills and, to support advice
and guide students to meet employers in the field
of Chemistry. Dr. Infas is serving as the first chair
of the CGU. Amongst the objectives was to
conduct activities related to Personal
Development, Professional Development,
Research & Academic Development.

The Gavel club

This was initiated by the CGU of the Institute and
conducted by the Alumni Association in order to guide
students in their personal development skills and
presentation and speaking ability for industrial
exposure.

We are proud to announce that at its first
installation, one of our students, Samadhi Nawalage
become the first runner-up in the Inter- University
Speechmaster competition organized by the Gavel
Club of the University of Sri Jayawardenapura, a
commendable achievement within this very short
period of time.

Toastmasters Club

This is also functioning under the CGU of the
Institute and was established as a staff development
program. The main purpose of setting the toastmasters
club is to develop the speech and presentation skills of
the staff. The President of the Club is Dr. Rathika
Kandiah.

Analytical Club

The club was initiated in February 2015 with the

initiative and support of Dr. Ranmal Gunathilake. The basic goal was to be on par with cutting edge technology which is not covered in the conventional syllabus. Monthly meetings are held in order to educate staff and students in the form of interactive sessions.

Students' Council

Office bearers for the students council was elected on the 25th of October 2015. Mr Thilina Gamagedera Serve as the President and Ameesha Fernando serve as the Secretary of the Student council for the year 2015/2016. Dr M. Infas serve as the Mentor of the Student Council. Sports Association was also formed at the AGM held on 25th November 2015 enabling the inclusion of representatives of each sport such that they would be part of the Student Council.

Social Events

Aura- Talent Show

A popular event among students, giving the skilled students a chance to display their talents from all levels of study. The show was organized by the passing out batch in collaboration with the Students' Association of College of Chemical Sciences. AURA 2015 was held on 18th January 2015 at the Kularathna Hall, Ananda College.

Freshers' Night and Sports' Day

Both these events are annual events organized by the students with the full support and encouragement from the staff and members of the Institute. It is quite popular and well patronized.

Inter-University Debating Competition

An event organized by the Institute itself, where all the local universities are invited annually, and the competition is conducted at the Adamantane house. Our team has continued to perform well and has been among the top three in the competitions. This year it was held on the 14th February 2015. Six universities participated in this competition. The University of Colombo emerged as the champions and the CCS team was placed second, while the University of Sri Jayawardenapura and the University of Peradeniya were jointly placed third.

Religious Events

I must at the outset mention that the late Prof J N O Fernando had a practical vision for bringing about ethnic harmony amongst the various groups/communities. The following events are his

entire brain child and we must pay a special tribute to him in this respect and hope that the future administrators will continue to foster peace and harmony as envisaged by him.

Wesak 2015

Wesak was celebrated in the year in a grand scale by the students in collaboration with the students association by organizing a “seeni-sambol paan dansala” on the 11th of May 2015 at Kotte road. Many students gathered on this occasion to make it successful.

Annual Poson Bana and Bhakthi Geetha

This occasion was held on the 1st of June 2015 at Adamantane House which was organized by the Students Association. The day commenced by a bana programme followed by Bhakthi Geetha sung by the students.

Navarathri

An event organized by the Tamil and Hindu students of the Institute. The annual event was held in November at the Adamantane House. The performance of a drama by the Internal Academics was the novel feature of the Navarathri function held in 2015. We were privileged to have Emeritus Prof Uma Coomaraswamy as the chief guest at this event.

Ramazan Festival

This is an event organized by the Muslim students of the institute annually. This year too it was held at the Auditorium; the guest speaker Brother Inthikab was able to clarify many misconceptions about Islam and was appreciated by all. Lunch followed.

Christmas Party

An annual event organized by the Level 2 students with the collaboration Christians with the other students from each level. This time the Christmas Party was held at Grand Oriental Hotel on the 13th of December 2015. This year it was entitled “NOEL ENSEMBLE” with the Dean/CCS as the chief guest.

Thanks-giving Mass

This event is held annually at the beginning of every year on the day of the inauguration of the Graduateship programme (the new intake). It is organized by the catholic students of the Institute. The members celebrated the Holy mass and blessed the staff and the students for a successful academic year.

Social Service activities conducted by Clubs and Societies

Blood Donation Campaign

An event organised by the Institute as part of the annual event practiced for the past 7- 8 years. Most of our students and members of the Institute actively took part in this event. Our thanks are due to all of them who organized this event and also to all the blood donors.

Avurudu Ulela at Kirulapone Children Centre

Rotaract Club of CCS organized an Avurudu Ulela for the kids at Kirulapona Children's centre. The event was successfully held and all the food and prizes for winners were sponsored by Rotaract Club of CCS.

Event at Cancer Hospital

A community service project done on behalf of the children who suffer from cancer. Rs. 83,800/ worth medicine and Rs. 46,000 worth other equipment were donated to the Cancer Hospital. On behalf of the College, I would like to offer our thanks to all those who made this possible.

Sports

Sports, has taken on a new dimension with the introduction of more and more activities, both indoor and outdoor sports. Practice sessions are held regularly at selected venues. Enthusiasm shown by our students is encouraging and it is hoped that with more participation, we will be able to go from strength to strength in the future. Cricket, Rugby, Basket Ball, Badminton, Karate, Carrom *etc.* are now quite popular and many students indulge in these games regularly.

Popularisation of Chemistry

Chemistry Olympiad

Chemistry Olympiad is a chemistry competition for high school students. The purpose of the competition is to stimulate young people to achieve excellence in chemistry. The American Chemical Society (ACS) has sponsored the program since 1984. Initiation of Chemistry Olympiad was brought forward by the Institute of Chemistry, under the guidance and leadership of Dr. Infas. A committee was established this year in order to build a pathway to International Chemistry Olympiad. It is also a new way to popularize Chemistry.

Titration Competition

In order to enhance the laboratory skills of A/L students, the College of Chemical Sciences organized

the "Interschool Titration Competition". This year the competition was held from 06th – 08th May, 2015 at Adamantane House, Rajagiriya for the Colombo based students with the participation of 11. The chief coordinator for this event was Dr. R. Kandiah.

This event was re conducted for the schools in Jaffna region in June 2015, and the coordinator for this event was Dr. R. Parthipan with the participation of 48 schools.

All Island Interschool Chemistry Quiz Contest 2014/2015

The above contest was held successfully for yet another year. The following schools were placed first, second and third respectively.

Winner : Challenge Shield donated by Mr N M S Hettigedara

Bt/ Vincent Girls High School

Second place: Challenge Shield donated by Link Natural Products Ltd

Nalanda College Colombo 02

Third place: GM/ Bandaranayake College, Gampaha

Prizes were also awarded to several students for their individual performances (**Based on Written Paper and Oral Contest**).

Australian National Chemistry Quiz Competition 2015

The competition was held in Sri Lanka for the first time at the Institute of Chemistry Ceylon in 1997. The competition is held in all three languages, namely, English, Sinhala and Tamil enabling it to be held throughout the island.

The nineteenth Award Ceremony of the Australian National Chemistry Quiz competition was held on 8th January, 2016 at Adamantane House. Professor Samitha Deraniyagala, Rector/CCS was the chief guest at this event.

A total of 122 schools participated in Senior Grade (SL Year 12) and 110 schools in the Junior Grade (SL year 11) The best performer in the Senior Grade, Mr. Manish Lanerolle from Colombo International School; he had answered all 30 questions. 6 other students from 6 schools answered 27 questions.

In the Junior Grade (SL Year 11) 5 students from 4 schools answered 28 questions correctly while 7 other students answered 27 questions correctly. Thus a total number of 19 students were given plaque and certificates from RACI, Australia and Certificate from IChemC.

I'll be failing in my duty if I do not acknowledge the efficient manner in which Mr. Nadarasa and his team are carried all activities pertaining to the conduct of the above competition.

Acknowledgment

Looking back, I consider one of my most difficult tasks is to write a note under acknowledgements for the year 2015, what I would call as the post JNOF era. The question is "How did we meet the challenges during this period? Were we able to sustain the vision and mission envisaged by the late Professor JNOF?" Some questions that are best answered by our members themselves. Nevertheless, we feel that we were able to make satisfactory progress in line with the objectives set due to the strong will and determination and cooperation of the entire staff of the CCS and IChemC, and the members of the Academic Board, Council and other committees. And of course the entire membership to all of them, I would like to propose a big THANK YOU.

I'll be failing in my duty if I do not highlight the role of our staff – academic, TA's, office, library, laboratory, finance etc. at, who have worked tirelessly throughout the year in all activities including the work associated with the convocation. Their support and cooperation is very much appreciated and acknowledged with gratitude.

There were many who spontaneously donated towards the **RECTORS fund**, [established in the middle of last year] which is to be renamed as the Professor JNOF scholarship fund when we have the ceremonial 1st death anniversary on 2nd March. Our gratitude to all of them for their kind gesture. The fund is still growing and so we hope more of our members will continue to donate towards this worthy cause. In this respect, we are happy to inform that individual.

The fund stands at Rs. 637000/ as at 31st Dec. 2015.

I wish to acknowledge with grateful thanks the donations of a sum of Rs 1.43 million by Dr **Sentheshanmuganathan from Canada**. We will utilize this money in accordance with the criteria laid out by the donor. This is in addition to the previous donation of \$10000/ (Canadian dollars), a sum exceeding Rs 1 million which has paved the way for financial assistance to be given to two very needy students as requested by him. Although Dr Sentheshanmuganathan is far away, his interest and contribution towards the Institute is quite remarkable and is very much appreciated by one and all.

Conclusion

The College has moved forward steadily in line with our objectives during the period under review thanks to the commitment and dedication of its staff and the support extended by our Members. Both GIC and DLTC have been able to sustain the respective programmes maintaining a very high standard. Nevertheless, we need to remind ourselves that we have a long way to go for which your continued support and encouragement are very much needed.

Information and Communication Technology has brought about major changes in the behaviour of the present generation and, we need to keep abreast with these changes, whether we like it or not. We need to do so in order to meet the demands of the present and future society. This cannot be done alone or in isolation. Collective effort and thinking is very much the need of the hour. The success of our students is of paramount importance; we need to continue to monitor the academic performance of our students and ensure that they receive support and guidance at all times.

On behalf of the College, may I call upon all passing out graduates, parents, alumni, students, staff and Members to extend your fullest cooperation this year and the years ahead in order to achieve our objectives.

In conclusion, may I quote from the Editorial published in the CCS newsletter (from an email under the title "FOOD FOR THOUGHT).

'Alone I can 'Say' but together we can 'talk'.

'Alone I can 'Enjoy' but together we can 'Celebrate'.

'Alone I can 'Smile' but together we can 'Laugh'.

That's the BEAUTY of Human Relations.

We are nothing without each other

I am sure working together (team work) would be one of the main strategies in meeting the future challenges. That, perhaps, sums up what I consider as the way forward for the future.

Citations, References, ACS style, and Mendeley Software

Dr Chinthaka N. Ratnaweera

College of Chemical Sciences, Institute of Chemistry Ceylon

When you write your thesis, a project report and scientific paper, or any document for academic purposes you often need to refer the work and ideas of other academics/people. Therefore, in order to recognize others work and avoid plagiarism (act of academic dishonestly) we must properly and clearly cite and give references of their contributions. However, we have to keep in mind that citations and references have to be made according to a **reference style** specify by the relevant institution.

Reference Styles

There are several accepted referencing styles developed by professional organizations. For example, the American Psychological Association (APA) style is popular in social science research, the Harvard reference style is popular among business students, the American Medical Association uses AMA style, and the Institute of Electrical and Electronics Engineers publications applies IEEE reference style. As chemists we generally follow the **American Chemical Society (ACS)** reference style as the standard. This article is focused on ACS reference style.

First let us clear out few terms.

Citing or a citation

Citing is referring a work of an author **in the text** of your document. Under ACS style you can cite a reference in following three ways;

1. By superscript numbers (outside the punctuation)
2. By italic numbers in parentheses
3. By author name and year of publications (e.g. (Harold et al., 2012))

We often see the first style (superscript numbers) is used in many ACS journals. An example for such citation is given in the following text.

After secretion it resides on a high density lipoprotein (HDL) particle containing apolipoprotein A1 (apo-A1).¹⁻⁴ HDL-apo-A1 particles provide extra stability to and enhance the hydrolysis rate of PON1.^{5,6} The main biological function of PON1 is to hydrolyze lactones produced during lipid oxidation.⁷

A Common mistake make by many of our students is inclusion of the superscript number before the punctuation mark, which is incorrect. See carefully

how the citations are shown when there are single source, two sources, and more than two sources in the above example.

Reference

Reference is the full details of the source cited. It must be presented using an appropriate reference style. A list of all references are usually appear at end of the document. See the following examples for references of the above citations.

- (1) Harel, M.; Aharoni, A.; Gaidukov, L.; Brumshtein, B.; Khersonsky, O.; Meged, R.; Dvir, H.; Ravelli, R. B. G.; McCarthy, A.; Toker, L.; et al. Structure and Evolution of the Serum Paraoxonase Family of Detoxifying and Anti-Atherosclerotic Enzymes. *Nat. Struct. Mol. Biol.* **2004**, *11* (5), 412–419.
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- (6) Gaidukov, L.; Tawfik, D. S. High Affinity, Stability, and Lactonase Activity of Serum Paraoxonase PON1 Anchored on HDL with ApoA-I. *Biochemistry* **2005**, *44* (35), 11843–11854.
- (7) Khersonsky, O.; Tawfik, D. S. Structure-Reactivity Studies of Serum Paraoxonase PON1 Suggest That Its Native Activity Is Lactonase. *Biochemistry* **2005**, *44* (16), 6371–6382.

Bibliography

Bibliography is a list of sources consulted in the preparation of your document/publication but may include sources that have not been cited in the text.

Primary source and secondary Source

The **primary source** is the original journal article or the original publication where the idea, method, or results initially published. When we read articles we often see authors summarize and interpret the work of the other people, particularly in the form of review articles. Those sources are called **secondary sources**. In academic affairs we should always try to cite the primary sources.

In an academic publication we may have to cite different types of sources such as journal articles, books, chemical abstracts, books, book chapters, theses, web pages, etc. **Reference format** for each of these are different.

The recommended format for reference a journal article, book, thesis, and a web site based on the ACS style is given below.

Journal articles	Author 1; Author 2; Author 3; etc. Title of Article. <i>Journal Abbreviation</i> Year, Volume, Page Numbers (Pagination) See above examples reference 1-7
Books (without editors)	Author 1; Author 2; Author 3; etc. <i>Book Title</i> ; Series Information (if any); Publisher: Place of Publication, Year; Volume Number, Pagination Levine, I. N. <i>Physical Chemistry</i> , 6th ed.; McGraw-Hill Book Company, Inc.: New York, 2009; pp 32-47.
Theses	Author. Title of Thesis. Level of Thesis, Degree-granting University, Location of University, Date of Completion. N. Bandara, Study on Cationic Magnanesetricarbonyl. Ph.D. Dissertation, Mississippi State University, 2011.
Web site	Author (if any). Title of Site. URL (accessed Month Day, year), other identifying information (if any) National Institute on Alcohol Abuse and Alcoholism, Moderate and Binge Drinking. http://www.niaaa.nih.gov/alcohol-health/overview-alcoholconsumption/moderate-binge-drinking , (accessed June 18, 2014).

For more details and for indicating references of other sources you can refer the ACS Style Guide.¹ The chapter on references (chapter 14) is freely downloadable at <http://pubs.acs.org/doi/pdf/10.1021/bk-2006-STYG.ch014>.

As you noted above there are specific and fine details such as punctuations, italicizing, author's names with initials, etc. in each reference. Therefore, when there is a large list of references manual edit is difficult. Moreover, manual numbering of citations often can be hectic, especially when inserting a new citation to the middle of the document.

Reference management software

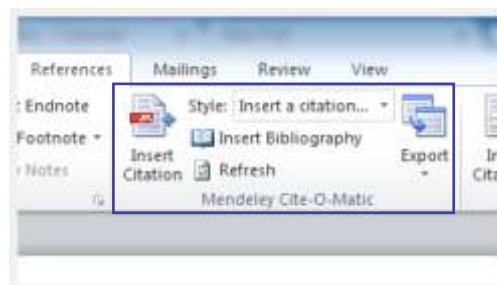
Fortunately, there are certain software which can manage and publish references, bibliography, and citations for you. One such standard software widely used by the research community is EndNote. However, this is a commercial software where you have to purchase the license to operate authentically. Bibtex is a powerful and freely available reference management software which is popular among the physics

community and goes together with Latex document preparation. What I recommend for you to use is software known as Mendeley to manage references.

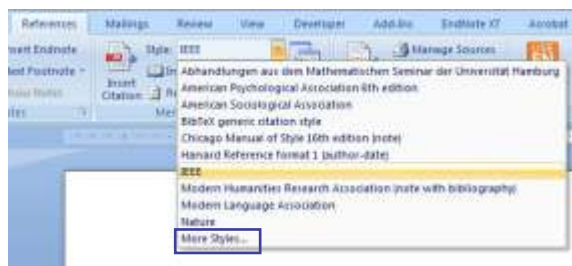
Mendeley is free and very easy to install and operate in Windows OS. Using Mendeley you can make your own reference library to organize your research articles and securely access it online from anywhere. Also, you can network with fellow researches round the world and search research articles through Mendeley.

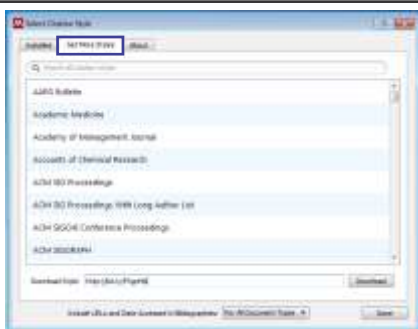
Following steps can be useful for you to install and use Mendeley.

1. First you have to download Mendeley Desktop executable from <https://www.mendeley.com/download-mendeley-desktop/> and install following the instructions.
2. You have to create a Mendeley account using the link you obtain during the installation. (Make sure you verify your email address by clicking the link receive through an email.)
3. Once the installation is over, open the Mendeley desktop. Click on tools and follow the steps and instructions to install the web installer and MS Word plugin.
4. Open MS Word and under the reference tab you should see the Mendeley tab. (see Figure below).



5. The ACS style is not installed in the default settings. Therefore, you have to manually add it to the list. As shown in figures below click on More Styles link and get more Styles Select ACS style and install it.





Now your computer is ready to perform citation and references with Mendeley using the ACS style. You can play with this software and explore more of its features! If necessary get help from your friend, Mr Google!

1. Dodd, J. S.; Solla, L.; Bérard, P. M. *The ACS Style Guide*; Coghill, A. M., Garson, L. R., Eds.; American Chemical Society: Washington, DC, 2006.

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RSC NEWS

THE ROYAL SOCIETY OF CHEMISTRY SRI LANKA SECTION

1. Membership

According to the records sent to us from the parent body, a breakdown of the membership is as follows:-

Category	Number
CChem, FRSC	11
FRSC	04
CChem, MRSC	12
MRSC	22
AMRSC	12
Affiliate /Under Graduate.	04
Total Membership as at July 2015	65

2. Committee of Management

The following were elected to the Committee at the 54th Annual General Meeting held in July 2015.

Hony. Chairman - Mr. R M G B Rajanayake
Hony. Secretary - Mr. W K Samarakoon
Hony. Treasurer - Mr. I M S Herath

Committee Members -

Prof. Sudantha Liyanage
Prof W S Fernando Dr Poshitha Premaratna
Dr Piyal Ariyananda Dr M P Deeyamulla
Dr N Sirimuthu Mr Sulith Liyanage
Mr S Perasiriyana

Co opted Members

Dr Rajitha Hanarasinghe Mr W A P Silva
Mr W J P D Jayalath Mr T M Kumara

3. Activities

3.1 Contributions to Activities of the Institute of Chemistry Ceylon

(a) Full page advertisement of "Chemistry in Sri Lanka".

(b) Contribution for the Interschool Chemistry Quiz

(c) Award for the Best Performance at the Graduate ship Examination in Chemistry Levels 3/4 Theory Examination

3.2 All - Island Inter School Chemistry Essay Competition.

3.3 Inter University Chemistry Essay Competition

3.4 Book donation programme

3.5 A/L Teacher training workshop

3.6 Advanced Level Chemistry Seminar

3.7 Industrial Visit for B.Sc. Special degree students, M.Sc. students and RSC Members

3.8 Collaboration with SLAAS E-2 workshop and seminars

3.9 Supporting Chemical Societies of Universities in Sri Lanka

4. Web Site

The members are reminded of the web site of our Section, the address of which is as follows:-
www.rsc.org/Membership/Networking/Internationalsections/SriLanka/index.asp.

Mr W K Samarakoon
Hony Secretary



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