

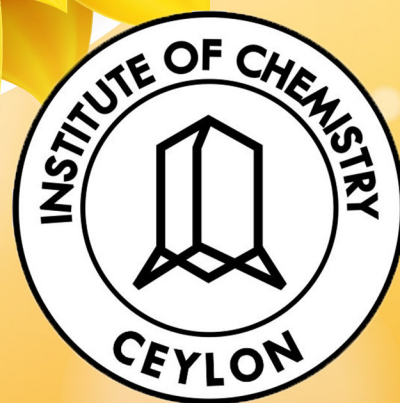
CHEMISTRY

in Sri Lanka



The Tri Annual Publication of the
Institute of Chemistry Ceylon
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Popularization of ICHEMC activities among the young chemists

A meeting with the special degree students of the Department of Chemistry at University of Sri Jayewardenepura was held prior to the 536th Council meeting on 7th April at 3.00 pm.



Chemistry in Sri Lanka

ISSN 1012 - 8999

The Tri-Annual Publication of the Institute of Chemistry Ceylon

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

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

Vol. 34 No. 2

May 2017

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Theme for the year -

Role of Chemists for a Better Tomorrow

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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

- directly become **Licentiate**
- 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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Council 2016/2017

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Mr. N M S Hettigedara	Prof. Hema Pathirana
Prof. S P Deraniyagala	Dr. R Senthilnithy

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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 2017.

- 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.

Role of a chemist in food security

Dr. Nandani Ediriweera, *C.Chem., F.I.Chem.C.*

Former Head, Agro Food Technology Division, Industrial Technology Institute



Ensuring food security at all levels; household, regional, country wise and globally, persists as one of the greatest challenges of present time. The definition of food security set out at 1996 World Food Summit stated that “Food security exists when all people at all

times have both physical and economic access to sufficient food to meet their dietary needs for a productive healthy life”. The concept of food security goes beyond calorie intake, and addresses both hunger and under-nutrition. Reducing levels of hunger places emphasis on the quantity of food and refers to ensuring a minimum calorie intake. Ensuring adequate nutrition refers to a diet's quality. A diet rich in proteins, essential fatty acids and micronutrients has been proven to improve birth weight, growth and cognitive development.

Throughout the history it is clear that chemistry has played a central role globally in meeting food and nutrition security, and hence chemists have been playing an important role in providing a secure food supply. Achievement of food security depends on three distinct but connected processes of food availability, access to food and effective utilization.

Food availability refers to ensuring sufficient quantity and diversity of food available for consumption. Food availability is linked to improving soil fertility and crop management. Soil chemistry and applications play a critical role in developing soil and crop management practices through enhanced understanding of soil processes, development of improved crop varieties, plant nutrition and fertilizer production, and methods of controlling pests and diseases. Applying advanced technology to high yield varieties of cereals caused marked achievement in world food production. Gradual replacement of traditional varieties of rice, maize and wheat crops by improved varieties account for almost 50% of calories in most of the diets. Scientific efforts to remove constraints such as insect pests, diseases, weeds *etc.* have focused on breeding of varieties resistant to such

constraints and scientific development on pest management practices. Chemists have been playing a pivotal role in this regards.

Food access refers to households having the physical and financial resources required to obtain appropriate foods for a nutritious diet. Further food access depends on what happens to the food after production such as during the post-harvest storage. Food chemists play an important role in improving the access to healthy foods through improved post-harvest storage loss.

To have food available and accessible to eat is not the sole solution to food security. A person's body must be in good physical condition in order to properly use the food. This is termed food utilization, the ability to use food effectively in order to live a healthy life. Utilization requires not only an adequate diet but also a physical environment including safe drinking water, adequate sanitation and hygiene, decreased burden of infectious disease and the knowledge and understanding of proper care for oneself, for food preparation ensuring safety. Chemistry is core to food utilization, improved bio fortification, food processing, and has contributed much to the food security.

It is essential that our bodies absorb the nutrients from foods that we eat. However the chemical composition of the foods consumed in specific combinations and the quality of the diet are critical in meeting dietary needs. Food chemists play a significant role in developing new food products and improving the quality of food. Value addition by converting the agricultural raw materials in to more convenient products through processing can be accomplished through, enrichment of nutrients, fortification of foods, development of functional foods and convenient foods. Chemists also can play a role to improve the taste and flavor of food for consumer satisfaction, and to enhance nutritive value and digestibility of food. Food chemists also play a role in ensuring that food is produced safe by following good manufacturing practices.

Institute of Chemistry Ceylon

Forty Sixth Annual Sessions and Seventy Sixth Anniversary Celebrations 2017

Inauguration of the 46th Annual Sessions, Institute of Chemistry Ceylon

Wednesday, June 14th 2017
Plastic and Rubber Institute, Rajagiriya

- | | |
|--------------|---|
| 9.00-9.30 am | Arrival of Members and Guests (<i>Refreshments will be served</i>) |
| 9.30 am | Ceremonial Procession of the Council Members and Past Presidents |
| 9.35 am | Inauguration by lighting of the Oil Lamp and playing the National Anthem |
| 9.40 am | Welcome Address by
Mr. M R M Haniffa
<i>President, Institute of Chemistry Ceylon</i> |
| 9.45 am | Presidential Address |
| 10.15 am | Address by the Guest of Honor
Dr M M J P Gawarammana
<i>Chairman, Tea Research Board, Talawakelle</i> |
| 10.30 am | Address by the Chief Guest
Mr S K Cyril Suduwella
<i>Advisor and Coordinator to the Minister of Science, Technology & Research</i> |
| 10.45 am | Presentation of Awards, Prizes and Certificates
Institute of Chemistry Ceylon Awards <ul style="list-style-type: none"> ▪ Distinguished Service Awards - Professor S P Deraniyagala ▪ Professor M U S Sultanbawa Award for Research in Chemistry 2016 - Dr. (Ms.) C Padumadasa ▪ Kandiah Memorial Award for Basic Chemistry - Mr. M M Qader ▪ Kandiah Memorial Award for Applied Chemistry - Ms. C L Kehelpannala ▪ Kandiah Memorial Graduateship Award - Ms. K S S P Fernando ▪ All Island Interschool Chemistry Quiz and Chemistry Olympiad prizes ▪ Special Awards – all Island two best performers in Chemistry (A/L 2016) Graduateship Examination in Chemistry <ul style="list-style-type: none"> ▪ Scholarships, Prizes and Awards ▪ J N Oleap Fernando Memorial Scholarships ▪ Felicitation of Students of College of Chemical Sciences in recognition of outstanding achievements |
| 11.10 am | Kandiah Memorial award for Basic Chemistry Lecture
Mohamed Mallique Qader
<i>Chemistry & bioactivity of secondary metabolites produced by endophytic fungi of three Sri Lankan medicinal plants</i> |
| 11.40 am | Vote of Thanks
Dr. Poshitha Premaratne
<i>President Elect, Institute of Chemistry Ceylon</i> |
| 11.45 am | Close of Ceremony |
| 12.30 pm | Annual General Meeting – 2017 at Adamantane House (<i>for Corporate Members only</i>) |



Chief Guest **Mr S K Cyril Suduwella**

Mr. S K Cyril Suduwella had his primary and secondary education at Deniyaya Central College and Ananda Sastralaya, Kotte. He entered the University of Peradeniya in 1974 and obtained his B.Sc. (special) degree in Chemistry with Physics as the subsidiary subject in 1978. He has also completed M.Sc. in Analytical Chemistry at the University of Colombo. Subsequently he has completed a Postgraduate Diploma in Petroleum Chemistry at the University of Urbino, Italy on a fellowship received from the Italian government. He had obtained a special training in Atomic Absorption Spectrophotometry at VARIAN Training Institute, Zug, Switzerland, Human Resource Management at AIT, Bangkok, Thailand and Corporate Management at University of Antwerpen, Belgium.

Immediately after graduation in 1978, he joined the University of Kelaniya as an Assistant Lecturer in Chemistry. Thereafter he joined the Research Division of NARA and in 1980 to the Ceylon Petroleum Corporation (CPC), refinery division as a Petro-chemist. Subsequently he had been promoted to the post of Chief Chemist / Head of Laboratory and thereafter Manager Technical Services Laboratory. In 2010, He retired from CPC service as a General Manager after serving various high positions in the capacities of DGM (Admin), Corporate affairs and Business Development. He had been conferred with Gold Medals for his unblemished service at the CPC.

In addition to his service to the CPC in the field of Petroleum Chemistry, he had served Nigerian National Petroleum Corporation and Petromin Yanbu Refinery at Royal Commission, Yanbu, Saudi Arabia as a Quality Control Specialist. For a short period, he had served in Stanic Refinery of Livorno, Italy as a part of his training programme in Italy. In 2010, he was appointed as the CEO of Rus Petroleum International and appointed as the Deputy Team Leader for the Feasibility Study of LNG usage in Sri Lanka. He is a long time visiting Lecturer in Petroleum Chemistry at the College of Chemical Sciences, and the Postgraduate Institute of Science, University of Peradeniya. He too serves as a Consultant to the Open University of Sri Lanka, and the City and Guilds Upstream oil training Institute, Lahore, Pakistan.

Mr. Cyril had been appointed as the founder Chairman of the Waste Management Authority (WP) from 2006 to 2009 and was appointed as the Chairman of the Sugarcane Research Institute of Sri Lanka for two consecutive terms from 2010 to 2015. Mr. Cyril had served the Airport and Aviation Services of Sri Lanka and Srilankan Airlines as the Jet Fuel Advisor.

Mr. Cyril is a Member of the Institute of Chemistry Ceylon since 1980 and a Chartered Chemist, and a Member of the World Energy Council (WEC).

Presently, Mr. Cyril is the Advisor and Coordinator to the Hon. Minister of Science, Technology and Research, and Advisor for the Science Technology and Innovations to the Hon Governor of Northern Province.



Guest of Honour **Dr M M J P Gawarammana**

Dr. M. M. J. P. Gawarammana, obtained his primary education at Welimada Central College, Badulla and completed his secondary education at Dharmaraja College, Kandy. He served as a Science and Mathematics Teacher at Mahinda College, Hali-ela, Badulla.

Being a Registered Medical Practitioner, he served as a Registered Medical Officer at the Base Hospital, Nuwara Eliya and the Medical Officer in-charge of the Primary Medical Care Unit in Kandapola and Nanu Oya Hospitals.

Dr. Gawarammana served as a Consultant to the Hon. Minister of Public Management and Reforms. He also served as a Provincial Nutritional Coordinator, Provincial Council of the Central Province.

At present he serves as the Chairman of the Tea Research Board of Sri Lanka, Thalawakelle which is under the purview of the Ministry of Plantations Industries. Tea Research Board consists of scholars of the fields of research, management and economics. Tea Research Institutes in the country are presently governed by the Tea Research Board.

Distinguished Service Award 2017

Professor S P Deraniyagala, *C.Chem., F.I.Chem.C.*



Professor S P Deraniyagala is a Senior Professor in Chemistry at the University of Sri Jayewardenepura. Professor Deraniyagala obtained his BSc special degree in Chemistry with Physics as the subsidiary subject and graduated with Second Class Honours (Upper Division) in 1978 from the University of Colombo. He joined the University of Sri Jayewardenepura as a Probationary Assistant Lecturer in 1979. He obtained his PhD from Dalhousie University in 1984. On his return to Sri Lanka he was promoted to the post of Senior Lecturer (Grade II) in 1984, and was appointed as Professor in Chemistry in 2002 and Senior Professor in 2009. He has a distinguished record of academic service to the Department of Chemistry and the Faculty of Science, University of Sri Jayewardenepura. He was the Head of the Department of Chemistry from 2001-2008. He served as the Chairman of the Board of Study in Physical Sciences of the Faculty of Graduate studies, and a member of the Science Faculty Research Committee, Board of Study in Life Sciences, Faculty of Graduate Studies and Ethical Review Committee. He has been the Editor of the Vidyodaya Journal of Science from 2009 to date. He has numerous publications in internationally refereed journals and communications at conferences and meetings to his credit.

Professor Deraniyagala was the Chief Examiner of the Advanced Level Examination from 1986 to 2008, and the Co-controller of Colombo District for several years.

Professor Deraniyagala is an active member of the Institute of Chemistry Ceylon and has made a significant contribution to the academic programme of the Graduateship in Chemistry. He joined the Institute as a visiting lecturer in 1985 and has continued his service as a lecturer, examiner and course coordinator in Inorganic Chemistry. He was the Head of the Faculty, College of Chemical Sciences and full time Visiting Professor in Inorganic Chemistry from 2008 to 2010

and Visiting Senior Professor in Inorganic Chemistry from 2016 to date. Professor Deraniyagala was appointed as the second Honorary Rector of the College of Chemical Sciences in March 2015 after the sudden demise of Professor JNO Fernando and he provided the leadership to the College until October 2016. He has authored several books and monographs. In recognition of his long service to the educational activities at the Institute, Professor Deraniyagala was awarded the Yeoman Service Award in January 2016 by the College of Chemical Sciences.

Professor Deraniyagala has been a Member of the Council, Institute of Chemistry Ceylon for many years and still serves in the Council. He served as the Hon. Joint Secretary of the Institute of Chemistry Ceylon in 1991, Vice President in 2007/2008, President Elect in 2008/2009 and President of the Institute in 2009/2010. As the Rector of the College of Chemical Sciences he chaired the Academic Board and Academic Board Finance Committee meetings. He has contributed substantially to the activities of the Institute and has served in several important committees of both the Institute and the College of Chemical Sciences; Educational Committee/Academic Board, Monograph Committee, Board of Examiners and Inter-school Chemistry Quiz Committee. He was the Vice Chairman, Secretary and Assistant Secretary of the Educational Committee, Chairman of the Monograph Committee, Awards committee and Inter School Chemistry Quiz Committee, and the Business Manager of the Editorial and Publicity Committee.

Professor Deraniyagala is a Life Member of the Sri Lanka Association for the Advancement of Science (SLAAS) and a Member of the Research Board of Advisors, American Biographical Institute. He served as the Hony. Secretary of the Chemical Sciences (Section E2) of the SLAAS.

In recognition of the valuable and dedicated service rendered towards the activities of the Institute of Chemistry Ceylon in an honorary capacity, the Council of the Institute of Chemistry Ceylon unanimously decided to award Professor S P Deraniyagala the "Distinguished Service Award" at the 46th Annual Sessions of the Institute of Chemistry Ceylon in 2017.

Theme Seminar on

Role of Chemists for a Better Tomorrow

Date : 15th June 2017

Venue : Plastic & Rubber Institute, Rajagiriya

Programme

8.30 a.m.	Registration
9.00 a.m.	Welcome address Mr. M R M Haniffa , <i>F.I.Chem.C.</i> <i>President, Institute of Chemistry Ceylon</i>
9.05 a.m.	Mineral Resources for Economic Development: Role of Chemists Guest Lecture by the Chief Guest Professor Oliver Illeperuma , <i>F.I.Chem.C.</i>
9.45 a.m.	Advanced Materials for Economic Prosperity Keynote address by Professor Nilwala Kottegoda <i>Professor, Department of Chemistry, University of Sri Jayewardenepura</i>
10.30 a.m.	Tea
11.00 a.m.	Chemistry in Environmental Protection and Waste Management Professor Nilanthi Bandara , <i>M.Sc. (Hons) (India), M. E. Des. (Canada)</i> <i>Professor, Department of Forestry and Environmental Sciences, University of Sri Jayewardenepura</i>
11.30 am	Forensic Chemistry and its Social impact Mrs. Sakunthala Tennakoon , <i>MSc, F.I.Chem.C.</i> <i>Former Government Analyst</i>
12.00 noon	Panel Discussion
12.30 p.m.	Lunch
1.30 p.m.	Local Pharmaceutical Industry – it's future and potential Dr. Sayuru Samarasundera <i>MD, Chairman, State Pharmaceutical Manufacturing Corporation</i>
2.00 p.m.	Effects of nutrients on body chemistry in the management of chronic kidney disease; a challenge to slow the progression by monitoring the diet Mr. N M S Hettigedara , <i>F.I.Chem.C.</i> <i>Superintendent of Police, Nutritionist & Dietician, Police Hospital</i>
2.30 p.m.	Tea
3. 00 p.m.	Sustainable Carbon Solutions for a Healthy Environment Dr Meththika Vithanage , <i>M.I.Chem.C.</i> <i>Senior Research Fellow, National Institute of Fundamental Studies</i>
3.30 p.m.	Current Trends in Nutrition and Chemistry of Life Dr. Renuka Silva <i>Senior Lecturer, Department of Applied Nutrition University of Wayamba</i>
4.00 p.m.	Panel discussion
4.30 p.m.	Vote of Thanks

Technical Sessions

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

Time : 2.00 p.m. – 4.20 p.m.

Date: 14th June 2017

Time	Title	Authors
	Kandiah Memorial Award for Applied Chemistry	
2.00 -2.40 pm	Study of the biological activities of metabolites produced by <i>Monacrosporium ambrosium</i> , and of <i>M. ambrosium</i> , ectosymbiote of shot hole borer (<i>Xyleborus fornicatus</i>) beetle of tea (<i>Camellia sinensis</i>)	C L Kehelpannala
	Prof. M U S Sultanbawa Award for Research	
2.40-3.00 pm	Determination of antioxidant, antibacterial, anti-inflammatory and anti-tyrosinase activities of peel, pulp and seed kernel of selected mango varieties in Sri Lanka	A Kuganesan, G Thiripuranathar, A N Navaratne, P A Paranagama
3.00 - 3.20 pm	Coumarin derived drug leads for human topoisomerase I and II	A G Guruge, C Udawatte, S Weerasinghe
	Abstracts	
3.20 – 3.35 pm	Xanthone derivatives from natural products found in Sri Lanka as acetylcholinesterase inhibitors; an <i>in-silico</i> approach	U L A S Perera, G A S Premakumara, C N Ratnaweera, C Udawatte
3.35 - 3.50 pm	Binding properties of angiotensin- converting enzyme binding properties with selected Sri Lankan natural products: an <i>in-silico</i> study	S M Abdullah, G A S Premakumara, C Udawatte
3.50 - 4.05 pm	Evaluation of polyethyleneimine functionalized magnetic nanoparticles for gene transfection	H D S Ishara, W R M de Silva, C Chandrasekharan, K M N de Silva
4.05 - 4.20 pm	Development of an antifouling agent using polymer blend nanocomposite	J M A R B Jayasinghe, W R M de Silva, D Perera, K M N de Silva

Technical Sessions Day 2: 16th June (Friday) 2017 (8.30 am onwards)

Time	Title	Authors
	Abstracts	
8.30 - 8.45 am	Cytotoxic potential of different fractions of methanolic extract of <i>Barringtonia asiatica</i> (L.) Kurz. seed kernel	P Ragutharan, S Ekanayake
8.45 - 9.00 am	Preliminary comparative phytochemical, anti-oxidant and thin layer chromatographic study of alcoholic extracts of <i>Cinnamomum zeylanicum</i> and <i>Aporosa cardiosperma</i> Barks	C Wijesinghe, N Pasan, R Watawala, I Kariyawasam, C Padumadasa
9.00 - 9.15 am	Analysis of metal content in Ashwagandha and Thipala Ayurveda drugs in Sri Lanka herbal market	H M H S Bandusena, C Udawatte, S C D Fernando, P K Perera
9.15 - 9.30 am	Radical scavenging activity of Ethyl Acetate extract of <i>Daldinia loculotoides</i> , an endolichenic fungus isolated from the lichen <i>Parmotrema</i> sp. in Sri Lanka	M A T P Manthirirathna, R Kandiah, D S Gunasekara, P A Paranagama
9.30 - 9.45 am	Determination of the content of Cd, Cu, Zn, and Pb in lotus (<i>Nelumbo nucifera</i>) and kohila (<i>Lasia spinosa</i>) & their effect in cooking	D V C D Madushani, E G Somapala
9.45-10.00 am	Mercury levels in hair samples of dentists: A comparative preliminary study	L A Wijesekara, R Usoof, S S T Gamage, N T Gamage, D de Silva, S Ekanayake

Time	Title	Authors
10.00-10.30 am	Refreshments	
	Kandiah Memorial Graduateship Award	
10.30-11.10 am	A Study of the chemistry of <i>Artocarpus heterophyllus</i> Lam. leaves and identification of active antioxidant and hypoglycemic fractions/compounds	K S S P Fernando
	Abstracts	
11.10-11.25 am	Determination of semiochemicals in <i>Gliricidia sepium</i> on the behavior of low country wood termite <i>Glyptotermes dilatatus</i>	C Weththasinghe, G Thiripuranathar, P A Paranagama
11.25-11.40 am	Determination of total phenolic content and antioxidant activity of <i>Borassus flabelifer</i> linn fruit pulp collected from several parts of Sri Lanka	A S N Kurian, G Thiripuranathar, P A Paranagama
11.40-11.55 am	Isolation and molecular identification of endolichenic fungi inhabiting in selected lichens collected from mangrove ecosystem of Puttalam lagoon	H A K Maduranga, R Attanayake, M D Amarasinghe, G Weerakoon, D S Gunasekara, P A Paranagama
12.00-1.00 pm	Lunch	
1.00-1.15 pm	Radical scavenging activity of extracts of endolichenic fungi isolated from Kala oya mangrove plants in Puttalam lagoon	S Sinthujah, R Attanayake, M D Amarasinghe, G Weerakoon, D S Gunasekara, P A Paranagama
1.15-1.30 pm	The effect of the chelating ligand in TISAB solutions on the potentiometric determination of fluoride in aquatic samples with ion-selective electrode	S P Deraniyagala, M I P Jayaweera, P L A T Cooray
1.30-1.45 pm	Synthesis of functionalized graphene oxide as a solid phase catalyst for Ullmann reaction	J Prasanna, D P Dissanyake, D T U Abeytunga
1.45-2.00 pm	Use of self- ligation effect of anthranlic acid in the synthesis of mefanamic acid derivatives	A Perera, D P Dissanyake, D T U Abeytunga
2.00-2.15 pm	Activity of <i>Barringtonia asiatica</i> extracts on MCF-7 breast cancer cells	P Ragutharan, S Ekanayake
2.15-2.30 pm	Molecular modelling of binding of coumarin derivatives to estrogen receptor protein	C T R Silva, C Udawatte, C N Ratnaweera
2.30-2.45 pm	Hypoglycaemic and toxicity effects of a diabetic tea product in normoglycaemic Wistar rats	T P A U Thennakoon, K P S N Pathirana, S Ekanayake
2.45-3.00 pm	Nutrient composition of some boiled <i>Ipomea batata</i> (sweet potatoes) cultivars	G R N N Waidyarathna, S Ekanayake, G A Pchandrasedkara
3.00-3.15 pm	Evaluation of bio-active compounds of <i>Piper longum</i>	P D T C P Peramuna, G Thiripuranathar, P A Paranagama
3.15-3.30 pm	Anti-bacterial, anti- inflammatory and anti-insecticidal activities of two endolichenic fungi isolated from Lichens inhabiting the Hakgala forest	A M R Chamara, M P R Coorey, G Thiripuranathar, P A Paranagama
3.30-3.45 pm	Molecular docking study on binding of derivatives of palmitoyl-CoA and 3-ketodihydrosphingosine to serine palmitoyltransferase	U Prayaga, D P Dissanyake, D T U Abeytunga
3.45 pm	Refreshments	

Kandiah Memorial Awards - 2017

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 - 2017

Chemistry and bioactivity of secondary metabolites produced by endophytic fungi of three Sri Lankan medicinal plants

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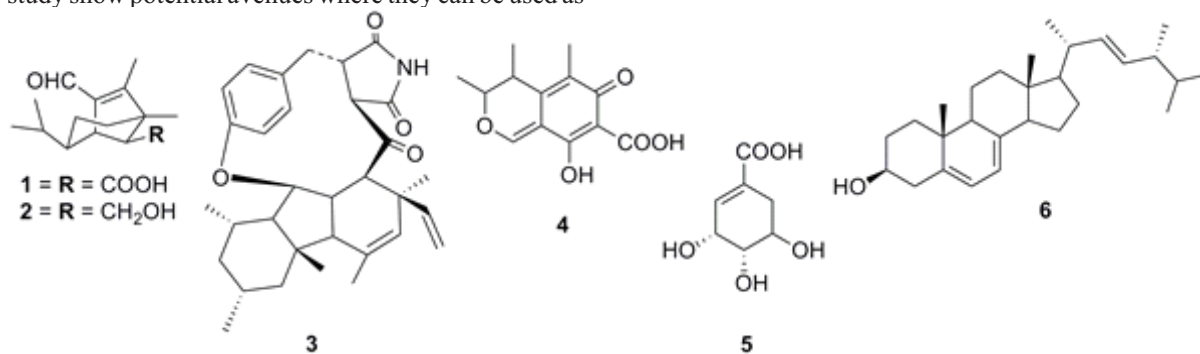
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Endophytic fungi are ubiquitous microorganisms that colonize inside or within the plant tissues without causing any apparent symptoms. Presence of many endophytes in a single plant; complex relationship with their host; production of range of complex bioactive molecules and ability to manipulate culture conditions to optimize the high recovery of bioactive molecules are the benefits of studying endophytic fungi. Lovastatin, vincristin and cephalosporins are some of the medicinally important drugs which are originated from fungi. The present investigation is on bioactive secondary metabolites produced by endophytic fungi: *Bipolaris sorokiniana*, *Penicillium citrinum* and *Fusarium decemcellulare* isolated from popular medicinal plants *Costus speciosus* (Sinhala: Thebu), *Garcinia mangostana* (Mangustin) and *Flacourtia inermis* (Lovi), respectively. Three endophytes were identified by molecular methods. Fermentation of pure cultures were carried out in potato dextrose broth media (PDB) for 28 days. Liquid medium and the mycelium were extracted separately with EtOAc and MeOH. Crude extracts displayed useful activity in the antifungal, antioxidant, brine shrimp lethality and phytotoxicity assays, except for the extracts of *F. decemcellulare*. Chromatographic separation of the bioactive extracts over silica gel, Sephadex LH-20,

PTLC and HPLC furnished helminthosporal acid (**1**), helminthosporol (**2**) from *B. sorokiniana* and GKK1032B (**3**), citrinin (**4**) from *P. citrinum* and shikimic acid (**5**) from *F. decemcellulare*, which were identified by the detailed analysis of NMR and FABMS data and comparison with reported data. Ergosterol (**6**) a common sterolic compound was also isolated from the three fungi. This is the first report of the i) isolation of above endophytic fungi from the respective plants and identification of secondary metabolites (**1-6**); ii) isolation of compound **1** from a natural source and complete assignments of ^1H NMR and ^{13}C NMR data and iii) species level identification of the source of the complex polyketide-peptide hybrid compound **3** from *P. citrinum* and production of citrinin in high yield (2.3 g/ 8 L). Compounds **1** and **2** inhibited (100%) germination of lettuce seeds at 62.5 ppm, both compounds inhibited hypocotyl growth with IC_{50} values of 45.5 and 28.6 ppm, respectively and radical growth at 31.6 and 20.6 ppm, respectively. This showed that **1** and **2** affects the seed germination, hypocotyl and radical growth of lettuce seeds. Further, **1** and **2** showed toxic effects on brine shrimps (LC_{50} : 27.1 and 28.3 ppm). Compound **1** showed strong inhibitory action against *Cladosporium cladosporioides* (MIC: 31.3 ppm). Compound **3** is known as an antitumor, antibiotic

compound and **4** is a mycotoxic, nephrotoxic compound. Both compounds **3** and **4** showed 50% lethality concentrations (LC_{50}) at 17.5 and 37.1 ppm, respectively against brine shrimps. Shikimic acid did not show any activity in these bioassays. In conclusion, the bioactive molecules that were discovered from this study show potential avenues where they can be used as

fungicides, weedicides, pesticides in agriculture and in medicine. So far, there are few studies reported on endophytic fungi of Sri Lankan flora. Hence it is useful to explore the chemistry of endophytic fungi associated with Sri Lankan flora for their potential applications in agriculture and medicine.



Abstract of Kandiah Memorial Award for Applied Chemistry - 2017

Study of the biological activities of metabolites produced by *Monacrosporium ambrosium* and of *M. ambrosium*, ectosymbiote of shot hole borer (*Xyleborus fornicatus*) beetle of tea (*Camellia sinensis*)

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The shot hole borer (*Xyleborus fornicatus*) beetle (SHB) is a serious insect pest of tea (*Camellia sinensis* var. *assamica*) plantation. SHB lives symbiotically with the fungus *Monacrosporium ambrosium* (syn. *Fusarium ambrosium*) within galleries made by SHB in tea stems. This study was carried out to investigate the secondary metabolites produced by *M. ambrosium* in laboratory culture media to understand the role of these metabolites in beetle infestation of tea and to evaluate their biological activity.

M. ambrosium was fermented in potato dextrose broth for four weeks and the metabolites produced were isolated and identified. Six naphthoquinones; Anhydrojavanicin, Dihydroanhydrojavanicin, 7-Acetyl-5,8-dihydroxy-6-methyl-1,4-naphthoquinone, Javanicin, Anhydrofusarubin and Solaniol were isolated by chromatographic separation and identified by detailed analysis of NMR and MS data, and by comparison with reported data. The crude extracts of *M. ambrosium* were subjected to bioassays to test for cytotoxicity using the brine shrimp lethality assay, phytotoxicity using lettuce seed germination assay and α -amylase inhibitory activity assay. Antifungal activity of the column fractions of crude extract against *Cladosporium cladosporioides* was

determined by the TLC bioautography method. Agar dilution assay using two endophytic fungi, *Pestalotiopsis camelliae* and *Phoma multirostrata* isolated from pencil thick tea stems of TRI 2023, and bio inhibitory studies between three endophytic fungi, *Bipolaris sorokinana* (from *Costus speciosus*), *Daldinia eschscholizii* (from *Phyllanthus acidus* L.) and *Glomerella magna* (from *Piper betel* L.) against *M. ambrosium* were carried out.

The shoot and root elongation of lettuce seeds were found to be completely inhibited by the ethyl acetate (EtOAc) extracts of culture broth and mycelium at 250 ppm and 1000 ppm, respectively. The root elongation was completely inhibited at 2000 ppm of methanol (MeOH) extract of mycelium and shoot elongation at 4000 ppm. The extracts were found to be positive in the brine shrimp lethality assay with LD_{50} values at 702 ppm, 1395 ppm and 993 ppm for the EtOAc extracts of culture broth, mycelium and MeOH extract of mycelium, respectively. None of the extracts showed high activity in the α -amylase inhibitory activity assay. TLC bioautography showed that the crude EtOAc extract of *M. ambrosium* possessed a number of compounds with antifungal activity against *C. cladosporioides*. EtOAc extract (in 10% DMSO in

water) was found to inhibit the growth of two endophytic fungi *P. camelliae* (100% at 1000 ppm) and *P. multirostrata* (38.1 % at 1000 ppm) in potato dextrose agar (PDA). *M. ambrosium* did not inhibit the growth in PDA, of three endophytic fungi that were isolated from the three medicinal plants. TRI 2025 tea stems having red colored galleries were extracted with chloroform. TLC studies of the CHCl_3 extract indicated the presence of UV active compounds similar to the

naphthoquinones isolated.

The results of the study suggest that *M. ambrosium* produces antifungal naphthoquinones which are able to inhibit the growth of the two endophytic fungi living within tea stems. *M. ambrosium*, is therefore not only the food and sterol source of the beetle, but is also a producer of fungal inhibitory substances which may help to keep SHB galleries free of other fungi.

Abstract of Kandiah Memorial Graduateship Award - 2017

A study of the chemistry of *Artocarpus heterophyllus* Lam. leaves and identification of active antioxidant and hypoglycemic fractions/ compounds

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The aqueous extract of the senescent leaves of *Artocarpus heterophyllus* is traditionally used in Sri Lanka as a hypoglycemic agent. It has been previously reported that the hypoglycemic activity lies in the ethyl acetate fraction of the water extract (EA/W). The main purpose of this study was to identify hypoglycemic fractions/compounds from the EA/W fraction. The study also encompassed antioxidant, antiglycation, α -glucosidase inhibition and anti-inflammatory assays. The EA/W fraction was fractionated by chromatography on sephadex LH-20. Five fractions eluting with the following solvent systems were obtained. Fraction 1, dichloromethane/hexane (4:1), Fraction 2, dichloromethane/acetone (3:2), Fraction 3, dichloromethane/acetone (1:4), Fraction 4, dichloromethane/ methanol (1:1) and Fraction 5, methanol. These fractions along with EA/W were screened for *in vivo* hypoglycemic and antidiabetic activities and as well as *in vitro* antioxidant, antiglycation, α -glucosidase inhibitory and anti-inflammatory assays.

Each fraction was tested for its effect on the blood glucose levels of fasted normal and diabetic rats. None of the fractions caused hypoglycemia on normal rats. However, there was significant ($p < 0.001$) reduction in the blood glucose level during the first three hours after giving the fractions 3, 4 and 5 to diabetic rats. Of the three fractions fraction 4 showed the highest hypoglycemic activity. Fractions 3, 4 and 5 were also the most active in the glucose tolerance test carried out on both normoglycemic and diabetic rats. However, fraction 3 showed the highest activity in this assay. In both assays fractions 3, 4 and 5 at 50 mg/kg body

weight showed activity of the same order as glibenclamide at 5 mg/ kg body weight. Fraction 4 was found to be the most active fraction in all the *in vitro* assays. In the DPPH radical quenching antioxidant assay fraction 4 showed an IC_{50} value of 21.69 ± 0.31 $\mu\text{g/mL}$ while gallic acid showed an IC_{50} value of 23.46 ± 0.43 $\mu\text{g/mL}$. In the superoxide anion radical scavenging assay it showed 98% percentage inhibition at 0.5 mg/ kg dose while quercetin showed 100% percentage inhibition. Fraction 4 exhibited strong α - glucosidase inhibition activity with an IC_{50} value of 0.40 ± 0.01 $\mu\text{g/mL}$ compared to acarbose which exhibited an IC_{50} value of 0.54 ± 0.01 $\mu\text{g/mL}$. In the antiglycation assay fraction 4 showed an IC_{50} value 0.44 ± 0.01 mg/mL while rutin showed an IC_{50} value of 0.18 ± 0.02 mg/mL. In the anti-inflammatory assay fraction 4 showed an IC_{50} value of 16.9 ± 0.1 $\mu\text{g/mL}$ compared with ibuprofen which showed an IC_{50} value of 11.8 ± 1.9 $\mu\text{g/mL}$. As thin layer chromatography analysis of fractions 3 and 4 indicated that they had several compounds in common, they were combined and subjected to compound isolation. Compounds 1-4 (Figure 1) were isolated using a combination of chromatographic techniques and their structures were elucidated using ^1H NMR, ^{13}C NMR, HSQC, HMBC, COSY, NOESY, IR and UV-visible spectroscopy, EI, FAB and HR-FAB mass spectrometry. Of the four compounds isolated, compound 3 has been reported previously from the twigs of *A. heterophyllus*. The other compounds are known but have not been reported previously from *A. heterophyllus*. This study indicates that the obtained hypoglycemic effect of the EA/W fraction of aqueous extract of the senescent leaves of

Artocarpus heterophyllus is caused by the total effect of a number of compounds of similar structures and that it may not be possible to isolate a single highly active compound with hypoglycemic activity. Further, the

results of this study may be of potential use for the development of a modern anti diabetic drug from leaves of *A. heterophyllus*.

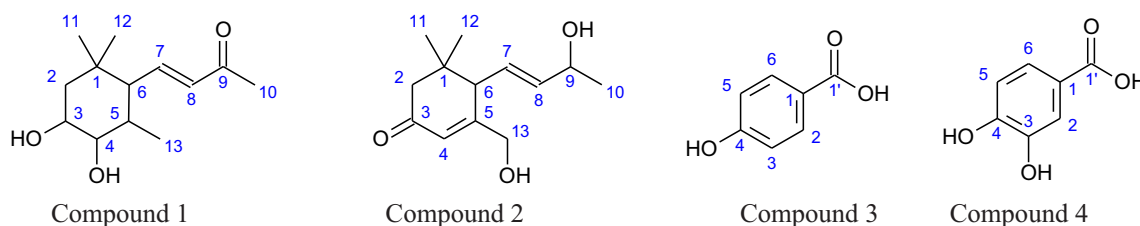


Figure1: Structures of compounds 1-4.

Abstracts of Research Papers to be presented at the 46th Annual Sessions 2017

Technical Sessions : A - 01

Determination of antioxidant, antibacterial, anti-inflammatory and anti-tyrosinase activities of peel, pulp and seed kernel of selected mango varieties in Sri Lanka

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Mango (*Mangifera indica* L.) is an important tropical fruit in Sri Lanka due to its flavor and health promoting activity. Presently in Sri Lanka, mangoes have been cultivated in about 27,500 Ac of the whole land area and total mango production is around 80,000 metric tons per annum. The objectives of this study were to determine the potential of antioxidant activities, antibacterial, anti-tyrosinase and anti-inflammatory activities of peel, flesh and seed kernel extracts separately. In the present study three mango varieties Willard, Karuthacolomban and Vellaicolomban were collected from Jaffna district during April to July, 2015. Ethyl acetate extract of flesh, peel and seed kernel of three mango varieties were studied for *in vitro* antioxidant activities using different assays, which include such DPPH radical scavenging assay, Ferric ion reducing power assay (FRAP) and ABTS radical scavenging assay (ABTS⁺). Anti-tyrosinase activities of samples were evaluated using mushroom tyrosinase enzyme and anti-inflammatory activities of samples were evaluated by human red blood cell (HRBC) membrane stabilization method. Apart from antioxidant, anti-tyrosinase and anti-inflammatory activities, antibacterial assay was tested

against three pathogenic bacteria; *Escherichia coli* [ATCC 25922], *Staphylococcus aureus* [ATCC 25923] and *Bacillus subtilis* [MTCC 121] using agar well diffusion method. Results obtained from the study showed that peel of Willard has the highest total phenolic content (275.61±5.24 mg GAE/g extract) and flesh of Vellaicolomban has the highest total flavonoid content (479.8015.30 mg QE/g extract). The DPPH radical scavenging activity results showed that the ethyl acetate extract of Karuthacolomban seed kernel (IC₅₀-7.73±0.26 µg/mL) has higher radical scavenging activity than that of the standard, ascorbic acid (IC₅₀-10.97±0.22 µg/mL). Peel obtained from Willard and seed kernel obtained from Karuthacolomban showed the highest antioxidant activity in FRAP assay. The ABTS⁺ assay results showed that the seed kernel of Karuthacolomban (IC₅₀-46.22±1.82 µg/mL) has higher radical scavenging activity than that of the standard, ascorbic acid (IC₅₀-156.70±6.86 µg/mL). HRBC membrane stabilization anti-inflammatory results indicated that seed kernel of Karuthacolomban extract has higher anti-inflammatory activity than aspirin. The extract obtained from seed kernel of Vellaicolomban showed the highest anti-tyrosinase activity (IC₅₀-

1448.99±105.88 µg/mL). The antibacterial results showed that seed kernel of Karuthacolomban and Willard showed antibacterial activity against *E. coli*. Seed kernel extracts of Karuthacolomban, Willard and Vellaicolomban showed the antibacterial activity against *S. aureus* and *B. subtilis*. None of the peel and pulp extracts inhibited the growth of *E. coli*, *S. aureus* and *B. subtilis*. The mango extract of peel and seed kernel can be used to develop potential value added ingredients for development of food additives and pharmaceutical products.

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Technical Sessions : A - 02

Coumarin derived drug leads for human topoisomerase I and II

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Due to limitations in existing anti-cancer agents, discovering novel anti-cancer agents with high potency is essential for better chemotherapy processes. Computational techniques and computational tools facilitate the prediction of new drug leads for targets in a cost effective manner. The current study attempts to predict coumarin derived drug leads for therapeutic targets; human DNA topoisomerase I (Htopo I) and human DNA topoisomerase II (Htopo II) using computational techniques; molecular docking and molecular dynamic (MD) simulations. Molecular docking processes were completed for coumarin derivatives (Figure 1) and MD simulations were carried out for top ranked molecules resulted from the docking process. As the references; topotecan and ATP were used for Htopo I and Htopo II, respectively. The same computational techniques were performed for the references. Computational tools; Avogadro, Chimera, DOCK6 and GROMACS were employed for all simulations. Grid scores of coumarin derivatives were compared with that of the reference for each target.

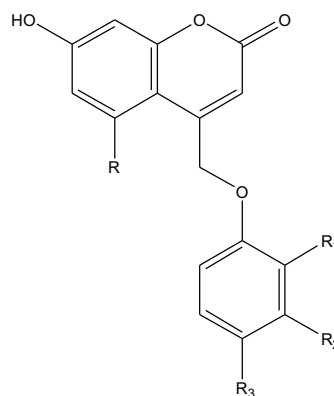


Figure 1: Coumarin skeleton used for the docking process

For the study with Htopo I, R position was changed with H, OH and CH₃ where as R₁, R₂ and R₃ positions were changed with H, F, Cl, Br, NO₂, and OCH₃. For the study with Htopo II, R position was changed with H, OH and CH₃ where as R₁, R₂ and R₃ positions were changed with H, F, Cl, Br, NO₂, OCH₃. For the target Htopo I, three coumarin derivatives; 4-(2,4-diacetamido-phenoxy-methyl)-7-hydroxy-chromen-2-

one (T1L25), 4-(2,4-diacetamido-phenoxy-methyl)-5,7-dihydroxy chromen-2-one (T2L25) and 4-(2,4-diacetamido-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one (T3L25) showed comparable grid score to the reference; topotecan (Table 1). Thus, those 3 ligands could be used as potent inhibitors for Htopo I. For the target Htopo II, four coumarin derivatives; 4-(2,4-dinitro-phenoxy-methyl)-7-hydroxy-chromen-2-one (T1L17), 4-(2,4-dinitro-phenoxy-methyl)-5,7-dihydroxy-chromen-2-one (T2L17), 4-(2,4-dimethoxy-phenoxy-methyl)-5,7-dihydroxy-chromen-2-one (T2L21) and 4-(2,4-dinitro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one (T3L17) showed comparable grid scores to the reference; ATP (Table 2).

Table 1 – Grid scores for coumarins with Htopo I

Ligand	Grid score (kJ/mol)
T1L25	-275
T2L25	-295
T3L25	-290
Topotecan	-302

Table 2 – Grid score for coumarins with Htopo II

Ligand	Grid score (kJ/mol)
T1L17	-211
T2L17	-209
T2L21	-210
T3L17	-210
ATP	-277

In order to investigate the stability of receptor-coumarin complexes in aqueous medium, MD

simulations were performed for Htopo I-TiL25 (when $i=1 \rightarrow R=H$, when $i=2 \rightarrow R=OH$, when $i=3 \rightarrow R=CH_3$, $R_1=R_3=NHCOCH_3$, $R_2=H$) complexes, Htopo II-TiL17 (when $i=1 \rightarrow R=H$, when $i=2 \rightarrow R=OH$, when $i=3 \rightarrow R=CH_3$, $R_1=R_3=NO_2$, $R_2=H$) complexes and Htopo II-T2L21 ($R=OH$, $R_1=R_3=OCH_3$, $R_2=H$) complex. Molecular properties calculated from MD simulations also provide positive evidences in predicting T1L25, T2L25 and T3L25 as potent inhibitors for Htopo I while T2L17, T2L21 and T3L17 as potent inhibitors for Htopo II. Even though the ligand T1L17 shows comparable grid score to ATP, MD studies imply that it may not be a good ATP competitive inhibitor. These findings can lead to the development of novel inhibitors for Htopo I and Htopo II, and may facilitate the use of these compounds in cancer treatment.

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Technical Sessions : A - 03

Xanthone derivatives from natural products found in Sri Lanka as acetylcholinesterase Inhibitors; An *in-silico* approach

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Acetylcholinesterase (AChE) hydrolyses the ester bond of acetylcholine (ACh), and converts ACh to choline and acetic acid. Cholinesterase is inhibited by AChE inhibitors which prevents breakdown of ACh. Therefore AChE inhibitors can be used for treatment of Alzheimer's disease (AD). Xanthenes have a dibenzo- γ -pyrone skeleton.

Natural products from over 100 Sri Lankan plant species were virtually screened, and binding of xanthenes to AChE was investigated.

The 3-dimensional structure of AChE was from protein data bank, PDB ID: 1GQR and PDB ID: 3I6M.

The active site was in close proximity to SER200, GLU327, HIS440 (Catalytic Triad of AChE) and TRP84, PHE330, TYR130, GLN118, PHE288 as peripheral residues. Conformational analysis was carried out with MMFF94, using conjugate gradient method, and geometry optimization of best conformer and calculation of HOMO/LUMO energies were performed using B3LYP/6-31G* with Spartan and GAMESS. Molecular Dynamics were carried out to equilibrate the X-ray structure prior to docking using AMBER 14 with GPU acceleration using Amber Force field 14. Protein was solvated in a cubic box (10-nm

edges) with TIP3P water molecules and minimized for 1500 steps using conjugate gradient method, heated to 300 K and equilibrated for 50 ns and 5 snapshots obtained in last 5 ns to be used in docking to address receptor flexibility. Compounds were virtually screened using AutoDock Vina, docking was carried out for xanthenes using AutoDock Vina with 16 modes and an exhaustiveness value of 24, AutoDock 4 using Lamarckian Genetic Algorithm(LGA), iGEMDOCK with a population size of 800, 80 generations and 10 solutions.

Binding affinities of eight naturally occurring xanthenes with respect to different docking methods (binding energies are in kcal/mol) and their absolute HOMO and LUMO energies by Spartan (in kJ/mol) were calculated (Table 01).

The above xanthenes had comparable binding affinities to the +ve control in all docking methods used. The first 4 compounds had better scores than the drug, Rivastigmine. (Figure 01.) Hydrogen bonds and van der Waals forces are the main features of these interactions with TRP84, TYR121, SER200, PHE330, TYR334 and HIS440 of AChE.

π - π interactions contribute to ligand-AChE stability and selectivity. These are formed between aromatic rings of ligands and the aromatic ring from the TRP84, HIS440 (Edge to Face/4.36°A for slnp_80) and PHE331 of AChE (Figure 02). All compounds make direct contact with TRP84 and HIS440 of AChE.

The results suggest the importance of electronic effects on ligand recognition, as compounds with the highest affinity to AChE have high LUMO energy and low HOMO energy.

These compounds are active site directed for AChE. They bind predominantly with the Trp84 of AChE, and probably decreases enzyme activity 3000-fold. π - π interactions with HIS440 give ligand-AChE complexes high stability. The insights gained from the study have great potential for design of novel drugs for diseases such as AD and Parkinson's disease.

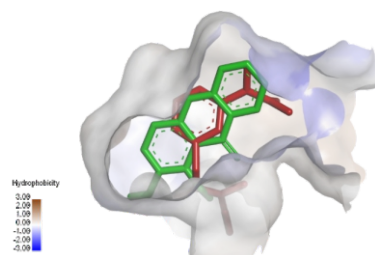


Figure 01: Rivastigmine (Red) and slnp_80 (Green) in the active site gorge represented by a hydrophobic surface

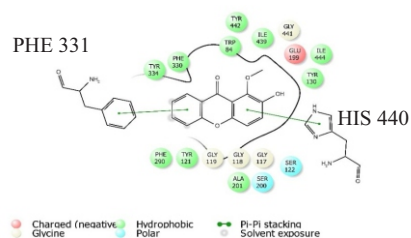


Figure 02: Interactions of slnp_80 with residues of AChE

Table 01: Calculated Binding Affinities and HOMO/LUMO energies of xanthone derivatives

Ligand ID	Common Name	AutoDock Vina		AutoDock 4	GEMDOCK	E LUMO	E HOMO
		Binding Energy	Average Binding Energy for Equilibrated Frames	Binding Energy	Binding Energy		
slnp_080	2-hydroxy-1-methoxyxanthone	-8	-8.05	-6.45	-83.31	-183.85	-541.26
slnp_078	2,8-dihydroxy-1-methoxyxanthone	-8	-8.02	-6.13	-88.29	-191.61	-554.05
slnp_062	1,8-dimethoxy-2-hydroxyxanthone	-7.9	-7.4	-6.39	-90.35	-172.36	-552.59
slnp_054	1,5-dihydroxyxanthone	-7.9	-8	-5	-91.55	-191.4	-580.30
slnp_060	1,7-dihydroxyxanthone	-7.7	-7.9	-6.09	-82.52	-189.98	-562.42
slnp_069	1-hydroxy-7-methoxyxanthone	-7.7	-7.7	-5.93	-82.54	-189.98	-562.42
slnp_053	1,5-dihydroxy-3-methoxyxanthone	-7.6	-7.6	-5.66	-89.20	-171.57	-573.87
slnp_114	3-hydroxy-4-methoxyxanthone	-7.5	-7.5	-6.85	-87.18	-154.49	-566.79
(+)ve control	Rivastigmine	-7.8	-7.4	4.29	-80.16	11.52	-549.76

Binding properties of angiotensin-converting enzyme with selected Sri Lankan natural products: An *in-silico* study

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Angiotensin-converting enzyme (ACE) plays a very important role in cardiovascular function. According to the data publishes by WHO, a total of 32,582 or 25.74% deaths were due to Coronary Heart disease, in Sri Lanka. Thus, ACE is a very important target. Likewise, natural products remain the best and most productive sources of drugs and drug leads. They possess enormous structural and chemical diversity that is unsurpassed by any synthetic library. Various natural products were screened with ACE using AutoDock Vin and the nine best compounds were chosen, then iGEM Dock and Auto Dock4 were carried out. Lisinopril, a commonly used drug, was used as the control in this study. From the results obtained (Table 01) proanthocyanidin had the most relatable result for iGEM Dock, Vina and Auto Dock4 compared to that of lisinopril. Moreover, this was supported with the receptor-ligand interaction figures (Figure 01 and Figure02). Delocalized pi-system in proanthocyanidin showed possible pi-cation interaction with zinc, suggesting this receptor-ligand interaction to be stable. Morelloflavone showed the highest binding energy with ACE compared to lisinopril. Apart from proanthocyanidin, GB 2a also showed possible pi-cation interaction with Zn. The other ligands, though they had shown good binding affinity with ACE, it was seen that they did not have any type of interaction with the Zn cation. By studying the interaction of the active site with the compounds and control, it was clearly seen that both proanthocyanidin and GB 2a showed possible pi-cation interactions with the zinc ion (Figure 01 and Figure 02). The ACE- Lisinopril interaction (Figure 01) could result in a stable receptor-ligand complex enabling the inhibition of ACE.

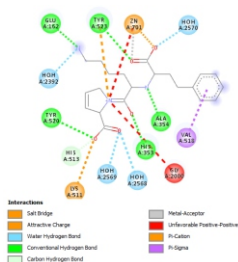


Figure 01: ACE-Lisinopril Interaction

Table 01: List of Ligand number and respective Ligand name

	Name
SLNP_406	Morelloflavone
SLNP_192	Garcinia biflavanoid 2
SLNP_211	GB 2a
SLNP_431	Proanthocyanidins
SLNP_432	Copoliferol A
SLNP_471	Quaesitol
SLNP_389	Mangostin
SLNP_373	Linarin
SLNP_128	4-O-methylcryptochlorophaeic acid
CHCK	Lisinopril

Table 02: Auto Dock Vina, Auto Dock 4 and iGEM

Ligand	Vina Binding Energy (kcal/mol)	iGEM DOCK(Accurate)			Auto Dock 4	
		Energy (kcal/mol)	VDW (kcal/mol)	HBond (kcal/mol)	Binding Energy (kcal/mol)	Unbound Energy (kcal/mol)
SLNP_406	-10	-148.04	-113.53	-34.5	-8.49	-3.85
SLNP_192	-8.2	-134.85	-101.34	-33.51	-7.8	-4.4
SLNP_211	-9.1	-132.31	-106.11	-26.19	-8.29	-4.71
SLNP_431	-8.5	-128.75	-98.94	-29.81	-6.19	-5.92
SLNP_432	-7.2	-126.9	-118.14	-8.76	-5.12	-2.2
SLNP_471	-8.7	-126.87	-105.16	-21.71	-8.32	-4.27
SLNP_389	-8.1	-126.11	-92.22	-33.89	-6.64	-2.28
SLNP_373	-9.5	-125.57	-93.96	-31.6	-7.71	-4.32
SLNP_128	-7.9	-125.14	-106.63	-15.1	-4.66	-3.62
CHCK	-8	-129.11	-85.2	-40.48	-5.67	-2.04

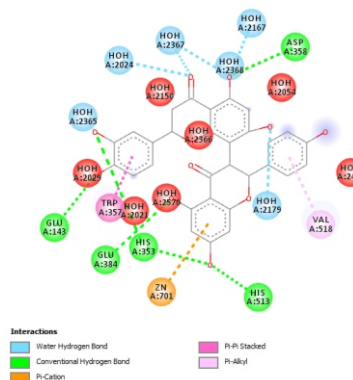


Figure 02: ACE-proanthocyanidin Interaction

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Technical Sessions : A - 05

Evaluation of polyethyleneimine functionalized magnetic nanoparticles for gene transfection

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Modern advances in nanotechnology and biotechnology have brought gene therapy to an interesting area of medical research due to their usability in gene therapy development. Polyethyleneimine (PEI) is a cationic polymer, which is commonly used as a non-viral vector for gene delivery. The magnetic nanoparticles coated with PEI act as effective agent for gene delivery. The PEI polymer is known to be toxic when applied at higher doses and its toxicity is mainly associated with the high positive charge of this polycation. This positive charge leads to strong interaction of PEI with cell surfaces and their damage. Therefore, modifications of polymeric backbone to reduce the positive charge of PEI might be useful in order to reduce the toxicity of the polymer. For this purpose, negative charges can be introduced into the polymer backbone by modification with succinic anhydride. In the present study, attempt has been made to reduce the cytotoxicity of PEI by synthesizing succinylated PEI (S.PEI) with succinic anhydride using already established method. The superparamagnetic iron oxide nanoparticles were synthesized and functionalized using both cationic polymer PEI and S.PEI. Synthesized PEI and S.PEI functionalized iron oxide nanoparticles (PEI-IONPs and S.PEI-IONPs) were characterized using Fourier transform infrared

spectroscopy (FT-IR), X-ray diffraction spectroscopy (XRD), and Scanning electron microscopy (SEM). The synthesis and functionalizing of iron oxide nanoparticles were tested with FT-IR and XRD and confirmed using previously reported data. According to the SEM image, the size of the iron oxide particle was obtained as 26 nm.

DNA binding capacity with PEI-IONPs and S.PEI-IONPs were assessed with pcDNA 3.1 vector which contains green fluorescent protein encoding sequence in it. Our results show that DNA binding capacity (amount of DNA that bind to 1 µg of nanoparticles) of PEI-IONP is around 0.148 µg DNA µg⁻¹ and S.PEI IONP is around 0.103 µg DNA µg⁻¹. The trypan blue cell viability assay was carried out using blood cells to both samples PEI-IONs and S.PEI-IONPs in order to test the cytotoxicity of PEI-IONPs and S.PEI-IONPs. The results obtained show that the S.PEI-IONP treated samples have higher cell viability than PEI-IONP treated samples. It can therefore be concluded that S.PEI-IONP is better for transfection than PEI- IONPs due to its low cytotoxicity. The transfection efficiency of both samples was tested by transfecting Hep G2 cells with green fluorescent protein carrying pc DNA 3.1 with PEI-IONPs and S.PEI-IONPs. According to the results only PEI-

IONPs showed the expected transfection and S.PEI-IONPs did not show any visible transfection. So, from that it was concluded that PEI-IONPs have higher transfection efficiency than the S.PEI-IONPs.

In conclusion, the present study established that the S.PEI-IONPs have low cytotoxicity and low DNA binding ability than PEI-IONPs and also low transfection efficiency than PEI-IONPs.

Technical Sessions : A - 06

Development of an antifouling agent using polymer blend nanocomposite

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Marine biofouling is an undesirable process, which takes place on marine submerged structures such as ship hulls, marine devices and fishing nets. Due to the unwanted biofouling, iron ships and other metal devices are getting highly corroded and consume higher fuel amount to overcome the dragging resistance. Therefore, the development of an antifouling agent is crucial to overcome these problems. Better antifouling effect has been observed with mixture of compounds such as polymer bend or nanocomposite rather than using single component such as polymer or nanoparticles. Therefore, in this study, the combination of polyaniline nanopolymer, ZnO nanoparticles, TiO₂ nanoparticles and TiO₂/polyaniline nanocomposite were used as antifouling agents and blended with marine epoxy to produce a paint with better antifouling properties. ZnO rod shaped nanoparticles were obtained by modifying previously reported method. The shape and size of the nanoparticles were confirmed using scanning electron microscope (SEM) and Powder X-ray diffraction analysis (PXRD). The average diameter of the synthesized ZnO nanorods were 40 nm. The semi crystallized polyaniline nanopolymer was obtained by modifying previously reported method. The synthesized polyaniline polymer was characterized using SEM, PXRD and FTIR spectrometry. The nature of the polymer was found to be semi crystalline and the average diameter was less than 100 nm according to the SEM analysis. Previously synthesized TiO₂ nanoparticles (100 nm) were obtained as a component of the paint matrix and it was used to prepare TiO₂/polyaniline nanocomposite.

The TiO₂/polyaniline nanocomposite was

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synthesized using *in situ* polymerization of polyaniline on the surface of TiO₂ nanoparticles. The synthesized composite was characterized using PXRD and SEM techniques.

Different combinations of each material were blended with epoxy resin and applied on separate metal plates to investigate the activity of each ratio keeping the neat epoxy resin as a control. Control and other metal plates were dipped in the harbor and same environmental conditions were provided. Observations of control and other metal plates were taken separately once a week. According to the results obtained for the past three months of the period, the combination of 2% PANI, 0.1% ZnO nanorods and 0.1% TiO₂ nanoparticles were revealed better biofouling resistance compared to control.

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Cytotoxic potential of different fractions of methanolic extract of *Barringtonia asiatica* (L.) Kurz. seed kernel

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Currently, there is an increasing awareness globally of the potential of unexploited natural products. Identification of active compounds with cytotoxic potential is important in the development of new anticancer drugs. The crushed *Barringtonia asiatica* (Mudilla) plant seed kernel was used as fish poison by Sri Lankans and preliminary investigations have proven the cytotoxic potential. This study aims to investigate different techniques for better fractionation of the crude methanolic extract of *B. asiatica* seed kernel and study the toxicity of different fractions, thus obtained and identify the class of compounds in fractions with toxicity as shown by brine shrimp assay (BSA).

The seed kernel was freeze dried and powdered (0.15 mm). The crude methanolic extract (15 g powder/40 mL MeOH; room temp., 24 hrs; dried at 45 °C) was separated by medium pressure liquid chromatography (MPLC). A solvent gradient was used to obtain different fractions (hexane, petroleum ether, ethyl acetate, ethanol and methanol). The cold methanolic extract was also separated using column chromatography (silica gel, 0.13-0.25 mm) with a gradient of solvents comprising of dichloromethane and methanol. The seed kernel powder was sequentially extracted in a Soxhlet (50 g/ 300 mL of solvent; petroleum ether, dichloromethane, ethyl acetate and methanol). Toxicity of all fractions were obtained by different extraction and separation methods were determined by BSA. Phytochemical screening was carried out with standard assays. BSA was conducted with a) methanolic crude extracts (50 ppm, 100 ppm), b) two MPLC fractions by pooling individual fractions (both fractions 50 ppm, 100 ppm), c) two fractions from silica gel column (both fractions 50 ppm, 100 ppm) and d) four fractions obtained from the Soxhlet extraction. All TLC separations were carried out with chloroform: acetic acid: methanol: water (64:32:12:08) solvent system.

The crude cold methanolic extract produced two distinct spots on TLC with R_f values of 0.43 and 0.25. Phytochemical screening of the MPLC fractions indicated steroids in the 1st pooled fraction with no spot

being visible on TLC, 2nd pooled fraction had saponins, flavonoids, phenolic compounds, terpenoids and triterpenoids and showed two spots (R_f values 0.43 and 0.25), and the 3rd pooled fraction (R_f value 0.43) had saponins, terpenoids and triterpenoids. Out of the silica gel column, 1st fraction contained saponin (R_f value of 0.43) and 2nd fraction had saponin, phenols and triterpenoids and yielded two spots (R_f values 0.43 and 0.25). The methanol extract of the Soxhlet had saponin, phenols and triterpenoids and showed two spots (R_f values 0.43 and 0.25). Other extracts (petroleum ether and ethyl acetate) contained terpenoids, and dichloromethane extract had steroids and terpenoids despite not indicating any spots with TLC when visualized with *p*-anisaldehyde.

The crude cold methanolic extract (30 ppm) showed a LD_{50} value within 24 hours on BSA. Only the 2nd and 3rd MPLC fractions at 50 ppm and 100 ppm showed cytotoxic potential. 1st and 2nd fractions of the silica gel column (50 ppm, 100 ppm) and methanolic Soxhlet extracts (100 ppm, 150 ppm) showed positive results with BSA. The other Soxhlet extracts were not positive for BSA. Fractions 2 and 3 of MPLC, and fraction 2 of silica gel column and methanolic Soxhlet extract showed high cytotoxic activity. The difference in the cytotoxicity of cold methanolic extract (30 ppm) and the hot methanolic extract (≥ 100 ppm) could be due to the heat degradation of the active components during Soxhlet extraction.

Cold methanolic extract, 2nd fraction of MPLC, hot methanolic extract and 2nd fraction of silica column indicated two spots with the same R_f values (0.43 and 0.25). MPLC 3rd fraction and 1st fraction of silica gel column indicated only one spot on TLC (R_f value 0.43).

The cold methanolic extract (30 ppm) showed a LD_{50} value within 24 hours on BSA. The MPLC resulted in better separation of active fraction. Heating may be detrimental to the active cytotoxic ingredient. Fractions that indicated toxicity contained saponins and triterpenoids.

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Technical Sessions : A - 08

Preliminary comparative phytochemical, anti-oxidant and thin layer chromatographic study of alcoholic extracts of *Cinnamomum zeylanicum* and *Aporosa cardiosperma* barks

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Cinnamon, commonly known as 'Kurudu' in Sri Lanka has been used as a spice since antiquity. It is obtained from the inner bark of several species of the genus *Cinnamomum* that belongs to the family Lauraceae. *Cinnamomum zeylanicum* (*Cinnamomum verum*) also known as true cinnamon is a small evergreen tree, native to Sri Lanka. This is used intensively in traditional medicine and has been reported to possess diverse pharmacological properties. Cinnamon produced in Sri Lanka has acquired a long- standing reputation in the international market. Today, there are many value-added products of cinnamon in the local and international market. Due to high price of true cinnamon, adulterants are used along with true cinnamon in the cinnamon industry. *Aporosa cardiosperma*, commonly known as Kambokka/ Gulthora is one such adulterant.

Phytochemical screening of 80% aqueous ethanolic extract of *C. zeylanicum* bark revealed the presence of alkaloids, flavonoids, proanthocyanidins, tannins and poly phenols, saponins, triterpenes and unsaturated sterols. Quaternary amine/amine oxides, anthraquinones and cyanogenic glycosides were absent in accordance with previously published reports. The same study done for the *A. cardiosperma* bark extract revealed the presence of alkaloids, flavonoids, proanthocyanidins, saponins, triterpenes and

unsaturated sterols and quaternary amine /amine oxides. Tannins, anthraquinones and cyanogenic glycosides were absent. DPPH radical scavenging activity expressed as IC₅₀ (mg/mL) for *C. zeylanicum*, *A. cardiosperma* bark extracts and ascorbic acid were 0.115±0.012, 0.094±0.016 and 0.150±0.008 respectively. The IC₅₀ values for bark extracts are clearly lower than that of ascorbic acid, which is an established standard used in anti-oxidant studies. Thus, bark samples especially that of *A. cardiosperma* appear to possess better antioxidant potential than the standard ascorbic acid. Thin layer chromatographic studies revealed that chemical profiles of freeze dried extracts of *C. zeylanicum* and *A. cardiosperma* barks are different. The results are given in Figure 1.

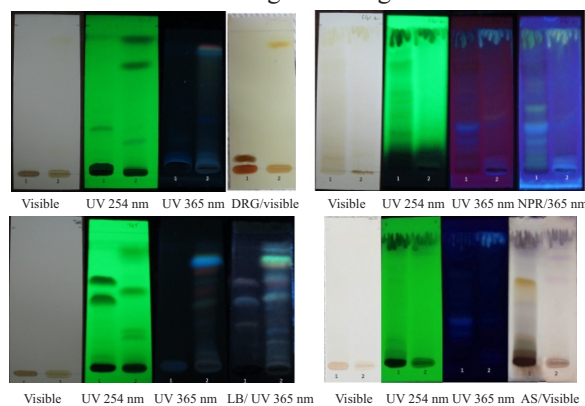


Figure 1: Thin layer chromatographic profiles for

alkaloids, flavonoids, saponins and terpenoids (arranged clockwise) of *Cinnamomum zeylanicum* and *Aporosa cardiosperma* bark extracts. (DRG - Dragendorff reagent, NPR - Natural Product Reagent, AS - anisaldehyde sulphuric reagent, LB - Lieberman Burchard reagent). In each TLC left spot - *Aporosa cardiosperma*, right spot - *Cinnamomum zeylanicum*.

Major classes of phytochemicals: alkaloids, flavonoids, proanthocyanidins, saponins, triterpenes and unsaturated sterols were present in both *C. zeylanicum* and *A. cardiosperma* bark extracts. However, thin layer chromatographic studies give preliminary evidence for the difference in their chemical profiles. Further studies are underway to identify chemical markers to develop thin layer chromatography as a simple and low cost technique to distinguish the bark of *C. zeylanicum* that from *A. cardiosperma*. Further, this technique could be extended to value added products of cinnamon in the Sri Lankan market. Comparative TLC studies carried out for value added products of cinnamon with that of barks of *C. zeylanicum* and *A. cardiosperma* may be of potential use to determine whether value added products of cinnamon have been adulterated by *A. cardiosperma*.

Technical Sessions : A - 09

Analysis of metal content in Ashwagandha and Thipala Ayurveda drugs in Sri Lankan herbal market

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The objective of this study was to analyze Ayurvedic powdered drugs, Ashwagandha Churna (AC) and Thipala Churna (TC) of three different brands available in Sri Lankan herbal market for the presence of metals. Each sample was analyzed as triplicates. A total of thirty six samples was purchased from an Ayurvedic pharmacy in Colombo area. Samples were prepared by wet digestion method using hydrogen peroxide and nitric acid treatment. Presence of metals was analyzed by Flame Atomic Absorption Spectroscopy using a HITACHI ZA3000 Polarized Zeeman Atomic Absorption Spectrometer. Results were compared with the extraneous maximum residue limit recommended by the Food and Agriculture Organization (FAO) /World Health Organization (WHO) for herbal medicines.

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Table 1: Metal levels of several selected heavy metals in Ashwagandha Churna.

Brand	Cd (mg/kg)	Pb (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Zn (mg/kg)
Brand A						
1	BDL	BDL	8.75±1.76	11.75±0.70	9.38±0.53	15.00±1.59
2	BDL	BDL	12.25±1.76	11.63±0.17	9.63±0.53	14.75±0.35
3	BDL	BDL	11.88±0.17	9.88±0.88	9.88±0.17	13.88±2.47
Brand B						
1	BDL	BDL	10.50±0.35	10.75±1.41	10.75±0.00	30.25±0.70
2	BDL	BDL	5.87±2.12	11.13±0.17	9.25±0.17	27.63±0.53
3	BDL	BDL	9.00±2.12	11.38±0.53	9.50±0.35	23.25±0.35
Brand C						
1	0.05±0.00	BDL	BDL	10.50±0.00	1.50±0.35	11.00±0.70
2	0.06±0.00	BDL	BDL	10.13±0.17	1.63±0.17	12.63±0.53
3	0.07±0.00	BDL	BDL	10.13±0.17	1.50±0.35	11.88±0.18

Values are expressed as mean± SD, n=3, SD= Standard deviation n= no of readings taken per sample

Table 2: Metal levels of several selected heavy metals in Thripala Churna

Brand	Cd (mg/kg)	Pb (mg/kg)	Cr (mg/kg)	Cu (mg/kg)	Ni (mg/kg)	Zn (mg/kg)
Brand A						
1	0.11±0.02	BDL	BDL	10.63±0.17	1.88±0.18	4.63±0.18
2	0.12±0.00	BDL	BDL	10.75±0.00	2.13±0.18	2.88±0.88
3	0.15±0.02	BDL	BDL	10.75±0.00	2.38±0.18	5.50±0.70
Brand B						
1	0.11±0.01	BDL	BDL	10.63±0.17	10.75±0.00	23.37±0.18
2	0.06±0.01	BDL	BDL	10.88±0.17	9.25±0.35	14.75±2.82
3	0.08±0.00	BDL	BDL	11.50±0.35	9.50±0.35	23.13±0.88
Brand C						
1	0.14±0.01	BDL	BDL	12.00±0.35	2.50±0.35	15.88±3.00
2	0.16±0.00	BDL	BDL	11.75±0.00	2.63±0.18	10.00±0.70
3	0.20±0.04	BDL	BDL	12.00±0.35	2.63±0.88	10.00±0.70

Values are expressed as mean± SD, n=3, SD= Standard deviation n=no of readings taken per sample

BDL= Below Detection Limit

According to FAO/WHO, the extraneous maximum residue limits of heavy metals in herbal plants have been fixed for cadmium (0.3 mg/kg) and lead (10mg/kg). Lead was not detected in both Ashwagandha Churna and Thripala Churna. This may be due to the tendency of losing lead in high

temperature in the open beaker. Cadmium was not detected in brand A and B of Ashwagandha Churna. However cadmium level in other samples were below the extraneous maximum residue limit. The extraneous maximum residue limits of the FAO/WHO have not been established yet for copper, nickel, chromium and zinc in herbal medicine. The results reveal that among the trace elements zinc (30.25 mg/kg) was found in the highest amount, but this was below the acceptable daily intake limit (60 mg/kg) set by FAO/WHO. Chromium was not detected in brand C of Ashwagandha Churna and Thripala Churna samples. The quality of herbal churna products analyzed did not contain unacceptable levels of heavy metals. However, there is a need for continuous monitoring of herbal products intended for human consumption.

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Technical Sessions : A - 10

Radical scavenging activity of ethyl acetate extract of *Daldinia loculotoides*, an endolichenic fungus isolated from the lichen *Parmotrema* sp. in Sri Lanka

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Modern remedies acknowledge bioactive natural compounds as leads for novel drugs. Endolichenic Fungi (EF) is a potential source of bioactive secondary metabolites with anti-oxidant, anti-inflammatory, antimicrobial and anti-cancer activities. Still, EF remains almost untapped as a source of bioactive compounds that may provide templates for new drug candidates. The objective of this study is to isolate compounds with radical scavenging activity from the EF *D. loculotoides* isolated from the lichen *Parmotrema* sp. in Sri Lanka. EF *D. loculotoides* was grown on 47 large plates of Potato Dextrose Agar (PDA). After an incubation period of 9- 10 days at room temperature, they were cut in to small pieces together with the medium. Secondary metabolites were

extracted in to Ethyl Acetate (5 L). DPPH assay was carried out according to the method described by Chatatikun and Chiabchalard (2013) with slight modifications to determine the radical scavenging activity of the crude extract. A concentration series of 12.5- 200 µg/ mL was tested in comparison with the standard antioxidant butylated hydroxy toluene (IC₅₀= 38.6± 7.8 µg/ mL), as the positive control. Methanol was the negative control. The crude extract with radical scavenging activity (IC₅₀= 198.3± 16.6 µg/ mL) was partitioned with hexane, chloroform and 60% aqueous methanol and antioxidant activities of the three fractions were determined. Chloroform fraction with high radical scavenging activity (IC₅₀= 144.5± 7.6 µg/ mL) was further purified using silica gel column

chromatography and preparative TLC to isolate seven pure compounds. Characterization of the isolated pure compounds is still in progress using ^1H -, ^{13}C -, 2D-NMR and MS data.

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Technical Sessions : A - 11

Determination of the content of cadmium, copper, zinc and lead in lotus (*Nelumbo nucifera*) and kohila (*Lasia spinosa*) and their effect in cooking

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Intake of heavy metal contaminated vegetables poses a major risk to human health. Thus, the concentration of cadmium (Cd), copper (Cu), lead (Pb) and zinc (Zn) of two different aquatic vegetables; kohila (*Lasia spinosa*), and lotus (*Nelumbo nucifera*) collected from different areas which belong to dry zone, intermediate zone and wet zone of Sri Lanka, was analyzed using flame atomic absorption spectrometry (Hitachi ZA 3000 Polarized Zeeman). Further, the leached out concentration of those heavy metals during cooking of the vegetables was also studied and compared with the values obtained for raw samples. The average contents of heavy metals detected in Kohila ranged from 0.08 - 1.20, 15.56 - 58.33, 14.44 - 410.00 mg kg⁻¹ for Cd, Cu and Zn, respectively. For Lotus the average contents of heavy metals ranged from 0.06 - 0.10, 27.50 - 63.33, 7.22 - 46.11 mg kg⁻¹ for Cd, Cu and Zn, respectively. The mean concentrations of heavy metals which leached out to the cooked medium during cooking were negligible when compared with the heavy metal concentrations of raw samples of Kohila and Lotus. Therefore cooking has no significant effect on reducing the heavy metal contents of above vegetables. In addition, the mean concentrations of metals in Kohila and Lotus were found in the order of their abundance as Zn>Cu>Cd and Cu>Zn>Cd, respectively. Pb was not detected. It was also found that the Cd and Zn levels of kohila exceeded the maximum permissible limits set by World Health Organization for human consumption and mean concentrations of Cd, Cu and Zn of lotus were below

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the maximum permissible limits. Thus the study highlights that long term consumption of kohila may possibly cause various health hazards in human. The consumption of Lotus however may not have significant effect on human health.

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Mercury levels in hair samples of dentists: A comparative preliminary study

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The USA Environmental Protection Agency (EPA) has defined mercury as hazardous due to its toxicity at low concentrations and biomagnification. Elemental mercury is widely used in dentistry as dental amalgam. Amalgam typically contains approximately 50% metallic mercury, 35% silver, 9% tin, 6% copper, and a trace of zinc and is suggested as an alternative potential source of the mercury in hair. The dentists that preserve teeth by undertaking more restorative work are exposed to mercury continuously. Hair samples are considered as more preferable biomarkers to determine the index of exposure to toxic metals, because of the higher level of metal concentration in hair than in blood or urine. This study is an attempt to ascertain the level of mercury in a selected sample of dentists and controls as no published data is available on the level of mercury in dentists.

Hair samples (0.5 g) from dentists working in Dental Institutes in and around Colombo District (n = 50) and controls (n = 50) who are not involved in dentistry were collected. The samples were digested with sulfuric acid-potassium permanganate solution and reduced to metallic mercury with stannous chloride. Thus digested samples were analysed for mercury using Atomic Absorption Spectroscopy. In addition, correlation between the parameters assumed to be affecting the concentration of mercury and the respective mercury concentrations were carried out. Data were expressed as mean $\pm$ SD and significances were calculated using SPSS package.

The average mercury contents of the test samples (n = 50) were 5.36 ± 2.64 ppb compared to the control samples (n = 50) where the value was 3.10 ± 1.99 ppb. The mercury content in hair of 64% of dental workers was more than 5 ppb whereas in the controls only 10% had mercury above 5 ppb. A significant difference in mercury content in the hair samples of test and control samples were observed ($p < 0.05$). Correlation between gender, number of years of service in dental work,

number of amalgam restorations carried out within a week, wearing protective clothing during handling of mercury and the respective concentrations of mercury were analysed. The average mercury contents of the female workers (n = 26) and male workers (n = 24) were 5.50 ± 2.76 ppb and 5.02 ± 2.74 ppb, respectively without a significant difference. For the analysis of number of years of service in dental work, dental workers were categorized into three groups as; ≤ 20 years (n = 18), ≤ 30 years (n = 23) and ≤ 40 years (n = 9) where the mean values obtained were 5.18 ± 2.61 ppb, 5.49 ± 2.93 ppb and 5.46 ± 3.37 ppb, respectively. However, no significant correlation between the number of years of service and the mercury concentration was apparent. Further, from the recorded data (n = 30), the correlation between the number of amalgam restorations done by the dental workers per week by categorizing them as ≤ 20 (n = 11), ≤ 30 (n = 8) and ≤ 40 (n = 11) and mercury concentration resulted 5.29 ± 3.01 ppb, 5.79 ± 3.07 ppb and 4.49 ± 2.82 ppb, respectively with no significant correlation. Similarly there was no significant difference in the mercury value with wearing protective clothing and eye wear ($p < 0.05$). It is estimated that the ratio of mercury in hair to blood in humans is 250:1. Thus the average contents of mercury in blood of dentists and in controls could be 0.02 ppb and 0.01 ppb, respectively. Thus the values of both groups were well below 10 ng/mL (10 ppb), within the concentrations considered as normal. According to the data set under consideration, a correlation was not found with the concentration of mercury and the examined parameters.

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Determination of semiochemicals in *Gliricidia sepium* on the behavior of low country wood termite *Glyptotermes dilatatus*

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Gliricidia sepium grows as a multipurpose tree in many countries, especially in tea and coconut plantation in Sri Lanka. The tree is used as a poison for rodents as well as flowers and leaves are utilized as food for animals including human being. The present study was aimed to investigate the semiochemicals of *G. sepium* against low country wood termite *Glyptotermes dilatatus* as one of the major pests of low country tea plantation in Sri Lanka. It was found that these pests are extremely difficult to control due to concealed habits of them. *Gliricidia sepium* leaves and stems extracts with ethyl acetate were used for TLC analysis to find out the major compounds present in the extracts. The results revealed that two major compounds are presented in both leaves and stems of the ethyl acetate extracts. The leaves and the stems of *G. sepium* extracts of ethyl acetate were partitioned into hexane, chloroform and methanol. These partitioned extracts were used for the no choice chamber force feeding bioassay to find out the feeding activity of termites. The feeding effect of *G. sepium* on termites was proportional to the weight loss of filter papers impregnated with partitioned extracts. It was revealed that termites are more likely to feed on stems extracts than the leaves extracts. Zero activity was resulted in negative control {EtOH : MeOH (1:1)}. In no choice chamber feeding bioassay, highest percentage mortality resulted in the stem extract of chloroform fraction and the least mortality percentage resulted in the chloroform fraction obtained from leaves. The steam distillation was carried out for *G. sepium* and it was found that the *Gliricidia* leaves and stems have considerable amount of volatile compounds to attract the low country wood termite *Glyptotermes dilatatus*.

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Determination of total phenolic content and antioxidant activity of *Borassus flabeliffer* Linn fruit pulp collected from several parts of Sri Lanka

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Borassus flabeliffer Linn (Palmyra palm) is widely distributed in the Northern parts of Sri Lanka. Its leaves, fruits and pith have various uses and therefore has been providing livelihood for many families in that region. The pulp obtained from the fruit has a high commercial value, specially in the Jaffna Peninsula. The pulp as well as the pith of *B. flabeliffer* has been widely used in folk medicine to cure various diseases, and has also been widely studied for its antidiabetic and antibacterial studies. As a result, this study was carried out to determine the total phenolic content and antioxidant activity of aqueous palmyra fruit pulp extracted from fruits of Kilinochchi, Anamaduwa and Batticalo districts were evaluated.

Total phenolic content of the pulp was determined using Folin Ciocalteu reagent, which measures the sample's reducing capacity. According to the results obtained, pulp extracted from the fruits collected from Anamaduwa district showed the highest value (9.30 ± 0.02 mg GAE/ g of extract), which was significantly different from the Kilinochchi and Batticalo samples ($p \leq 0.05$). The lowest phenolic content was showed in the Batticalo sample. The free radical scavenging activity was determined using the DPPH radical. The results were expressed as IC_{50} values. Thus the highest radical scavenging activity was observed in the samples collected from Anamaduwa district (3.06 ± 0.18 mg/ml). The total antioxidant capacity was determined using Phosphmolybdenum assay. In this assay, antioxidants reduce Mo (VI) to Mo (V). The highest capacity of this assay was also shown by Anamaduwa samples (68.17 ± 2.07 mg AE/ g extract) which was significantly higher than that of Batticalo and Kilinichchi samples ($p \leq 0.05$). The lowest antioxidant capacity was shown by the Batticalo district sample (31.13 ± 0.47 mg AE/ g sample). From these results, it can be concluded that, the palmyra fruit samples collected from the Anamaduwa district showed a higher antioxidant capacity than the fruit samples collected from Batticalo and Kilinochchi samples.

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Isolation and molecular identification of endolichenic fungi inhabiting selected lichens collected from mangrove plants of Puttalam lagoon

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Lichens are symbiotic relationship among algae or cyanobacteria and filamentous fungi. However, endolichenic fungi (ELF) do not associate to symbiotic relationship and they live within symbiotic lichen thallus just like endophytic fungi live within healthy plant tissues. Under this research area very few censurships have been carried out on the isolation and molecular identification of ELF. A preliminary investigation of molecular identification of ELF, that occur within the lichens was carried out in this study. The crustose lichens were collected from Puttalam lagoon in two different areas (Athale and Nara), Sri Lanka, ELF were isolated from the segments of healthy thallus, using surface sterilization technique. Identification of isolated pure strains of the endolichenic fungi was carried out using a molecular biological protocol by genomic DNA extraction, amplification and sequencing techniques. Promega Wizard® Genomic DNA Purification Kit was used for the extraction of fungal DNA. The fungal strains were identified by analysis of the nuclear internal transcribed spacer (ITS) region of extracted DNA, and selectively amplified by polymerase chain reaction (PCR) using ITS 1 and ITS 4 primers according to the method described by Arnold & Lutzoni. Before being subjected to sequencing, the excess nucleotides and remaining primers, enzymes *etc.*, in the PCR product were removed using gel purification protocol described by Arnold, 2007. First, the desired amplified DNA bands were separated from non-specific bands using agarose gel electrophoresis. To isolate the DNA from the gel, Promega Wizard® SV Gel and PCR Clean-Up System was used. The amplified and purified DNA was subjected to DNA sequencing and the obtained sequences were submitted to the GenBank as a nucleotide query and compared with already existing DNA sequences using NCBI BLAST®. Pure cultures of these identified fungi were vouchered in sterile water

and deposited at the collection maintained by the Department of Chemistry, University of Kelaniya. Isolated and identified ELF are given in table 1.

As reflected by the results *Arthonia antillarum* shows comparatively high diversity of ELF than the other host lichens. *Arthonia antillarum* also shows high variety at the genus and species levels. *cf. Roccella montagnei*, *Arthonia antillarum* and *Opegrapha medusulina* inhabit in different host mangrove plants. Genus and species of isolated ELF varies according to their habitat of host mangroves. The abundance of such diverse fungal populations within the same lichen species suggests that they may have a defined important ecological role that affects the successful colonization of the lichen.

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Table1. Identified ELF and their host lichens

Lichen codes	Host Lichen	Name of the host plant	Names of Identified ELF
N/L7	<i>cf. Roccella montagnei</i>	<i>Cassia auriculata</i>	<i>Nigrospora sp.</i> <i>Rigidoporus vinctus</i>
AT-II/L6	<i>Opegrapha medusulina</i>	<i>Cocos nucifera</i>	<i>Xylaria feejeensis</i> <i>Preussia sp.</i>
N/L10	<i>Pyrenula ochraceoflava</i>	<i>Cassia auriculata</i>	<i>Lasiodiplodia theobromae</i> , <i>Byssosclamyces spectabilis</i> <i>Chaetomium sp</i>
AT/L11	sterile	<i>Cocos nucifera</i>	<i>Aspergillus fumigatus</i> <i>Neurospora intermedia</i>
N/L4	<i>Arthonia antillarum</i>	<i>Syzygium sp</i>	<i>Phellinus noxius</i> <i>Diaporthe phaseolorum</i> , <i>Phellinus noxius</i> <i>Diaporthe phaseolorum</i>
AT/L8	<i>Arthonia antillarum</i>	<i>Cocos nucifera</i>	<i>Daldinia eschscholtzii</i> <i>Cerrena unicolor</i> <i>Aspergillus hiratsukae</i> , <i>Neurospora sp</i>
AT/L6	<i>Opegrapha medusulina</i>	<i>Rhizophora neucronuta</i>	<i>Aspergillus hiratsukae</i> <i>Nigrospora sphaerica</i> , <i>Hypoxylon anthochroum</i>
N/L6	<i>Arthonia parantillarum</i>	<i>Cocos nucifera</i>	<i>Preussia tenerifae</i>
N/L5	<i>Pyxine cocus</i>	<i>Syzygium sp</i>	<i>Daldinia sp.</i> <i>Diaporthe sp.</i>
N/L8	<i>cf. Roccella montagnei</i>	<i>Syzygium sp</i>	<i>Lasiodiplodia theobromae</i> <i>Lasiodiplodia</i> <i>pseudotheobromae</i>
N/L2	<i>cf. Roccella montagnei</i>	<i>Exoecaria aggalocha</i>	<i>Xylariaceae sp</i> <i>Daldinia eschscholtzii</i>

Technical Sessions : A - 16

Radical scavenging activity of extracts of endolichenic fungi isolated from mangrove plants in Puttalam Lagoon

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Two lichens *Dirinaria picta* and *Crateria dissimilis* collected from mangroves in Puttalam district were used for isolation of endolichenic fungi. The ethyl acetate extracts of endolichenic fungi were investigated for antioxidant activity. The objectives of this study were to isolate and identify endolichenic fungi inhabiting mangroves in Puttalam lagoon, and to isolate extracts with bioactive secondary metabolites of above endolichenic fungi. Endolichenic fungi (EF) were isolated from mangrove lichens in Puttalam lagoon and identified. Identification of the endolichenic fungi was carried out using a molecular biological protocol by genomic DNA extraction, amplification and sequencing techniques. Identified EF were grown on Potato Dextrose Agar (PDA) plates. Five large PDA plates were prepared from each fungal species and incubated at room temperature for two weeks. Secondary metabolites were extracted in to ethyl acetate (300 mL) to obtain the crude extract. Antioxidant activity of each extract was evaluated using DPPH radical scavenging assay. Out of the seven EF tested, *Aspergillus fumigatus* showed the highest

activity (IC₅₀ = 19 µg/mL) in DPPH assay which was higher than that of the control. Butylated hydroxy toluene (BHT) (IC₅₀ = 108±0.072 µg/mL), was the positive control. Methanol was used as the negative control.

IC₅₀ values of *Neurospora calospora*, *Sordariomycetes* sp., *Aspergillus* sp., *Aspergillus fumigatus*, *Daldinia caldariorum*, *Neurospora intermedia* and *Hypoxylon* sp. were 843.3 µg/mL, 643.7 µg/mL, 119.7 µg/mL, 19 µg/mL, 134.5 µg/mL, 764.5 µg/mL and 306.3 µg/mL, respectively.

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Technical Sessions : A - 17

The effect of the chelating ligand in TISAB solutions on the potentiometric determination of fluoride in aquatic samples with ion-selective electrode

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Potentiometric determination of fluoride with ion-selective electrode is one of the frequently used methods to quantify fluoride in aqueous samples. The method requires using TISAB (Total Ionic Strength Adjusting Buffer) solution to improve the accuracy because it measures the activity of an analyte rather than its concentration. One of the main disadvantages of this method is high cost of commercial TISAB solutions. In this research project, fluoride concentration in well water samples was determined

using a fluoride ion-selective electrode and several TISAB solutions developed in the laboratory. The main objective of this study was to evaluate the effect of the chelating ligand in TISAB solutions on the accuracy of the measured fluoride concentration. The data generated in this study will be used to develop a cost effective TISAB solution that can produce statistically comparable results to commercial TISAB solutions.

During the study, eight (08) TISAB solutions were developed and seventy five (75) well water samples

were analyzed by using these buffers. All the buffer solutions contained 1.0 M NaCl, 0.1 M sodium acetate pH buffer, adjusted to pH 5.5 and a metal complexing ligand to break metal-fluoride complexes to free fluoride ions to the solution to be determined by the fluoride selective electrode. The ligands used in this study were CDTA, EDTA, HE-EDTA, triethanolamine, citrate, tartrate and phosphate. One buffer was developed without any ligand where acetate was the pH buffer and the metal chelating ligand. In addition to the above buffers, WTW brand TISAB (140100) solution was used as the reference. WTW brand 340i pH/ion meter equipped with a WTW brand fluoride electrode were used for fluoride analysis. All the analyses were carried-out in duplicate. Finally the samples were also analyzed by YSI 9500 photometer for fluoride using the Zirconyl-Cyanine R colorimetric method. In addition to fluoride concentration, pH and conductivity of the samples were also measured.

The measured conductivities of the samples were in the range of 53.3 to 481.0 $\mu\text{S cm}^{-1}$ and the fluoride concentrations were in the range of 0.389 to 1.961 mg dm^{-3} . Sample pH values were in the range of 6.4 to 8.5. The standard deviations of the duplicate fluoride

measurements were less than 5% for all data. According to the results, the highest fluoride concentrations were produced by the WTW (commercial TISAB) buffer and the lowest fluoride concentrations were produced by the buffer without a ligand (acetate only buffer) at all times. Furthermore, WTW and CDTA TISAB solutions produced comparable results for most of the samples. Interestingly, Zirconyl-Cyanine R colorimetric method which is generally accepted as a standard method for total fluoride analysis produced low fluoride concentrations compared to WTW, CDTA, EDTA and HE-EDTA buffers for most of the samples.

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Technical Sessions : A - 18

Synthesis of functionalized graphene oxide as a solid phase catalyst for Ullmann reaction

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The Ullmann coupling is an important and well known nucleophilic aromatic substitution ($\text{S}_{\text{N}}\text{Ar}$) reaction. This reaction is widely used in pharmaceutical and agrochemical industries, where homogeneous ligated Cu(I) compounds are employed as catalysts.¹⁻³

In the present study, a solid graphene based catalyst was developed for the above coupling reaction. The solid catalyst was developed by converting graphite into graphene oxide, then converting graphene oxide into aminated graphene oxide and chelating with Cu(I). This catalyst was used to catalyze the *N*-arylation of bromobenzene and benzylamine.

Synthesis of *N*-phenylbenzylamine (Figure 01) was carried out using a reaction mixture of, 0.060 g (0.315 mmol) of freshly prepared CuI, 0.104 mL (0.990 mmol) of bromobenzene, 0.109 mL (0.998 mmol) of benzylamine, 0.60 mL (1.5 mmol) of dimethylsulfoxide, 0.137 g of potassium carbonate (1.0

mmol) and 0.060 g of different solid graphene based catalysts (0.060 g were used according to the earlier studies). The reaction mixture with the particular catalyst was then heated at 80 °C for 3 hours. Purification was carried out using column chromatography. The purified product was identified and characterized using NMR spectroscopy [¹H NMR CDCl₃ δ 7.24-7.40 (m, 5H), 7.18 (m, 2H), 6.74 (m, 1H), 6.65 (m, 2H), 4.33 (s, 2H)].

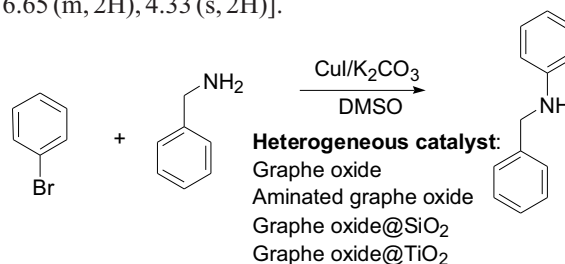


Figure 1: Synthesis of the *N*-phenylbenzylamine using the heterogeneous catalysts in the presence of Cu (I)

Product yields over different heterogeneous catalysts are given in Figure 02.

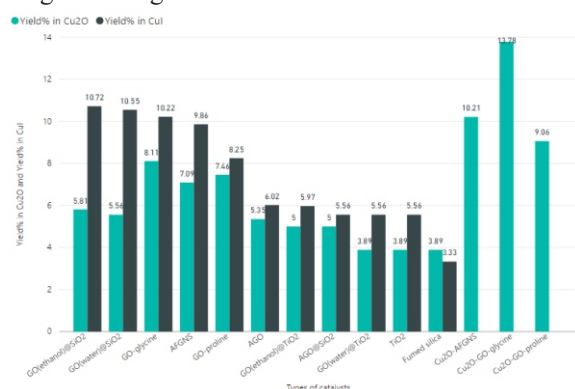


Figure 2: Comparison of the percentage yield of the product at different GO-based catalysts

Improved Hummer's and modified Hummer's methods were used to prepare graphene oxide (GO). GO prepared by both methods was used in synthesizing amine functionalized GO and aminated graphene oxide (AGO). Bucherer reaction was used to synthesize aminated graphene oxide (AGO). Amine-functionalized graphite nanosheets (AFGNS) were prepared treating graphite powder with HNO₃:H₂SO₄ (1:1 v/v) and reducing the -NO₂ group on the GO surface in to -NH₂ with sodium sulfide (Na₂S). AFGNS contains higher percentage of -NH₂ groups than AGO. This may be the reason for the enhancement of the product yield from 6.02% to 10.21%.

Silica (SiO₂) and TiO₂ were used as solid supports for graphene oxide (GO) sheets. The effect of the solvent in the preparation of graphene oxide coated on SiO₂ and TiO₂ catalysts (GO@SiO₂ and GO@TiO₂) was studied using water and ethanol as solvents. Solubility and the effect of GO on coating onto solid support in water and ethanol were observed to be similar in preparation of GO suspension of GO@SiO₂ and GO@TiO₂ catalysts. GO densities in both solvents and the yield percentages of *N*-phenylbenzylamine obtained from GO@SiO₂ and GO@TiO₂ catalysts prepared using GO/water and GO/ethanol suspensions are approximately equal.

GO@SiO₂ enhanced the product yield than GO@TiO₂ (e.g. 10.55% over GO (water)@SiO₂ and 5.56% over GO (water)@TiO₂) and the reasons for this observation is not clearly understood. This could be due to the inefficient coating of GO on to TiO₂ surface than silica.

To improve the catalytic activity of amine functionalized GO sheets, modified Cu₂O/graphene

oxide based composites were prepared and 13.78 % maximum yield of product was obtained from copper(I) oxide supported on glycine grafted graphene oxide (Cu₂O-GO-glycine) catalyst.

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Use of self-ligation effect of anthranilic acid in the synthesis of mefanamic acid derivatives

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Nucleophilic aromatic substitution catalyzed by ligated Cu(I) has been reported and is referred to as the Ullmann reaction. These reactions have been used to form C-N, C-O and C-S bonds. Some of the chelating ligands that have been used are α -diketones, β -diketones, amino acids and amino alcohols *etc.* This article reports a study on the possibility of using the nucleophile itself as the chelating ligand as there are no reports of that nature.

Mefanamic acid is a useful non-steroidal anti-inflammatory drug which is categorized in the Fenamic acid class. The aryl C-N bond can be synthesized using Ullmann type condensation in the presence of CuI, a base and a ligand. In the literature, amino acids have been used in such coupling, hence the possibility of the use of anthranilic acid itself (Figure 1) as a ligand was tested in this study.

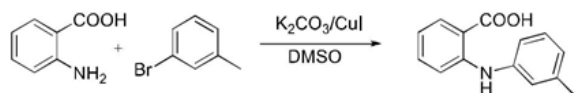


Figure 1: The synthesis of *N*-(*meta*-toluene)anthranilic acid (Mefanamic acid derivative)

Synthesis of *N*-(*meta*-toluene)anthranilic acid was carried out using a reaction mixture of 0.6 mL of DMSO, 0.137 g (1 mmol, 1 eq) of K_2CO_3 , 0.02 g (1 mmol, 1 eq) of CuI, 0.137 g (1 mmol, 1 eq) of anthranilic acid (A), 0.12 mL of 3-bromotoluene (B) and 0.137 g (1 mmol, 1 eq) of anthranilic acid. The reaction mixture was exposed to microwave power of 180 W for 10 seconds. This was followed by a cooling time of another 10 sec. This procedure was repeated for 6 times so that the accumulated microwave exposure time was 1 minute.

The crude product was acidified using (1.0 mL) of 1M HCl solution, the product was extracted to methylene chloride and it was purified using column chromatography (stationary phase- silica, mobile phase-hexane:ethylacetate = 8:2). The pattern of microwave heating and the order of addition of reagents on the product yield was investigated.

The effect of the order of addition of reagents (anthranilic acid and aryl halide) was carefully

scrutinized in order to establish a reasonable mechanism and the effect of self ligation.

Table 1: The product yield of different reaction mixtures

Reaction mixture	Percentage yield (%)
1 [1:1 mmol of A & B 10 s microwave + add 1 mmol A] [10 s microwave] x 5	28.6
2 [2 mmol of A 10 s microwave, then 1 mmol B] [10 s microwave] x 5	7.5
3 [2 mmol of A & 1 mmol B] [10 s microwave] x 6	13.2

Reaction mixture 1 recorded the highest yield where anthranilic acid was used as the ligand at the inception followed by 3-bromotoluene.

The addition of 2 equivalents of anthranilic acid at the inception gave a very low yield. This can be explained by the possible self inhibition at the catalytic site.

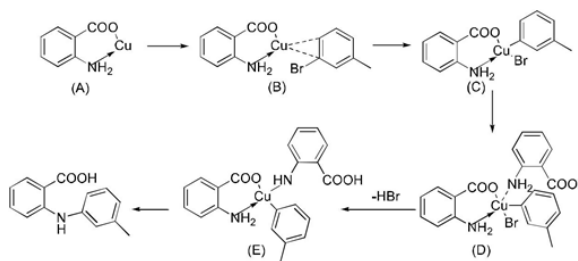


Figure 2: Suggested mechanism for the synthesis of *N*-(*meta*-toluene)anthranilic acid.

Initially, anthranilic acid molecule chelates with Cu(I) and then the π complexation takes place such that to activate C-Br bond. Later another anthranilic acid molecule co-ordinate *via* $-NH_2$ as in Figure 2(D). Thereafter, the base removes HBr and the product is obtained from the reductive elimination.

The major emphasis of this research is the concept of self-ligation. Self-ligation could eliminate the formation of undesired products by cross coupling of aryl halide with foreign ligands. Observed low yield when the order of addition was swapped, suggests the requirement of arylhalide activation prior to the addition of nucleophile to chelated Cu(I).

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Technical Sessions : A - 20

Activity of *Barringtonia asiatica* extracts on MCF-7 breast cancer cells

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Currently cancer has become a critical burden to the world. Patients have to undergo surgeries, radiotherapy and chemotherapy while chemotherapy provides a worthwhile increase in both relapse-free interval and survival. Its effect is relatively modest and there is a pressing need to identify new drugs with greater efficiency against these tumours. Organ specific *in vitro* assays are imperative in large scale screening of agents with useful clinical activity. Among many such assays, sulforhodamine B (SRB), assay employs a protein binding aminoxanthene dye, to provide a quantitative analysis of viable cells in a culture following the introduction of potential extracts or isolates of extracts. Preliminary investigations indicated that the crude methanolic extract of *Barringtonia asiatica* seed kernel and a fraction obtained with medium pressure liquid chromatography (MPLC) of crude extract were positive for brine shrimp assay (unpublished data).

Thus this study aims to investigate the toxicity of the crude methanolic extract (15 g powder / 40 mL MeOH) and the brine shrimp active fraction obtained by MPLC by SRB assay with the breast cancer cell line MCF-7. The cells were cultured, trypsinized and cell density was measured. Cells were suspended in appropriate growth medium (5×10^3 cells in the well). The cell suspension (200 μ l) in Dulbecco's Modified Eagle's Medium (DMEM) was aliquot in to 96 wells plate. After incubation cells were treated with different concentrations of methanolic crude extract and brine shrimp active fraction of *B. asiatica* (12.5, 25, 50, 100 and 200 ppm) extract. After incubation (24 hours), medium was removed and washed with phosphate buffered Saline to remove cell debris. The wells were then fixed with 25 μ l of ice-cold 50% trichloroacetic acid solution and the plate was incubated and wells were rinsed. SRB solution (0.4%; 50 μ l stain/ well) was added to each well. Acetic acid (1%) was used to remove unbound dye. The bound SRB dye was solubilized by adding of tris-base solution (200 μ l/well), and plates were placed on a shaker (1 hour) at room temperature.

Plates were read at OD 540 nm, using a micro plate reader. Half maximal inhibitory concentration (IC_{50}) values were determined by analyzing sigmoid dose-response inhibition curves using Graph Pad Prism software (version 5.0).

After adding of SRB dye to crude methanolic extract at low concentrations (12.5 and 25 ppm) a pink colour was observed but with concentrated solutions (100 and 200 ppm) clear wells were observed. The fractionated Brine shrimp assay active fraction, above 25 ppm (50, 100 and 200 ppm) showed clear wells indicating that no viable cells were present. The crude methanolic extract showed an IC_{50} value 34.13 ppm on SRB assay within 24 hours and brine shrimp active fraction showed an IC_{50} value of 11.32 ppm. Crude methanolic extract and brine shrimp active fraction have shown high cytotoxic activity on SRB assay. Further cytotoxic assays and purification and structure elucidation of brine shrimp active fraction is being carried out.

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Molecular modelling of binding of coumarin derivatives to estrogen receptor protein

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Human cytochrome P450 aromatase, which is an enzyme located in the endoplasmic reticulum of estrogen producing cells, plays a significant role in development of estrogen receptor positive breast cancer. Aromatase catalyzes the conversion of androgens to estrogens. The third generation of aromatase inhibitors are found to be the most potent drugs for breast cancer treatment and they are in clinical use, among them Exemestane (EXM). The coumarins present in natural products show high pharmacological activities for cancers. Therefore, twenty different coumarin derivatives were studied using Molecular Docking Simulations. AutoDock Vina and AutoDock4 were used as docking software and it was shown that 4-(3-chloro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one had comparable results to the commercially available drugs. The insight gained from the study herein has potential for the design of novel derivatives of coumarins for inhibition of aromatase.

The estrogen receptor protein with PDB ID: 3s7s was selected from the protein structure database for this study and visualized with Chimera 1.9 and VMD. Active site residues were identified as Arg115, Ile133, Phe134, Phe221, Trp224, Ile305, Ala306, Thr310, Asp309, Val313, Val370, Leu372, Val373, Met374, Ser478 and His480. Twenty different coumarin analogues were designed and their binding affinities to the estrogen receptor protein were investigated using molecular docking. Subsequently, coumarin derivatives were designed using MarvinSketch and the geometry was optimized with Avagadro software. Different conformers of each derivatives and references Exemestane and Androstenedione, were obtained from Spartan software. Autodock Vina and Autodock 4 with PyRx 0.8 were used to dock molecules with the references and coumarin derivatives. Binding affinities of the best poses were determined using the respective scoring functions. Results were compared with the two references, Exemestane and Androstenedione.

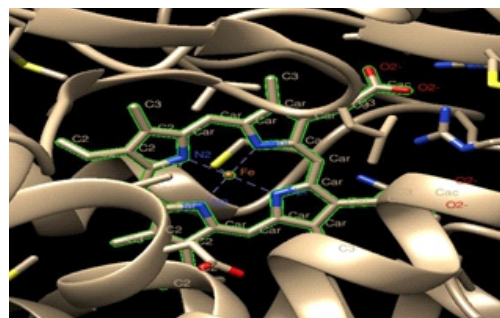


Figure 1: Active site of the protein where prosthetic heme group is present

Results showed that the novel Coumarin derivatives have comparable binding energies with drug molecules such as Exemestane and the natural substrate Androstenedione.

Table 1: Binding affinities of best ligands from docking studies

Ligand	Binding Affinities kCal/mol	
	AutoDock vina	AutoDock4
Androstenedione	-13.2	-12.26
Exemestane	-12.4	-13.04
4-(3-chloro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one	-9.2	-10.1
4-(2,4-dichloro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one	-9.9	-8.89
4-(4-chloro-phenoxy-methyl)-7-hydroxy-5-methyl-chromen-2-one	-9.6	-9.34
7-hydroxy-5-methyl,4-phenoxy-methyl-chromen-2-one	-9.3	-9.66

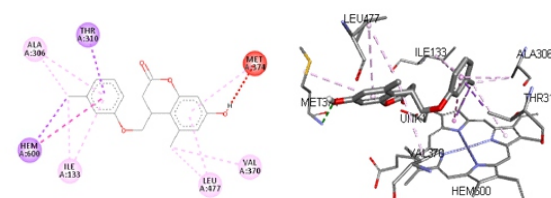


Figure 2: Receptor ligand Interaction diagram for ligand 8 generated from Discovery Studio 2016

The docking results of the above coumarin derivatives were compatible with those of the existing clinical drugs, and therefore coumarin derivatives can

Further docking studies will be conducted using Dock 6.6, IgemDock and Gold software. Moreover, molecular dynamics simulations will be conducted to investigate binding free energies of the protein ligand complexes.

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Hypoglycaemic and toxicity effects of a diabetic tea product in normoglycaemic Wistar rats

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Wistar rats (n=20) obtained from MRI, Sri Lanka were used in the study. The rats were divided into test and control groups based on the average fasting blood glucose and body weights where the average values were not significantly different. A dose of 8 mL/kg body weight herbal tea was orally administered to the test group twice a day for six months while same dosage of water was given to the control group. Animals were provided with the meal according to the WHO standard diet and water, and had free access to both. Weights of the animals, food and water intake, and behavioral changes were recorded during the study. The FBG (fasting blood glucose) levels were measured after 3 months and 6 months of feeding and AST (aspartate amino transferase), ALT (alanine amino

The average FBG values of the test group and the control group after 6 months of feeding (test group - from 107 ± 10 to 102 ± 5 mg/dL and control group - from 97 ± 9 to 99 ± 5 mg/dL) were not significantly different ($p > 0.05$). However, a significant reduction ($p = 0.02$) in HbA1c% of test group (1.8 ± 0.1) was observed when compared to the control group (2.1 ± 0.1). Oral GTT results showed a significant reduction ($p = 0.01$) in blood glucose level of test group (101 ± 5 mg/dL) compared to control group (135 ± 5 mg/dL) after 3 hours. This could be due to the insulin-receptor-binding effect of components in *S. dulcis* plant extract. Further, synthesis and secretion of insulin and binding to the receptors may have increased by the plant extract. No significant differences in body weights, AST, ALT, urea and creatinine levels between test and controls were

observed.

OGTT results showed that administration of the herbal tea induced a decrease in blood glucose levels of the test group compared to control group. However, effect on FBG was not apparent. The long term administration of diabetes tea had decreased the HbA1c (15%) of normoglycaemic Wistar rats in the test group compared to the control group. Long term ingestion of the tea had no toxic effects on the kidneys or liver in the rats.

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Technical Sessions : A - 23

Nutrient composition of some boiled *Ipomea batata* (sweet potatoes) cultivars

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Sweet potato (*Ipomoea batatas* L.) root is an underutilized tuber crop which can be considered as a low cost energy source. This study aims to make available the data on proximate composition of five sweet potato varieties consumed by Sri Lankans. Determination of the proximate composition of CARI 426, Ranabima, Dhawala, Hordi Malee, and CARI 273 was carried out with flour of freshly boiled (home cooked) sweet potatoes of the above varieties. Determination of moisture, ash, crude protein, crude fat, dietary fiber (soluble/insoluble) and digestible carbohydrate were done by standard methods.

Table 1: Proximate composition of boiled sweet potato varieties on dry weight basis.
(mean± SD)

Variety	Total starch %		Fat %	Protein %	Ash %	Dietary Fiber (DF)%	
	Digestible starch	Resistant starch				Insoluble	Soluble
CARI 426	35.0±1.7	0.9	4.6±0.6	4.0±0.1	5.0±0.2*	11.4±0.0	1.4±0.0
Ranabima	31.3±2.7	10.1	5.3±0.4*	3.0±1.0	4.1±0.3	11.4±0.0	4.6±0.0*
Dhawala	47.3±1.8	7.3	4.6±0.4	3.5±0.1	3.7±0.9	9.1±0.0	0.6±0.0
Hordi Malee	44.4±1.3	14.5	3.8±0.2	2.8±0.1	3.7±0.1	10.1±0.0	2.5±0.0
CARI 273	29.0±1.7	7.3	3.7±0.9	2.8±0.1	3.9±0.1	10.1±0.0	2.9±0.0

In each column, *for indicate significant differences at P < 0.05.

Total starch (digestible and resistant) was the major macronutrient present in all the sweet potato varieties which varied between 35.9% - 58.9%. Hordi malee had the highest resistant starch content among the five tested sweet potato varieties while Dhawala was found to have the highest digestible starch content. The resistant starch content of CARI 426 was negligible compared to other varieties. Fat was the second major macronutrient found in all the sweet potato varieties while protein was the third. Fat content of sweet potatoes varied between 3.7% - 5.3% with the highest (p < 0.05) fat content found in Ranabima variety. CARI 426 had significantly high ash content (5%) indicating high mineral content. Total dietary fiber content constituted approximately 10% of the total dry weight. Insoluble dietary fiber content provided higher contribution to the total dietary fiber content which ranged from 9.1- 11.4% while soluble dietary fiber content ranged between 0.6- 4.6% among the five varieties. Ranabima variety had the highest soluble, insoluble and resistant starch content.

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Technical Sessions : A - 24

Evaluation of bio-active compounds of *Piper longum*

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Piper longum, popularly known as ‘Thippili’ in Sri Lanka, has been used as a therapeutic agent in the treatment of various pathological conditions. Further it is widely used as a remedy for inflammation in Ayurveda and Unani systems of medicine. The objective of this study was to carry out phytochemical screening and determine different bioactivities including DPPH radical scavenging assay, Antibacterial assay and Human red blood cell (HRBC) membrane stabilization assay for different parts of *Piper longum* such as leaf, matured fruit, immatured fruit, and stem. The extraction of plant materials was carried out according to cold extraction process. Ethyl acetate was used as the solvent in the extraction process. The results obtained from phytochemical screening and bioactivities depicted that, immature fruit extract possessed high amount of phenolic content (113 mg GAE/g of extracts) where as matured fruit extract possessed high amount of flavonoid content. (270 mg QE/g of extract). The DPPH radical scavenging activity results revealed that stem extract showed high radical scavenging activity (47%) comparative to other plant extracts at a concentration of 0.3 mg/mL. The antibacterial activity was evaluated using agar well diffusion method. According to the results stem extract exhibited antibacterial activity against *Bacillus subtilis* (MTCC 121) whereas leaf extract exhibited antibacterial activity against *Bacillus subtilis* (MTCC 121) and *Escherichia coli*. (ATCC 25922) at the concentration of 10 mg/mL. Anti-inflammatory activity of plant extracts was evaluated by HRBC membrane stabilization method. The results obtained from the study depicted that all plant extracts derived from cold extraction showed high percentage inhibition activity than the standard drug, Aspirin.

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Anti-bacterial, anti-inflammatory and anti-insecticidal activities of two endolichenic fungi isolated from lichens inhabiting the Hakgala forest

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Lichens formed by a symbiotic association of fungi and algae or cyanobacteria have been discovered recently as hosts for endolichenic fungi that live asymptotically, much the similar way of plant endophytes live in plant tissues. In this study the endolichenic fungus *Daldinia eschscholzii* (DE) and *Penicillium pinopilium* (PP) occurring in the *Parmotrema* sp. and *Pseudocyphellaria* sp. inhabiting the Hakgala forest were investigated for their biological activity. Both fungi were grown in Potato dextrose agar (PDA) medium and incubated at room temperature for two weeks and the secondary metabolites were extracted into ethyl acetate. The crude extract of DE (DE/01) was subjected to anti-inflammatory and anti-bacterial assays and crude extract of PP (PP/01) was evaluated for its anti-inflammatory and anti-insecticidal activities against, *Callosobruchus maculatus* which is the major pest of cowpeas, green gram and lentils. The DE/01 (10 mg/mL) showed considerably high anti-bacterial activity against the three bacteria strains, *Staphylococcus aureus*, *Escherichia coli*, and *Bacillus subtilis* used in the Agar well diffusion assay compared with the standard positive azithromycin used at 0.5 mg/mL. The PP/01 exhibited positive results for both anti-inflammatory and anti-insecticidal activities. Both DE/01 and PP/01 were then partitioned with hexane, chloroform and aqueous methanol to obtained hexane (DE/02 and PP/02), chloroform (DE/03 and PP/03) and MeOH fractions (DE/04 and PP/04), respectively. The DE/03 showed the highest anti-bacterial activity whereas PP/03 showed the highest anti-inflammatory and anti-insecticidal activities. These fractions were separated using silica column to obtain DE/03/S1 (0.260 g) and DE/03/S2 (0.140 g), and seven fractions from PP/03 (PP/03/F1-PP/03/F7). A Sephadex column was used to further separate the active sub fractions to receive seven fractions from DE (DE/03/F1 - DE/03/F7) and three fractions from PP (PP/03/A - PP/03/C). Resulted fractions were evaluated for their bioactivities and preparative TLC was used to isolate possible pure compounds from DE/03/F4 and from PP/03/A, PP/03B

and PP/03/C.

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Molecular docking study on binding of derivatives of palmitoyl-CoA and 3- ketodihydrosphingosine to serine palmitoyltransferase

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The first step of biosynthesis of sphingolipids is the condensation between L-serine and palmitoyl-CoA producing 3-ketodihydrosphingosine. This reaction is catalyzed by serine palmitoyltransferase enzyme (SPT). 3-ketodihydrosphingosine is eventually converted to sphingosine. It is reported that the levels of sphingosine and sphingosine-1-phosphate play a pivotal role in the regulation of tumor growth.

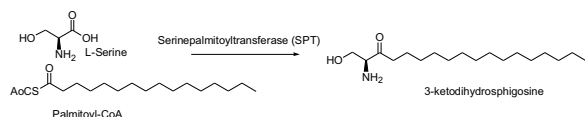


Figure 1: Reaction facilitated by *serine palmitoyltransferase*

In this research, attempts were made to study the relationship between the degree of unsaturation and binding affinity of palmitoyl-CoA derivatives and their products to SPT. The binding affinities were compared with that of Myriocin, which is a known inhibitor of SPT.

The crystal structure of SPT was downloaded from the Protein Data Bank (PDB ID: 2JG2). SPT contains one chain, Mg^{2+} and a cofactor (pyridoxal phosphate). Pyridoxal phosphate cofactor is involved in the mechanism of formation of 3-ketodihydrosphingosine. Palmitoyl-CoA and 3-ketodihydrosphingosine substrates were docked on to the active site of SPT using the software, AutoDock from Scripps Institute, USA. All the water molecules were removed and polar hydrogens were added prior to docking procedure.

Binding affinities of palmitoyl-CoA and 3-ketodihydrosphingosine substrates with increasing unsaturation and changing the position of a double bond are given in the Table 1.

Table 1 shows that the binding of all the palmitoyl-CoA substrates are thermodynamically feasible and binding to SPT becomes more favorable as the unsaturation of the substrate increases. The substrate with four double bonds, d16:4 $\Delta^{4t,6t,8t,10t}$ has the highest affinity (-7.0 kcal/mol) to SPT. The reason for this observed variations would be due to π - π interactions between fatty acid chain and the amino acid residues in the enzyme. When only a single double bond is present,

binding affinity slightly increases as the distance from carbonyl group increases.

Table 1 : Affinities of *palmitoyl-CoA* and 3- ketodihydrosphingosine substrates to *Serine palmitoyltransferase*

Substrate	Affinity (kcal/mol)		Product	Affinity (kcal/mol)
	Deprotonated (Ionized phosphate groups)	Protonated (Neutral phosphate groups)		
Palmitoyl-CoA (d16:0)	-5.8	-5.3	3-ketodihydrosphingosine (d18:0)	-4.1
d16:1 Δ^4	-6.0	-5.7	d18:1 Δ^6	-4.2
d16:2 $\Delta^{4t,6t}$	-6.4	-6.7	d18:2 $\Delta^{6t,8t}$	-4.5
d16:3 $\Delta^{4t,6t,8t}$	-6.5	-6.8	d18:3 $\Delta^{6t,8t,10t}$	-4.8
d16:4 $\Delta^{4t,6t,8t,10t}$	-7.0	-7.4	d18:4 $\Delta^{6t,8t,10t,12t}$	-5.1
d16:4 $\Delta^{4t,6t,8t,11t}$	-6.7	-7.1	d18:4 $\Delta^{6t,8t,10t,13t}$	-5.0
Palmitoyl-CoA d16:1 Δ^6	-5.7	-5.9	d18:1 Δ^8	-4.3
d16:1 Δ^8	-6.0	-5.9	d18:1 Δ^{10}	-4.3
d16:1 Δ^{10}	-6.1	-6.1	d18:1 Δ^{12}	-4.5
d16:1 Δ^{12}	-6.1	-6.4	d18:1 Δ^{14}	-4.7
d16:1 Δ^{14}	-6.5	-6.7		-4.9

The same trend was observed with the binding affinities of the product/s. The product formed from naturally abundant palmitoyl-CoA does not have strong binding to the enzyme. This experiment showed that myriocin, which is a known inhibitor of SPT has a binding affinity of -4.9 kcal/mol which is lower than the binding affinities of some of the substrates studied in this research. The phosphorylated products of Palmitoyl-CoA d18:4 $\Delta^{6t,8t,10t,12t}$ and d18:4 $\Delta^{6t,8t,10t,13t}$ have binding free energy changes comparable to the binding free energy change of myriocin. This shows that these products have the potential to act as palmitoyl-CoA inhibitors.

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CHEMEX - 4

Educational Exhibition & Industrial Trade Fair 2017

26th to 28th January 2017 at SLECC



Entrance to the Exhibition Centre at SLECC



Students gathered in large numbers to visit the Exhibition



The Chief Guest Hon. Susil Premajayantha, Minister of Science, Technology and Research, and Mr. M R M Haniffa, the President of the IChemC arriving for the Inauguration Ceremony



Welcome address by Mr. M R M Haniffa



Hon. Minister Susil Premajayantha addressing the gathering



Vote of thanks by Dr. H M M Infas, Chairman/CHEMEX 4 Organizing Committee



Head Table of the CHEMEX 4 Opening Ceremony



A section of the audience including the Council members, staff of the IChemC and students of the CCS

A/L Chemistry Lectures and Popular Lectures

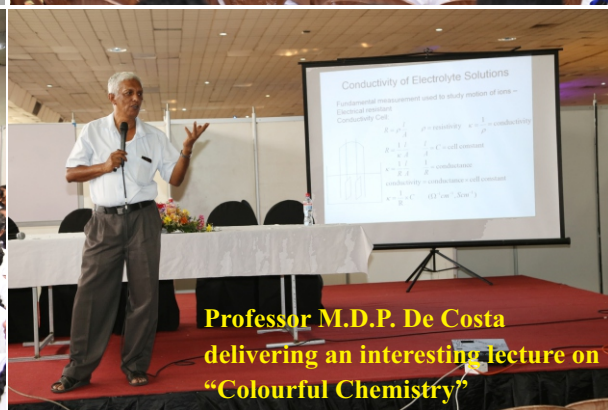


Professor Sudantha Liyanage



Professor P A Paranagama

Students from different schools eagerly listening to A/L Chemistry lectures



Professor M.D.P. De Costa
delivering an interesting lecture on
"Colourful Chemistry"

Award Ceremony of the Australian National Chemistry Quiz (ANCQ) Competition



Mr. Ruwan Gallage



An award winner receiving her award from the Chief Guest

Inter University Debating Competition



CCS and university students participating in the Inter University Debating Competition

CCS students' innovative stalls on Organic & Cosmetics and Pharmaceutical



CCS Students demonstrating chemical experiments to enthusiastic students and general public



The most popular Chemistry Magic Show “Wonders of Chemistry”



Magic shows were the most entertaining to the students

“CHEMEX-4” Educational Exhibition and Trade Fair: A Mega Event to Celebrate 75th Anniversary of ICHEMC

A M Jayasekara

*Additional Registrar, College of Chemical Sciences, Institute of Chemistry Ceylon
Secretary, Organizing Committee of CHEMEX-4*

The Institute of Chemistry Ceylon conducted its most successful Education Exhibition and Trade Fair “CHEMEX-1” in 2011 under the theme **“Chemistry Our Life- Our Future”** as a part of the UN International Year of Chemistry at BMICH with the support of the Sri Lanka National Secretariat for UNESCO, Presidential Secretariat, several ministries and relevant government agencies, private sector industrialists, universities, and media organizations. It was followed by the “CHEMEX-2” and “CHEMEX-3” Exhibitions which were conducted in the end of 2011 and in 2014, respectively at Adamantane House of the Institute of Chemistry Ceylon (ICChemC). The exhibitions which were mainly aimed at student community of the country were extremely successful due to the support rendered by sponsors, stall holders and the assistance of the Ministry of Education. The collaborative effort of the members of the Institute along with the support of lecturers, alumni and undergraduates of the College of Chemical Sciences (CCS) made the three exhibitions very attractive and beneficial to the visitors who came from all over the country.

In view of the demand from school students, teachers, university students as well as the general public, the Council of the Institute of Chemistry Ceylon organized the “CHEMEX-4” Educational Exhibition and Trade Fair from 26th to 28th January 2017 at the Sri Lanka Exhibition and Convention Centre (SLECC). The Exhibition was inaugurated on 26th January 2017 by Hon. Susil Premajayantha, Minister of Science, Technology and Research. The Exhibition also marked the 75th year since the establishment of the Chemical Society of Ceylon, the predecessor to the Institute of Chemistry Ceylon and it was based on the theme of the year **“Role of Chemists for Better Tomorrow”**.

The Ministry of Education, as in the previous exhibitions extended its fullest cooperation by informing all the Provincial Education Departments and the school principals in their respective areas to instruct the students/teachers to participate in the “CHEMEX-4” exhibition and witness the rare opportunity in view of its importance in chemical education. The Council of the Institute of Chemistry

Ceylon made the arrangements for the school students in uniform to visit the exhibition free of charge. Thus, more than 6,000 school children visited the exhibition which comprised of over 150 stalls set up by the students of the College of Chemical Sciences, universities and the industrial sectors. These stalls depicted many different areas of chemistry and chemical sciences, and catered not only for Advanced Level students and undergraduates, but also for the general public to discern how chemistry is involved in day-to-day life. It was indeed very much than a conventional exhibition.

The industrial sector stall holders at the “CHEMEX-4” Educational Exhibition and Trade Fair were given the opportunity for maximum exposure of their products to a large cross section of the society. The organizers took every effort to meet their demand to enable them to get maximum publicity for their products through this exhibition. Among the private sector agencies were those involved in the production and sale of cosmetics, plastic and rubber, mineral sands, pharmaceuticals, cement, laboratory equipment, and science books *etc.* A several number of stalls including displays of food, health, nutrition, minerals, environment, pharmaceuticals, toxicology, complementary medicine-therapy, practical demonstrations, debates, magic shows and game corner attracted large crowds. It was very interesting to observe and learn about food labelling, packaging, food spoilage and food colouring, glove manufacture, glass industry, gem industry, soap industry and petroleum industry processes, and medical laboratory technologies. Further areas such as toxicology involved drugs, narcotics, heavy metal poisoning, food contamination and hazards. Environmental aspects such as alternative energy sources, global warming, and water and air pollution methods were on display. These exhibits were extremely useful for the university students, school students as well as the general public. Private sector stall holders played a big role in satisfying the information needs of the students while they had an opportunity to display and popularize their products.

The “CHEMEX-4” was the destination of

passionate youth yearning for scientific discovery. It was an ideal platform for Advanced Level students to get hands on experience in all the experiments in the Advanced Level chemistry syllabus along with special lectures delivered by the best lecturers in the field.

Award Ceremonies of the Australian National Chemistry Quiz (ANCQ) Competition and the All Island Interschool Titration Competition were also held on 27th January 2017. Mr. Ruwan Gallage, the President of the Organization of Professional Association graced this occasion as the Chief Guest.

The Inter University Debating Competition was held on 27th of January. These debating competitions attracted many students from universities and schools as well, and they gained much knowledge. The University of Jaffna emerged as the Champions and University of Colombo won the second place.

The “CHEMEX-4” was, in a way, symposium of professional, industrial, research and academic bodies in Sri Lanka. The three-day exhibition also consisted of popular lectures conducted by well-known educationists including the Senior Professors, renowned chemists as well as industrialists in Sri Lanka who are specialists in their subject area. The students had an additional benefit of participating at these seminars.

A variety of other activities such as orchestra, musical programmes, dances, entertainment corners and many other events organized by the College of Chemical Sciences provided much entertainment to the young crowd.

A large number of students gathered to see the chemical magic shows conducted by the College of Chemical Sciences. The visitors including school children had the opportunity to develop their enthusiasm and interest in chemistry and chemical sciences while they were able to witness ‘wonders of chemistry’ demonstrated by students of the College of Chemical Sciences. Vivid colour changes through unbelievable chemical reactions, making “soft drinks”, making “elephants’ toothpaste”, etc. were some of the chemical marvels displayed at the magic shows. School children as well as the general public enjoyed the magic shows very much and they could witness how chemistry is involved in their day to day life.

The theme of the year “*Role of Chemists for a Better Tomorrow*” no doubt deeply penetrated into the minds of younger generation, industrialists, policy makers and general public through the exhibition.

Chemistry is the Central Science and our industries need more and more chemistry professionals to innovate new technology, improve quality standards of chemical products, foods and beverages, and thus to increase production from the industrial sector which would bring more income and employment for our youth and generate much needed foreign exchange for the country. With this objective, the Institute of Chemistry Ceylon will continue to conduct such exhibitions annually to increase interest and enthusiasm in chemistry among younger generation in our country.

The great success behind “CHEMEX-4” was due to the dynamic task force of highly qualified lecturers, researchers and scientists of Sri Lanka along with the undergraduates of the College of Chemical Sciences who worked tirelessly on bringing the magic of chemistry with the hope that it would inspire the visitors to venture on a journey of finding their potential and executing it for the best of mankind. The hard work of the students of the College of Chemical Sciences was commendable and their contribution of knowledge and experience to other students has been fully appreciated.

Organizing Committee of CHEMEX-4:

Chairman	Dr. M Infas
Secretary	Mr. A M Jayasekara
Assistant Secretary	Ms. H Gunathilake
Event Treasurer	Mr. M R M Haniffa

Committee Members

Professor Priyani Paranagama, Professor M D P De Costa, Dr. P Premrathne, Dr. A A P Keerthi, Dr. C N Rathnaweera, Mr. N I N S Nadarasa, Mr. K R Dayananda, Mr. N M S Hettigedera

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Croplife International

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Omega Engineering & Stainless Steel Fabrications

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Lanka Minerals and Chemicals Pvt Ltd

C & T Worldwide Pvt Ltd

Colombo International Nautical & Engineering

College

Lanka Mineral Sands Ltd

First M.Phil. student funded by the CCS research grant scheme



The CCS research grant scheme was initiated by the College of Chemical Sciences, the education arm of the Institute of Chemistry Ceylon in 2013 to provide funds for internal academic staff members to carry out high quality research at the College. Mrs. Amali Guruge, the first M.Phil. student funded under this research grant successfully defended her thesis titled “Coumarin derived inhibitors for human DNA topoisomerase I and II: An *in silico* approach” in January 2017. This project was jointly supervised by Dr. Chandanie Udawatte, Senior Lecturer of the CCS and Professor Samantha Weerasinghe, Senior Lecturer of the University of Colombo and it was collaborated with Professor B S Jayashree of the Department of Pharmaceutical Chemistry, Manipal College of Pharmaceutical Sciences in India.

Her research resulted one international research paper titled “An *in silico* approach of coumarin-derived inhibitors for human DNA topoisomerase I” in Australian Journal of Chemistry in 2016. She has presented her research work in two international conferences; the 16th Asian Chemical Congress (16ACC), Dhaka, Bangladesh and the Seventh Asia-Pacific Conference of Theoretical and Computational Chemistry (APCTCC7), Kaohsiung, Taiwan in 2016. She has received an International travel grant (RGB/GEN/06/2016/01/01) from the National Science Foundation, Sri Lanka. She has made two other presentations at the Annual Sessions of the Institute of Chemistry Ceylon and the Annual Sessions of the Sri Lanka Association for the Advancement of Science. Mrs. Amali Guruge is a Computational Chemistry special degree graduate of the University of Colombo.

The Institute congratulates Mrs. Amali Guruge and her supervisors for successful completion of the project.

Cover Page

The cover photograph shows the Graduate Chemists at the 13th Convocation of the college of Chemical Sciences, Institute of chemistry Ceylon held at the Eagles' Lakeside Banquet & Convention Hall on 16th February 2017. This was the 34th batch and 102 students were formally awarded Graduate Chemist status and thereby increasing the overall production to a total of 1274. More formal photographs of the Convocation are on pages 52 - 53.

Commemoration of the Second Death Anniversary of Emeritus Professor JNO Fernando on 2nd March 2017



**President Mr. M R M Haniffa
giving the welcome address**



**Mrs. Mandrupa Fernando handing
over the Scholarship document to the
Dean, Professor P A Paranagama**



**Dr. Piya Ariyananda,
addressing the audience.**



**Mrs. Mandrupa
Fernando Addressing
the audience**



**Memorial oration by Vidya Jyothi
Emeritus Professor Eng. Dayantha
Wijeyesekera, on the subject
"Diversification of Tertiary Education
with Quality and Relevance"**



**Mrs. Mandrupa Fernando unveiling
the bust of late Professor J N O
Fernando**



**Bust of late Professor
J N O Fernando**



Audience at the ceremony



**Sculptor Mr. Dayananda
receiving the memento
from past president Mr.
K R Dayananda**

Commemoration of the Second Death Anniversary of Emeritus Professor JNO Fernando

The second death anniversary of the late Professor J N O Fernando was commemorated on 2nd March 2017 at the Adamantane House, Rajagiriya. The almsgiving was held in the morning at Sri Ganawansa Thripitaka Vidyayathanaya in Rajagiriya. His long years of dedicated services to the Institute of Chemistry Ceylon, the College of Chemical Sciences and the tertiary education in Sri Lanka were highlighted and appreciated at the commemoration ceremony held in the afternoon. A Bust of Professor Fernando was installed at the foyer of the Adamantane House. The Professor J N O Fernando Memorial Oration was delivered by Vidya Jyothi Emeritus Professor Dayantha Wijeyesekera. The criteria for selection of a suitable candidate for the Professor Oleap Fernando Memorial Scholarship Fund launched at the first death anniversary were formally announced during this ceremony. This Scholarship will be awarded to the selected candidate at the Annual Sessions of the Institute Chemistry Ceylon in June 2017. Mrs. Mandrupa Fernando, family members and former colleagues of late Professor Fernando, members of the IChemC, the staff and students of the College of Chemical Sciences participated at the ceremony. (pictures on page 46)

Professor J N O Fernando Memorial Oration

Diversification of Tertiary Education with Relevance and Quality

Vidya Jyothi Emeritus Professor Dayantha Wijeyesekera

It is my humble privilege and honour to be invited to deliver the first Professor J N O Fernando Memorial Oration on his second death anniversary. Professor Fernando (Oleap) well known to us, his friends and colleagues as J N O was actively involved in his professional and academic activities until he passed away a couple of days after his 71st birthday. He had very strong religious convictions, high academic and professional standards, large hearted social responsibility and firm political views, and did not mince his words.

Although there were many issues on which he and I agreed, there was one issue on which we did not. I often told him *“you should have come forward as the Vice Chancellor of the Open University which you developed so well as the Dean of the Faculty.”* With annoyance he used to retort *“I do not wish to be appointed to the Office of Vice Chancellor, by going through the current stupid procedure.”*

It has been often said why he was named by his parents as Oleap, having been born on the 29th of February 1944, during the world war torn days. He did live upto his name and leap frogged in many ways. My acquaintance with him dates back to the 1950s but before that his father and mine being sons of the Moratuwa soil had been close associates. We were together at the school by the sea and parted after the GCE O-levels temporarily because the subject he liked most was my dislike. This led him to pursue the traditional route in Higher Education through the conventional system at the University of Colombo,

while I opted to pursue the technical education route through the Junior Technical Officers' (JTO) course at Maradana Technical College and at the Institute of Practical Technology (IPT) Katubedda, now upgraded as the National Diploma in Technology (NDT) at the University of Moratuwa.

Building of Interests and Research

However, it is worth mentioning that I was motivated in the subject of Chemistry during my Technical Education by the well known teacher of the subject Mr Errol Fernando and similarly the interest in Geology which was the subject I disliked in my undergraduate studies, was kindled by the very practical Geotechnical Engineer Mr. Sithamparapillai from the Mahaweli Development Board visiting lecturer at the University of Moratuwa at that time. This combination of subjects gave rise to investigations on Thermal Hot water springs for various applications such as eco tourism, thermal energy, domestic purposes and above all for therapeutic uses with the usage of Chemistry through water samples tested and compared with those at various Health resorts worldwide such as in Japan, New Zealand and Australia with one of the best being close to Melbourne <http://www.peninsulahotspots.com>. Having illustrated my interaction with the two subjects Chemistry and Geology, which I disregarded in my early life and the valuable results produced thereafter as shown, the lesson I learned from it and later imparted to others was not to discard any knowledge gathered in early life as it

will not be known when such knowledge would be required subsequently.

Strangely, my research interest in thermal water springs led me to supervise my first research student on the therapeutic properties in Hot water Springs in Sri Lanka. He eventually earned a MPhil and PhD of the University of Moratuwa for this research.

The surveys and studies revealed that there are eleven hot water springs located in the eastern part of Sri Lanka. They showed different surface temperatures and flow rates.

The nature and origin of these hot water springs were important when developing these for economic use. Research has found that the origin of these hot water springs has a relationship with the major geological boundary of Sri Lanka.

- According to geochemical parameters Kapurella, Mahaoya and Padiyatalawa show similar conditions with chloride, sodium, magnesium, and potassium concentrations being almost the same.
- Mahapelassa showed an exceptionally high content of chloride, fluoride and bicarbonate compared to other locations.
- The pH of the hot waters also varies between springs at Kanniyai and Palanoya and all others, Kanniyai and Palanoya are acidic while others showed basic conditions.
- Temperatures of most hot water springs in Sri Lanka are over 40 °C except the Palanoya spring.
 - ❑ Hot water springs at Mahapelassa should be developed for eco-tourism and therapeutic uses.
 - ❑ The hot water springs in Kanniyai should also be developed for eco-tourism because their flow rate do not imply a large hot water aquifer inside.
 - ❑ The hot water springs categorized under the group Kapurella, Padiyatalawa, Mahaoya and others around the area should be developed for geothermal energy. The results of the study indicated that there is a possibility of exploring large geothermal sources in the area. However it should be confirmed after conducting high precision geophysical investigation and deep drill holes.

Bestowment of an Honour

With my interest in research continuing, it came as a surprise to me when JNO inquired from me whether I would accept an Honorary Fellowship of the Institute of Chemistry. My reaction was “why me?” when I am

no scholar in Chemistry! He then explained that it is the practice every year of the Institute of Chemistry Ceylon to nominate an eminent person from another Profession for the conferment of an Honorary Fellowship of the Institute and hence I was chosen. That enabled me to accept the Honour.

Parting and meeting of Paths

The parting of paths of JNO and me due to Chemistry at secondary school level was the cause of the beginning of my enthusiasm on alternative avenues and lateral entries in Tertiary Education, which interest JNO himself developed after his traditional academic career in Chemistry at the University of Colombo.

We both realized the need to diversify relevant tertiary education while maintaining academic standards and professional ethics and practices.

Alternative Avenues

In order to focus on the main topic of this oration which I feel is currently very topical to the crises in tertiary education which have surfaced, it would be prudent to indicate how both JNO and I diversified and promoted alternative paths in addition to the traditional routes in tertiary education.

JNO and I once again came together through this topic when I was appointed the Vice Chancellor of the Open University of Sri Lanka, and very soon he became the Dean of the Faculty of Natural Sciences. This was at a time when it was considered ridiculous to consider Science and Engineering Technology degrees through Open and Distance learning (ODL). We could confidently say that JNO and I along with the unstinted support of the other academic and administrative staff were able to scientifically engineer the two degree programmes to successfully become the first ODL degrees in the world in these disciplines. The operations at an ODL university have to be different from a conventional university with deadlines and time targets having to be kept, which JNO did so meticulously, setting an example to both staff and students.

This may be the reason why JNO, while being the Professor of Chemistry at OUSL, wanted to strengthen his skills and knowledge in Management and also Law by pursuing the courses of study at the same university. However due to academic conflict of interests the pursuance of the Law degree was not possible.

Fee-levying Tertiary Education

While there has always been resistance to fee

levying in tertiary education it was possible in the 1980s to very gently and tactfully impose a fee at the state Open University of Sri Lanka, as it was mainly for cost recovery purposes to supplement the grant from the Treasury. This has been done previously in another state institute involved in Business Management recovering cost on a similar basis. The success of its performance is evident from the upgrading of it to a degree awarding status as a school of Business Management.

Fee levying in Tertiary education, whether through State or Non- State institutions may be essential for the purpose of supplementing a grant to maintain quality, services and above all standards. It should, however, not be encouraged for commercial purposes, fleecing the students.

Foreign Qualifications

Historically, there have been foreign universities and international qualifications being awarded before local degrees and other professional qualifications were available. They are such as those which were offered by the University of London as external degrees, the University of Saskatchewan, Canada, also as external degrees at the Hardy Institute Ampara, on a S.E Asian sub-regional basis, City and Guilds qualifications, qualifications awarded by the Council of Engineering Institutions, UK, *etc.* These have all been fee levying in Sri Lanka (then Ceylon) while other students left Sri Lanka to pursue foreign tertiary education.

However, on their return to the country, those with foreign qualifications had to get their qualifications approved by the respective professional bodies to permit them to practice their professions in Sri Lanka.

More recently, now there are Off-Shore campuses in Sri Lanka, offering degree courses and also awarding the degrees of foreign universities, some of which are well reputed and others are not. As long as the degrees being offered by the foreign universities have the formal approval of the respective Academic Authorities of such universities, such as their respective Senates and Councils this would be acceptable as at present. However if they are professional degrees, the practice of the profession in Sri Lanka would depend solely on the accreditation and acceptance of those professional degrees by the relevant local professional bodies.

Local Academic and Professional Qualifications

With the establishment of the University of Ceylon

which later separated into the different state universities under the University Grants Commission, Universities established by individual Acts of Parliament, degree awarding institutes, and the professional bodies conducting their own examinations, the Higher Education component in Tertiary Education was expanded, strengthened and somewhat diversified.

University Education

Currently, there are 15 Conventional Universities including the Open University operating under the University Grants Commission.

Degree Awarding Institutes

At present there are Degree Awarding Institutes, though not termed Universities, approved by the UGC under the provisions of the Universities Act. It has to be carefully noted that unlike in fully fledged universities, the degree awarding status is granted for each specific programme of study and not at once to all the programmes in an institute. This is sometimes misinterpreted and misrepresented. For example, when a degree in Management is accredited in a degree awarding institute, it does not mean that a degree in Medicine or Engineering is also automatically accredited by the University Grants Commission or the respective local professional body.

Universities established under separate Acts of Parliament

At the moment there are four such universities established under their own Acts of Parliament, permitted to grant degrees.

Organisation of Professional Associations (OPA)

While there are currently over 30 member associations in the OPA, with many conducting courses of study, only about 10 such courses are deemed to be of degree equivalent standard. Some such institutes have been granted degree awarding status and some others essentially concentrate on Professional/ Charter Qualifications.

The Institute of Chemistry Ceylon caters for both Charter qualifications and other qualifications through different courses of study. However, the Institute has not been granted degree awarding status as yet.

The success of the Institute is very evident by the rapid growth in quantity and strengthening of quality. The credit for such development should undoubtedly

be given to the founders and pioneers such as Professor J N O Fernando.

Relevance, Recognition , Registration and Accreditation

The above aspects are of paramount importance in tertiary education. They should be considered from economic, academic, professional and somewhat political points of view purely for geographic reasons. Quality Assurance needs to be carried out on a regular basis. These aspects should be verified for each discipline of study in the institute

Relevance

A programme of study however attractive, novel, or popular it may be, if it is not relevant to the needs of industry and the country, it is necessary to be cautious in commencing and / or continuing same. This could be done through various market/needs surveys and determination of Human Resources development. The establishment of an institute and the connected infrastructure would have to be economically justified.

Recognition

The criteria for recognition should be rational. The membership of an Association granted merely on the payment of an annual subscription may not be the best measure of recognition of a foreign university or institute. There are reputed foreign and local universities and institutes not listed in the members' list merely because they have not paid their subscriptions and some inferior tertiary institutes get the recognition just because of the annual subscription they have paid.

Registration

There should be a stringent process for registration of a tertiary institute. This should be determined by the infrastructure facilities, staff resources, public utilities and services. The registration of an institute does not mean that a particular programme of study conducted there is accredited.

Accreditation

This is an exercise which has to be undertaken by experts in the subject area and determined by rigid criteria. Accreditation has to be regularly updated and done for each course of study.

Professional, Charter, Corporate, Incorporate, Licentiate status

In professional programmes of study, the above aspects should be reviewed by the relevant professional bodies as well, even though a degree has been awarded through legal provisions.

Whither Tertiary Education?

Tertiary Education covers a very wide spectrum. It is usually defined as post secondary school education, including Vocational, Academic and Professional Education and Training.

Professor J N O Fernando, being an eminent academic as well as a professional, not only promoted academic undergraduate, postgraduate and professional education, but also highlighted the need and importance of Vocational Education and Training and established training courses for Laboratory Technicians at the Institute of Chemistry Ceylon.

Finally, while diversification of relevant Tertiary Education and Training is essential to meet the development needs of the country, a clear understanding of the subtle differences and the interaction between these three subsectors in Tertiary Education and Training, viz Vocational, Academic and Professional, should be realized in order to maintain academic standards and professional ethics and practice. This applies not only to Medicine, but also to other leading professions such as Accountancy, Architecture, Chemical Sciences, Engineering, Law *etc.* Such efforts would avoid and defuse crises, prevent unnecessary provocations and facilitate the development efforts of those who love the motherland, by utilizing the knowledge they possess and gain at all levels for the betterment of the country.

13th Convocation: 102 Graduate Chemists and 95 DLTC Diplomates Pass Out

The 13th convocation of the 34th batch of graduate chemists and 42nd batch of DLTC diplomates was held on 16th February 2017 at the Eagle's Lakeside Banquet and Convention Hall, Attidiya.

DLTC Diplomates in Procession



Graduate Chemists in Procession



Academic Procession



Welcome address by the President, IChemC



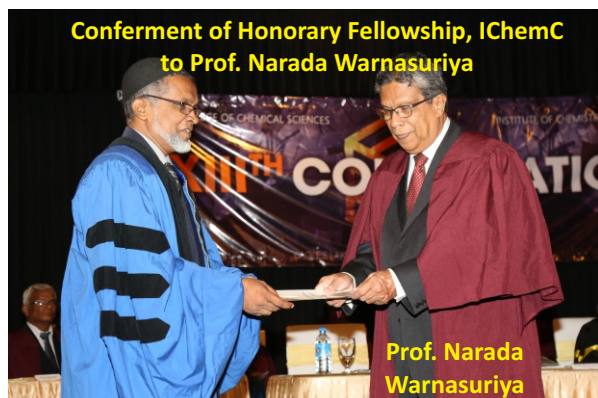
Mr. M R M Haniffa

Annual Report by the Hony. Rector, CCS



Prof. S Hewage

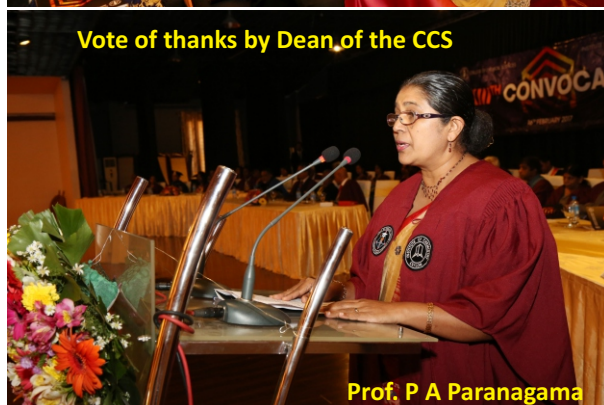
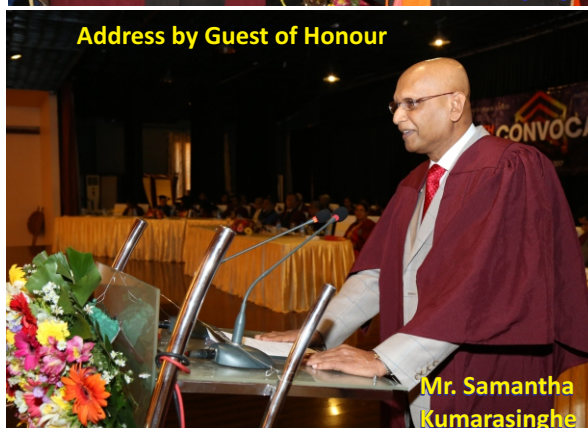
Conferment of Honorary Fellowship, IChemC to Prof. Narada Warnasuriya



Prof. Narada Warnasuriya



Guests and invitees



Thirteenth Convocation of the College of Chemical Sciences

Convocation Address

Desirable Attitudes in a Professional Chemist

Professor Narada Warnasuriya

Senior Professor of Paediatrics, Kotelawela Defence University

Emeritus Professor & Former Vice Chancellor, University of Sri Jayewardenepura

Being recognized by your peers in a discipline outside your own is an honour that any academic or professional appreciates. I am very grateful to Professor Sujatha Hewage, Rector of the College of Chemical Sciences and the Council of the Institute of Chemistry for inviting me to deliver this convocation address. I am aware that I am joining a galaxy of distinguished academics in doing so.

I consider myself as belonging to two professions, viz; medicine and teaching. This morning it is in my capacity as a teacher in higher education for over 43 years that I address you.

At the outset, I wish to congratulate the graduate chemists and the diploma holders of the laboratory technology in chemistry course who are receiving your certificates today. I offer you my best wishes for success in the professional path that you have chosen. Being the products of a unique institute of professional training with a highly credible track record I am sure that you will be received by whatever sector of our society that you join, with respect and expectation. It is upto you to fulfill that expectation and to advance in your career simultaneously.

Aims and objectives of the Institute of Chemistry include ensuring the maintenance of high standards in the professional activities and general conduct of its members and establishing and enhancing the status of the profession of chemistry in Ceylon (Sri Lanka).

I presume that the all the graduate chemists and even some of the more ambitious amongst the diploma holders are aspiring to become professional chemists, designated by the Institute as chartered chemists, in other words full members of the learned profession of chemistry.

It is appropriate at this point to see what is meant by a 'learned profession'. The essential characteristics of a learned profession have been summarized by Cruess and Johnston as follows.

- An occupation whose core element is based on the mastery of a complex body of knowledge and skills.
- A vocation where the practice of an art founded upon science and learning is used in the service of others.

- Its members are governed by a code of ethics and profess a commitment to competence and integrity.
- They are committed to promotion of public good within their domain.
- These commitments form the basis of a social contract between the profession and society.
- Society in return grants the profession a monopoly over the use of its knowledge base.
- The profession is given considerable autonomy in practice and the privilege of self regulation.
- The profession and its members are accountable to those served and to society.

These concepts which have been enunciated primarily with the medical profession in mind are as relevant to the learned profession of chemistry.

Professor J N Oleap Fernando the founder of your course stated this more succinctly in his address on "Choosing a rewarding career for sustainable success through a productive profession".

He identified the essential ingredients of a profession as follows

- Body of learning
- Experience and competence in practice based on that body of learning
- Responsibility and integrity in dealing with others in the application of that body of learning
- An Institute or organization that guarantees the standards of learning, of practice and of ethics

The principal attributes of any learned professional can be categorized in to knowledge, skills and attitudes. Everyone in this audience is likely to have a clear idea as to what knowledge and skills are but some are probably less clear as to what attitudes are and how they affect overall competence as a professional. I crave the indulgence of those who are already familiar with these concepts to elaborate on them for the benefit of the others.

In this context I note with admiration that the theme for the 75th Anniversary sessions of your Institute in 2016 was "Ethics, Values and Responsibilities of Chemists in National development" Mevan Pieris, a

former President of your Institute who delivered the keynote address summarized the concept beautifully.

I quote “The human mind is both rational and irrational in thinking capability. Humans have all kinds of beliefs and all beliefs are what the mind accepts as real. Some of our beliefs are valuable to us and are deeply cherished and get embedded in our minds as values which serve as a pair of lenses through which we see the rest of the world before us. Based on the values, attitudes result, and that show the mind reacts towards other things and the general environment. It is the attitudes that generate responsibilities and conduct of chemists”.

An attitude has a knowledge (cognitive) component, an emotional (affective) component and a behavioral (conative) component. It could be described as an idea or belief charged with emotion predisposing an individual to act in a particular way to persons, things, situations, issues *etc.* This becomes clearer if we give a specific example. President Trump has an attitude towards immigrants. We all have an attitude towards private higher education. An attitude has three characteristics, *viz*: **Direction** - favorable, unfavorable or neutral, **Intensity** (strength) - ranges from intense to apathetic, **Salience** (relevance)-perceived importance to the person holding it.

In a professional context attitudes have some overlap with values, competencies and soft skills but are distinct from them in many ways. Seldom does behavior result from one single attitude. Our actions are often shaped by a cluster of attitudes. Personality and character are two other related but distinct concepts which influence professional behavior and conduct. Character is the aggregate of all the persistent moral qualities of a person that combine to form his real nature. Simply stated it is the sum total of his virtues and vices. Personality on the other hand is composed of a collection of psychological characteristics or traits which determines your personal preferences and individual style of behavior.

For the purpose of this lecture the desirable attitudes of a professional chemist have been identified within this broad context. Not being a chemist myself, I had to resort to a broad based web search using a variety of keywords in various combinations. A few had compiled lists of desirable attributes. One website had a free flowing blog of ideas which was quite fascinating. I complemented this with informal discussions with a few professional chemists and perusal of biographical citations of many outstanding chemists, mostly from publications of the Institute of Chemistry. As it is not

possible to present all these lists separately I have picked the recurrent themes into a composite list which by no means is comprehensive.

Though I have perused codes of conduct for chemists, scientists, researchers, medical practitioners *etc.* prepared by various professional bodies including the American Chemical Society, Sri Lanka Association for Advancement of Science (SLAAS), National Science & Technology Commission (NASTEC) and Sri Lanka Medical Council (SLMC) in preparing this list, this is not a code of conduct. I have excluded universally applicable traits such as honesty, integrity and humility as they are implicit in many of the attitudes in my list. I have also left out some traits such as empathy and sensitivity which are more relevant to professions like medicine and teaching where direct personal contact with the professional and client occurs more frequently. This list which is based on the ideas of professional chemists is quite specific to them. It is clearly open to further expansion or contraction and refinement by a professional body like yours. The desirable attitudes or a frame of mind in a professional chemist include the following. (in alphabetical order)

- Analytical
- Creative
- Empirical
- Flexible
- Inquisitive
- Mathematically inclined
- Methodical
- Open minded
- Perseverant
- Practical
- Precise
- Rational

At first glance the list may seem somewhat disjointed and even contradictory. However, I assure you that these are ideas of chemists that occurred more than once in my search and were rationalized at least briefly. I will now briefly elaborate on each of them giving related attributes where relevant. I will be mostly paraphrasing the thoughts of chemists with only a little bit of my own input as an educationist.

Chemists have an **analytical** frame of mind. I think this goes without saying. They love to tease out the theoretical abstractions and test them in the laboratory. They tease out the details of what makes a certain structure tick. They can analyse data, extrapolate and extend them to research hypotheses.

They are **creative**, innovative and quite original

and ingenious in the way they plan their experiments. They are able to think creatively about a specific problem and believe that every problem has a solution.

However they are **empirical** in their approach and rely greatly on past experience. Their hypotheses are always based on observation. Standing on the shoulders of giants keeps them grounded in the fundamentals of the field and gives them a sense of direction.

Chemists are **flexible** and are prepared to work in different working contexts and conditions. They are ready to work as a member of a team or on their own. They have the initiative to adjust and adapt.

An inquiring mind is essential for a chemist. They are **inquisitive**. Driven by intellectual curiosity they question conventional thinking. The little piece of the puzzle that does not fit interests them most.

Making accurate measurements they are **mathematically inclined**. Having a respect for quantification they appreciate mathematics as a language of science. They know that correlations do not necessarily prove cause and effect and appreciate probability and statistics.

They are **methodical** and task oriented. They have a logical approach to problem solving. Laboratory work can be messy unless there is method in the madness!

Being **open minded** they leave preconceptions and biases at the door of the laboratory. They are capable of suspending judgment until the evidence is in. They are aware of the assumptions on which the conclusion rests. They are willing to change opinion when new facts emerge.

Chemists are patient and **perseverant**. Experimental studies take long to come to fruition. They have emotional toughness and long staying power even when nothing seems to come right. They are able to endure disappointments and persevere till they get it right.

Being mechanically inclined they are **practical** in their approach to work and feel comfortable doing bench work and in using complex equipment. Though fond of abstract conceptualization they are quite pragmatic and resourceful in the laboratory.

Of all the desirable attitudes of a chemist being **precise** is the *sine qua non*. They love replicating results and meticulous attention to detail is a must to achieve this. Careful observation and accurate measurement is a way of life for them.

Chemists are **rational** beings. They are loyal to reality and have an aversion to superstition and an

automatic preference for the scientific explanation. Unlike some other scientists they rarely gravitate into pseudo science.

Having identified the desirable attitudes in a professional chemist let us now focus on how they are acquired or formed. Our main interest is to know whether they can be inculcated during the professional training and if so how?

We learn our attitudes from direct experience with objects, phenomena and people related to the particular attitude. In early life our parents and family and later on school and peers fashion our attitudes. We know that our intelligence and personality are very much determined by our genetic constitution and the environmental influences especially in early childhood. Core values such as honesty, fairness and kindness are formed during early childhood.

However the professional attributes and attitudes we are concerned about, though influenced by these core values, are formed later in life. Attitudes towards science and chemistry may start to form while in school. Attitudes once formed are difficult to change. However they are not immutable.

Attempts to change attitudes are as old as human life on earth. With either selfish or altruistic motives community leaders, politicians, priests, scientists, teachers, doctors, social workers and many others have influenced attitude formation and change. They have used traditional approaches which are mostly intuitive. Rarely have they attempted a scientific approach which needs a systematic understanding of attitude formation.

If we are all agreed that the attitudes I listed earlier are indeed useful in being a good professional chemist it would be worthwhile if they are inculcated, or if already present, reinforced in all the trainees during their professional training. But this is easier said than done.

There are several evidence based approaches that one may use for this purpose.

The first is to select trainees who have an aptitude for chemistry. It is much more likely for a person with an aptitude for chemistry to have or develop positive attitudes which are expected in a chemist. I know that Professor JNO Fernando was a strong advocate for aptitude testing for University entrants. Though it is not practiced within the present scheme for university entrance mainly due to logistic reasons, non state sector institutions have the option of using it.

The next step is to explicitly publish the desired attitudes/attributes in the course prospectus. It will make a keen student to introspect and reflect whether

he already has the right attitude or not and hopefully, induce him to move towards it.

I was rather disappointed to see that neither the prospectus of the graduateship programme nor the UGC Subject Benchmark in Chemistry made any specific reference to attitudes to be acquired by a student. In contrast most benchmarks in professional disciplines did so. I was happy to see that the list of preferred 'qualities of mind' for a civil engineer mentioned in their subject bench mark had some overlap with our list. Their list is as follows.

- Creative
- Analytical
- Innovative
- Self disciplined
- Self motivated
- Inquiring mind
- Independent of mind
- Enthusiastic

The content of the training has to include both a theoretical input as well as some practical input including group work and brainstorming sessions relating to ethics, values and attitudes. Although it is almost a cliché to say that attitudes cannot be taught it is not strictly true. A knowledge (cognitive) input lays the foundation for attitudinal change. Now most modern medical curricula have a personal and professional development stream. They have not been there long enough to assess their impact on actual performance. The preliminary impressions are promising.

An important contribution to attitude formation in a professional training comes from planned exposure to peer influence. It is important that students are randomly allocated to group work. This ensures that they come across a variety of attitudes.

The most powerful tool for good attitude formation is role modeling. Teachers have to be professional role models. Students model their behaviour both consciously and unconsciously from the teachers they admire. Learning occurs through observation and reflection. The downside of this is that perfect role models are rare. Teachers need to be conscious of their role as "role models" in order to minimize any negative impact.

Finally teachers know that the most effective way of ensuring learning is to include some aspect of the attitudes to be acquired into the summative assessment. This is difficult but not impossible. There are ingenious ways of testing attitudes but no way to ensure that they are sustained into professional practice!

The Institute of Chemistry Ceylon has an Institutional culture of quality. It has a long and proud history of academic and professional achievement. It is replete with a galaxy of exemplary role models whose portraits adorn its walls and whose biographies are documented for posterity. Tracer studies of its graduates confirm a high return to society. Thus it has all the pre requisites to embellish its graduate profile with an attitudinal component. I hope I have stimulated your interest in this endeavour and wish you success.

Thank you for your undivided attention.

Senior Professor Sujatha Hewage, *C.Chem., F.I.Chem.C.*

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

It gives me great pleasure and honour to present the Honorary Rector's Report for the year 2016, highlighting the achievements and the progress made in its educational activities at the College of Chemical Sciences of the Institute of Chemistry Ceylon.

First and foremost I wish to remember and recognize the unparalleled contributions made by the late Professor J N O Fernando, at this second convocation held after his passing away. He had committed and devoted his life to the development of the College of Chemical Sciences to a status where the two programmes, GIC and DLTC are in high demand today. His vision in human resources development in the area of Chemical Sciences has gained much recognition in the country.

Professor Fernando's demise is a great loss to the Institute of Chemistry Ceylon and to the college. He gave the leadership for the development of educational programmes to what it is today and for the construction of the four storied Adamantane House with adequate facilities under one roof to conduct educational activities thus removing the difficulties faced by the College. His dream was realized during his life time. I still remember how happy he was at the inauguration of the new building, Adamantane House, in 2005. He was happier when the extension was completed in 2013. We, at the College are greatly indebted to him for his vision and his achievements. Today, the student community at the Institute of Chemistry Ceylon, including school leavers, late developers, adults and middle level employed persons, is enjoying the fruits of his efforts to become professionally qualified chemists, to serve the nation.

2nd of March 2016, the first death anniversary of the late Professor J N O Fernando was commemorated. His more than 40 years of dedicated and committed services to the Institute and the College resulting in stable and flourishing education activities were duly recognized and remembered. The staff and students of the College of Chemical Sciences joined the memorial service at the Holy Emmanuel Church, Moratuwa on 29th February 2016 to remember and celebrate the life of the late Professor.

The Institute of Chemistry Ceylon organized a series of activities to commemorate the event. A Dhamma sermon delivered by the Reverend Professor

Indurugare Dhammaratne Thero of the University of Kelaniya was held on 1st March at the newly constructed roof top of the Adamantane House. This was followed by an alms giving on 2nd March 2016 at the Sri Gnanawasa Tripitaka Vidyayathanaya, Rajagiriya. In the afternoon a special Christian Prayer Service was held followed by the launch of the Professor J N O Fernando Memorial Scholarship Fund. In addition to these activities, the Alumni Association of the College of Chemical Sciences refurbished a laboratory of the President's College, Rajagiriya in memory of Professor J N O Fernando and the opening ceremony was held on 7th February 2016.

In a few weeks time, on the 2nd of March 2017, the 2nd death anniversary of Professor Fernando will be commemorated in a fitting manner by the members of the Institute of Chemistry Ceylon including the students and the staff of the College of Chemical Sciences. A Bust of Professor Fernando will be installed at the foyer of the Adamantane House, followed by the Professor J N O Fernando Memorial Oration. The Professor Oleap Fernando Memorial Scholarship Fund will be inaugurated and the criteria for selection of a suitable candidate will be formally announced on 2nd March. The Scholarship will be awarded to the selected candidate at the Annual Sessions of the Institute Chemistry Ceylon in June. So far 1.5 million rupees has been collected for the fund.

75th year of the Chemical Society of Ceylon and the Institute of Chemistry Ceylon

The year 2016 marked the 75th anniversary of the Chemical Society of Ceylon, the predecessor to the Institute of Chemistry Ceylon. The 75th anniversary was celebrated by organizing a three day Symposium on, "Environmental Challenges for Sustainable Development" organized by Professor Oliver Ileperuma in September 2016. Hon. Minister Patali Champika Ranawaka was the Chief Guest at this event.

A very successful three-day CHEMEX-4 exhibition was held from 26th to 28th January 2017 at the Sri Lanka Exhibition and Convention Centre (SLECC). The Exhibition was inaugurated on 26th January 2017 by the Minister of Science and Technology, Hon. Susil Premajayantha. This Exhibition was mainly focused on school children with many stalls from the Institute

Chemistry Ceylon and universities displaying novel, attractive and very interesting exhibits, based on the chemical sciences. Many government institutions and private sector institutions participated at this event. Apart from the exhibits, magic shows and chemistry seminars were held to educate the students. In addition, the Inter University Debating competition and the Award Ceremonies of the Australian National Chemistry Quiz Competition and the All Island Interschool Titration Competition were also held on 27th January 2017. Dr. Mohamed Infas was the overall coordinator of these events and his commitment resulted in a well planned and well implemented activity. We thank him for his efforts and also the staff and students of the CCS who contributed whole heartedly to the success of the CHEMEX-4.

Graduateship in Chemistry (GIC) programme

The 39th intake of students for the year 2017 for the GIC programme had recorded the highest number of 250 students registering for the programme and the official inauguration was held on 7th January 2017. Professor S P Deraniyagala participated as the chief guest. The GIC programme is conducted during the weekend as well as on 3 days of the week to accommodate the large number of students registered to follow the programme. Although the numbers are increasing year after year, satisfactory arrangements have been made to give a quality programme for the students. The course is not only restricted to teaching chemical sciences, as we have the responsibility of producing Professional Chemists who are required to serve the nation. We strive to produce highly qualified Professionals possessing quality knowledge and skills in chemical sciences with ethical and moral values and leadership qualities making them employable immediately after graduation. Several laboratories with adequate facilities to carry out practical training to develop skills, a library with latest text books with fully computerized facilities are available to gather knowledge and a computer laboratory are provided with adequate facilities to improve modern computer based knowledge including research. The student community at the College is multiethnic and multireligious and hence opportunities are provided to celebrate their religious and cultural activities, encouraging all the students to participate in these activities. The students take part in many sports activities and there are a large number of clubs and societies to cover the interests of the students. These activities contribute to the personality development of

the students.

The GIC programme is one of the most successful tertiary level programme in Sri Lanka producing Professional Chemists needed by the private sector and the government sector. Graduate chemists also have the opportunity to do postgraduate programmes in chemical Sciences, locally as well as abroad. Many have successfully completed the PhD programmes abroad and have joined the CCS as academics. Being based in Colombo the pool of academics is vastly enlarged due to the availability of academics in the State Universities, Government Institutes and Private sector. The visiting academics, therefore, helps to maintain high standard of GIC education programme for our students. Today, at this convocation 102 students are graduating. The total number of graduates produced so far then reaches 1273.

Diploma in Laboratory Technology in Chemistry (DLTC)

A record number of 120 students so far have been registered as the 44th batch for the year 2017 and the inauguration was held on 13th January 2017 with Mr. D M R D Dhanapala, Principal of the School of Medical Laboratory Technologist, National Institute of Health Services, Kalutara, as the Chief Guest. This was the first formal education programme commenced by the Institute of Chemistry Ceylon in 1973. It was designed to meet a pressing need to provide middle level technical expertise required by the Government and Private sector. This is the only such course available in any field of sciences in Sri Lanka. The Diploma programme is designed to provide school leavers to follow a technical job oriented programme. This course also would help to improve the knowledge and skills of those already employed in medical and industrial laboratories. The programme is especially geared to produce Industrial and Food Chemistry Technologists and Clinical Laboratory Technologists where there is a huge demand. At this convocation 95 students are receiving their diplomas making the total number of diplomates produced to 1196. In the near future facilities for this programme will be improved by establishing two new fully equipped Biochemistry and Microbiology laboratories. These laboratories will be fully functional during the second semester of this year's programme benefitting not only DLTC students but many other undergraduates and research students.

Adamantane House

As the enrollment of students for the two

programmes has been increasing gradually over the years, and with 250 students registering for the Graduateship programme in Chemistry and 120 students registering for the Diploma in Technology in Chemistry course this year, the space at Adamantane House is being stretched to the maximum. Anticipating the increasing number of students to the programme in the future, the facilities at the Adamantane House will no longer be adequate. Our negotiations with the Urban Development Authority over the last year gave positive results enabling us initially to obtain a plot of eighty perches land on lease at Malabe and negotiations are continuing to obtain a larger plot of land. Already 17 million rupees has been paid and soon the new building project will commence to accommodate the increasing number of students. We hope to build a fully fledged building complex for educational activities with facilities for hostels and sports activities and we are hoping to commence activities there in 2018.

New B.Sc. Special Degree Programme in Chemistry

We have been planning to commence a 4 year B.Sc. Special Degree programme in Chemistry for the past few years. The lack of space prevented us from pursuing this matter to its logical conclusion. As we have obtained an eighty perches land at Malabe from the Urban Development Authority and the new building project being initiated, we are hoping to commence this programme during the next year. The commencement of this programme requires the accreditation of the course and we have already submitted the documents to the Ministry of Higher Education for this purpose. We are confident that we will be able to commence this programme during 2018. Although the B.Sc. programme will be commenced in the near future, our professional programme, the Graduateship in Chemistry programme will continue as usual producing Professional Chemists.

Preparation of documents for accreditation was no easy task. A large number of documents have to be collected from the inception of the GIC programme to prepare the corporate plan for 5 years. This tedious work was on the shoulders of Professor Sukumal Wimalasena. She spent long hours at the Institute for many months to prepare the documentation. We record our sincere appreciation of Professor Wimalasena for her untiring and dedicated efforts to see through the process. Professor Sithy Iqbal helped in finalizing the documents for submission to the Ministry of Higher Education. We thank Professor Iqbal for her efforts to submit the document in an acceptable format.

Academic Staff

Professor Priyani Paranagama (Chair of Organic Chemistry, University of Kelaniya) continued to serve as a Senior Visiting Professor and her services have been extended for another year. She has been appointed as the Dean, College of Chemical Sciences in July 2016 and would hold the position until December 2017. Professor Priyani Paranagama delivered the eighth Inaugural Professorial Lecture on “A Journey through Sri Lankan Medicinal Plants, Essential Oils and Endolichenic fungi: bioactivity and value addition” on the 8th of June. Professor Oliver A Ileperuma, Emeritus Professor, University of Peradeniya delivered the ninth Inaugural Professorial Lecture titled “From coordination chemistry to semiconductor photochemistry and solar energy conversion: a voyage through four decades of research” on 28th October. After serving the College for one year he left the Institute at the end of January 2017. Professor K A S Pathiratne continues as a Senior Professor at the College. Professor S P Deraniyagala joined the CCS on 1st January 2017 as a visiting Senior Professor in Chemistry. Dr. Radhika Kandiah has been granted overseas leave for one year.

Seventeen new Teaching Assistants were appointed with effect from 1st December 2016 for one year. The teaching assistants not only assist in conducting practical courses, they also help in seminar and workshop organization and involved in research. These activities prepare them to pursue postgraduate studies as well as train them for future employment. Five Teaching Assistants resigned and joined the Industrial sector and we wish them well in their new careers while thanking them for their contributions to the CCS.

New Computer Centre

A new Computational Research and Learning Centre (CRLC) was established in February 2016 at the level V of the Adamantane House. The centre is equipped with a few research computers to perform Computational Chemistry research. Dr. Chinthaka Ratnaweera who holds a PhD in Computational Chemistry is the in-charge of the centre. Undergraduate and postgraduate students use this centre to conduct research in Computational Chemistry. The Centre also helps the students in writing and formatting project reports and it conducts computational practical courses for undergraduates. Computational Chemistry is a new emerging area which at times help to reduce long hours of laboratory work substantially by using

computational methods.

Library

A complete library automation system which is used worldwide was installed in the library. This system helps the students and staff to have an easy access in searching required books. Alumni Association donated books worth Rs. 500,000 related to Chemical Sciences to the library and Dr. Ranmal Gunatillaka coordinated this activity.

Inauguration of the Professor E R Janz Laboratory

Professor E R Janz has made significant contributions to the teaching activities of the Institute of Chemistry Ceylon. He is one of the three who had been conducting lectures for Diploma in Laboratory Technology in Chemistry (DLTC/LTCC) and also for Graduateship in Chemistry (GIC) programme from its inception in 1979. He was the coordinator of the DLTC programme for many years. To appreciate his dedicated services to the academic activities, the Council decided to name a laboratory in his honour.

The Inauguration of the Professor E R Janz Laboratory and unveiling of his portrait was conducted on 10th January 2017 at the Adamantane House. Professor E R Janz oration was delivered by Emeritus Professor Ajit Abeysekere and Emeritus Professor Vijaya Kumar unveiled the portrait painted by Mr. Mevan Pieris.

Research

The College encourages the 3/4 level students to do research and those who are unable to do so are now required to offer at least a literature survey course or be involved in a seminar presentation.

A total of 5 research assistantships have been provided enabling our internal staff to conduct research leading to postgraduate degrees. I am happy to record that one of the first research grants holders, Dr. Chandanie Udawatte and her research assistant Mrs. Amali Guruge have concluded their research and Amali successfully defended her thesis titled "Coumarin derived inhibitors for human DNA topoisomerase I and II: An *in silico* approach". She will be receiving her M.Phil. from the University of Colombo. Dr. Samantha Weerasinghe from the Department of Chemistry, University of Colombo was a co-supervisor of the research project.

Ms Guruge's research resulted in one international publication in Australian Journal of Chemistry in 2016 and two conference publications in Taiwan and Dhaka,

Bangladesh. Two other presentations were made at the Annual Sessions of the Institute of Chemistry Ceylon and the Annual Sessions of the Sri Lanka Association for the Advancement of Science.

Dr Chandanie Udawatte has also successfully supervised three undergraduate students on "Molecular docking and molecular dynamic studies of coumarin derivatives binding to oncogenic proteins" and their research work has been presented at the Annual Congress of the Asian Chemical Societies (FACS) in Bangladesh.

Several other research projects are also being conducted by postgraduate students under the supervision of academic members and the titles of those are; Decarboxylation of waste Coconut Oil and comparison of acid values; Evaluation of bioactive compounds in peel, pulp and seed kernel of selected mango varieties from Sri Lanka; Bioactive Secondary metabolites from endolichenic fungi; and Status of toxic elements in selected rice varieties grown under different management systems and Enhancing crop productivity and minimizing toxic heavy metal uptake of four economically important agricultural plants in Sri Lanka by using tea waste biochar.

Collaborations/affiliations with foreign universities

The College of Chemical Sciences has established credit transfer programmes with the University of Cincinnati and Truman State University in USA, and the University of Northumbria in UK. Discussions were held to have a similar arrangement with Deakin University, Australia. Some students have already joined Cincinnati and Truman universities to continue their degree programmes with the first two year credit transfer.

In October 2016, a three member delegates visited the College of Chemical Sciences to educate our students on the credit transfer scheme. They reviewed the University MOU between the University of Cincinnati and the Institute of Chemistry Ceylon. The students who have a cumulative GPA above 3.0 in their first two years of study at the CCS have the opportunity to enroll into the four year B.S. Degree programme of the University of Cincinnati in the third year. Scholarships worth of US\$ 7000 to 15000 will be available depending on the GPA value. This programme is coordinated by Professor K A S Pathiratne.

Co-Curricular activities

Several popular talks were held during the course

of the year 2016. A popular talk on “Integration of chemical safety, security and sustainability and opportunities at the OPCW” was delivered by Dr. Rohan Perera on 14th January 2016. Professor K A S Pathiratne conducted a popular lecture on “Instrumental methods of chemical analysis: Important facts frequently ignored” on 7th June 2016. Emeritus Professor S. Sotheeswaran delivered a popular talk on “Pharmaceuticals from marine organisms” on 19th November 2016. Two more popular talks were delivered by Dr. Leena Dharmaratne on “Sonochemistry and its applications: Ultrasound initiated radical formation and electron transfer reactions in aqueous solutions”, and by Dr. Ananda Seneviratne on “Biochemical analysis of monoclonal antibodies and antibody drug conjugates in cancer therapeutics” on 23rd November and 27th December 2016, respectively.

Professor Pathiratne also coordinated two, one day training seminars on “Atomic Absorption Spectrometry” on 16th August 2016 and “Atomic Spectrometric techniques on elemental analysis” on 22nd November 2016. A seminar on “Chemical handling and laboratory safety” was held on 6th May 2016, coordinated by Dr. U S K Weliwegamage and Dr. U K Jayasundara. A seminar and workshop on “Bioassay methods in natural product research” was held on 30th September coordinated by Professor Priyani Parangama and Dr. Dinusha Udukala.

Students' Council

The Annual General meeting of the Students' Council was held on 11th September 2016 at the P P G L. Siriwardene auditorium. The office bearers were elected and Mr. Thanvir Shiraz was elected as the President and Ms. Oshani Nayanathara as the Secretary for the year 2016/2017. Dr. Mohamed Infas serves as the Mentor of the Students' Council. The new student representatives of the Sports Council were also appointed and Dr. Ranmal Gunathilake was appointed as the Sports Mentor.

Extra-Curricular activities

The College encourages the students to conduct and participate in extracurricular activities in order to enhance their soft skills including leadership, communication, social and organization skills and sports in a formal manner. These included religious activities; Vesak and Poson celebrations, Christian Thanksgiving Mass, Eid, Navarathri, and Christmas celebrations, the talent show AURA-2016 which

displayed the hidden talents of the students, CCS and Inter-University debating competition, Cricket, rugby, Badminton, Basketball and Martial Arts (Karate) *etc.* Some of these competitions were won by the College students and received awards and Gold medals. The College annually provides a substantial amount of funds towards these activities.

We have an active Alumni Association and a Career Guidance Unit. There are several clubs; The Gavel club, Rotaract, Analytical, Organic Chemistry, Photography clubs and there is also an active Saukyadhana Unit. Students participate in the activities of these clubs depending on their interests.

Students participated in several social service activities in 2016 which were conducted by clubs and societies. These include blood donation campaign, an eye clinic, helping in flood relief activity, donation of food and cloths.

There were several chemistry popularization programmes conducted throughout the year in 2016. Among them are, All Island Inter-School Chemistry Competition, Australian National Chemistry Quiz Competition and the initiation of the Chemistry Olympiad. These competitions are conducted to increase the enthusiasm in Chemistry and enhance the practical skills of the Advanced Level students.

Acknowledgement

It is my privilege and duty to acknowledge those who supported the activities of the College of Chemical Sciences of the Institute of Chemistry Ceylon during the past year.

Professor Fernando's demise is a great loss to the Institute and the vacuum created is even felt today. However the former President of the Institute of Chemistry Ceylon, Mr. K R Dayananda and the current President, Mr. M R M Haniffa, the former Rector of the College of Chemical Sciences, Professor S P Deraniyagala, together with Professor H D Gunawardhana, Professor M D P De Costa, Mr. E G Somapala and the Registrar of the CCS, Mr. N I N S Nadarasa, with the other academic and non-academic staff supporting them, activities of the Institute and the CCS were conducted in a professional manner during the past two years. I wish to record our greatest appreciation and gratitude to them for their contributions to the Institute and the CCS.

We made satisfactory progress during the last years due to the unwavering commitment, determination and cooperation of the entire staff of the CCS and ICHEMC, the members of the Council, academic board

and other committees and many members of the ICHEMC. I also acknowledge with many thanks, their support and contributions.

I wish to highlight the role of the CCS personnel including academic staff, teaching assistants, the staff of the office, library, laboratories and the finance section, who have worked tirelessly throughout the year in conducting many activities as well as the work associated with the convocation. Their support and cooperation is very much appreciated and acknowledged with gratitude.

There are many who contributed to the 'Rector's Fund' which was established last year. The fund has been renamed as "Professor Oleap Fernando Memorial Scholarship Fund". Our sincere thanks go to all the contributors to the fund for their kind gesture. The fund is still growing and the total collection stands at 1.5 million rupees as at present. The criteria to award the scholarship is being worked out and the selected candidate will receive the award at the Annual Sessions of the Institute of Chemistry Ceylon which is to be held in June.

Conclusion

The College has moved forward steadily in line with our objectives during the period under review. We have been able to sustain both GIC and DLTC programmes at a very high standard. However, we need to remember that we still have a long way to go for which, your support and encouragement is very much needed. The demand for GIC and DLTC programmes is increasing steadily.

The success of students is our responsibility and we need to continue to monitor the academic performance of students and ensure that they receive guidance and assistance at all times.

The new building project has become a major requirement to accommodate the increasing number of students. With the possibility of commencing the four year B.Sc. Special degree programme in Chemistry in the near future, need of space has become much more urgent. The support and commitment of the alumni, members and well wishers are required to build a modern structure with essential facilities to conduct, fully fledged, internationally accepted, Chemistry programmes. The dedication and commitment of all are required to successfully implement the building project.

On behalf of the College, may I call upon our graduates, parents, students, staff, members and well-

wishers to extend the fullest support and cooperation in the years ahead in order to achieve our goals.

Thank you all for your kind presence today and for your patient hearing.

Chemicals of mass destruction targeting malarial mosquitoes

Professor S Sotheeswaran

Emeritus Professor of the University of the South Pacific, Fiji

Destroying mosquitoes of the genus *Anopheles*, that spread the deadly disease referred to as malaria, was once done using the chemical named dichlorodiphenyltrichloroethane (DDT) (Figure 1). Though DDT was a popular and effective destroyer of these mosquitoes, the use of DDT was subsequently banned as it is a persistent organic pollutant of the environment. This has no doubt resulted in the spreading of malarial mosquitoes and many millions of people, including children, being killed annually by malaria in many tropical countries.

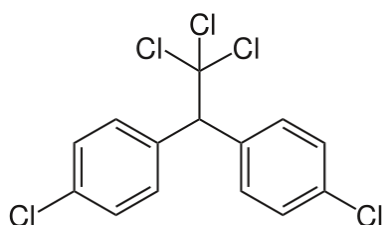


Figure 1. Structure of DDT

Destroying malarial mosquitoes is an urgent need. Scientists are now thinking of using humans as baits to kill these mosquitoes. People living in the areas where malaria is rampant will be dosed with a drug called ivermectin. Those suffering from malaria cannot be cured by ivermectin. But by dosing prospective sufferers with this chemical, it would be possible to eradicate malarial mosquitoes as the chemical is poisonous to mosquitoes. How does this work? When mosquitoes bite humans dosed with ivermectin, they suck the human blood which contains sufficient concentration of this chemical. Mosquitoes do not tend to fly far off from the place they hatch, and experiments have suggested that if most of the inhabitants of the villages are dosed with ivermectin, they could collectively do serious damage to the local *Anopheles* population. This would substantially reduce the number of cases of malaria in an area.

Ivermectin can thus be referred to as a new chemical of mass destruction for destroying malarial mosquitoes.

Ivermectin was discovered in 1975 and came into medical use in 1981. It is on the World Health Organization's List of Essential Medicines for the

treatment of some tropical diseases such as filariasis, river blindness, scabies and several other tropical diseases in Africa. The wholesale cost in the developing world is about US \$ 0.12 for a course of treatment.

Is it ethical to dose people with an anti-*Anopheles* chemical? As mentioned above, it is not a new drug used by people in tropical countries. However, drugging healthy people to kill *Anopheles* mosquitoes is something we have to think about seriously. Another problem is that ivermectin, once administered, does not remain in the human body long enough to make this a concerted anti-mosquito campaign and to make this look like a realistic proposition to eradicate malaria.

However, the scientists at the Massachusetts Institute of Technology (MIT) along with the medical scientists at Brigham and Women's hospital in Boston, USA, have devised a means to keep ivermectin concentrations in the human blood at mosquito killing levels for far longer than has previously been possible by melting E-caprolactone with powdered ivermectin. The use of E-caprolactone was to effect a slow release of ivermectin into the blood from the stomach over a period of 14 days. Modification of this slow release of ivermectin into the blood has been achieved and animal studies have been successful. Human clinical trials are to be started in 2017 and if successful, millions of people prone to malaria can be saved annually in tropical countries. Research is underway on the two ivermectins B1a and B1b, whose structures are given below Figure 2.

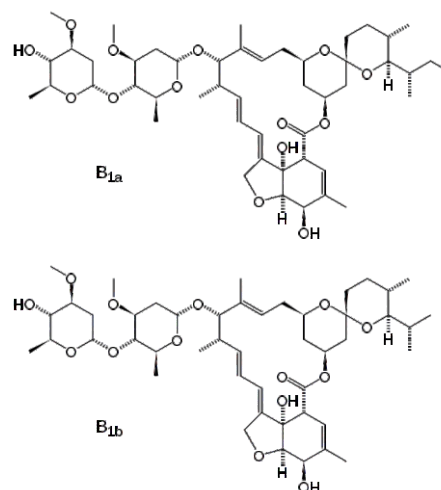


Figure 2. Structures of Ivermectins B1a and B1b

How Opium was “Tamed”

Dr. Chayanika Padumadasa

Senior Lecturer, Department of Chemistry, University of Sri Jayewardenepura

Many pain killers may have made their way into medical practice since the advent of morphine. Although, two centuries may have passed since the birth of one of the most widely used pain killers, it still holds on to its position as the gold standard which the potencies of other pain killers are compared with. The roots of morphine date back to an era where civilizations existed. Opium which is the resinous gum obtained from the opium poppy seed (Figure 1), *Papaver somniferum* was first cultivated from a wild strain, *Papaver setigerum*. Mention about opium is found in a 6000 year-old Sumerian tablet and the Greek classic, *The odyssey*. Even the Egyptian pharaohs had placed opium in their tombs. During this era the effects of opium were considered as magical and mystical, no surprise that even today morphine, which is derived from opium stands out as the premier drug used for extreme pain and in end-of-life care.



Figure 1. Opium poppy seed pod exuding resinous gum from a cut

It was only after centuries later that opium was declared a pain killer by the Greek great, Hippocrates. The famous Greek physician Galen used it to treat a variety of ailments, including poisoning, venom, vertigo, headache, epilepsy, deafness, vision problems, asthma, jaundice, urinary problems, fever and leprosy. This long list of medical symptoms raises a few eyebrows today, but the patients never complained, as all they cared for were the sleep and the euphoria associated with morphine so that they could forget about the ailments they were having. Portuguese sailors are thought to be the first to smoke opium, diverting from the usual trend of either eating or drinking it. Opium was more popular for its use in recreation, rather than medical.

By the 1800s opium made its way to the top as the painkiller of choice. However, the effects were so

unpredictable. It is when a 21 year old pharmacy assistant in Germany, Freidrich Wilhelm Adam Sertürner (Figure 2) heard frustrated physicians grumbling to his boss about the unpredictability of this drug, that he began his quest to isolate the active ingredient. He knew if he succeeded, he could standardize the dosages. Working after hours on the pharmacist's old equipment, Sertürner eventually isolated an organic compound from the resinous gum secreted by the opium poppy seed. Sertürner found that opium with the isolated compound removed had no effect on animals, but that the isolated compound itself had 10 times the power of processed opium. He named that substance morphine (Figure 3), after Morpheus, the Greek god of dreams, for its tendency to cause sleep. Contrary to popular belief at the time, the substance produced was an alkaloid, the first ever derived from a plant source. This not only was the birth of morphine, but this also paved the way to the emergence of natural products chemistry and the origins of modern pharmaceutical industry.



Figure 2. Freidrich Wilhelm Adam Sertürner (1783-1841)

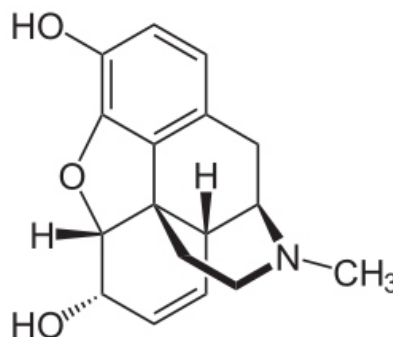


Figure 3. Structure of morphine

Sertürner tested the drug on a few dogs, but they died. Sertürner's lack of credentials and the poor scientific method, made morphine not to be accepted

among the medical community. Discouraged by this, he decided to set aside his work on morphine. Even he may not have realized that a wonder drug was on its way, until years later when he was compelled to use a small dose of it on himself for a troublesome toothache. After waking up from a sound nap, he discovered the remarkable effectiveness of this drug. He conducted a few trials on children living in the area and found out that it was quite safe and reliable. He was ably supported by the French physician, François Magendie who conducted trials on morphine. In 1818, Magendie published a paper on morphine's pain relieving and sleep-inducing qualities. By the mid-1820s, pharmaceutical companies, including that founded by Heinrich Emanuel Merck, were producing standardized doses of the drug. This marked the birth and emergence of the potent opioid analgesic, morphine. In 1831, Sertürner won an accolade for his remarkable discovery.

Ironically morphine was initially marketed not only as an analgesic but also as a cure for addiction to both alcohol and opium until it was found out later that

its addictive properties were far greater than those of opium. Addiction to opium had been a growing concern even in the 1800s. Even diacetylmorphine (heroin) was discovered on the way to finding a cure for addiction to morphine.

The discovery of the hypodermic needle in 1853 by the French surgeon Charles Pravaz and the Scottish physician Alexander Wood who worked independently of each other, enabled morphine to be administered directly into the blood stream, thereby increasing its potency. Today, drug delivery systems have advanced so much that morphine can be administered as an epidural injection and also in patient controlled pumps.

From opium, mainly an agent used for recreational purposes, morphine has emerged as a potent alleviator of suffering through the untiring work of a pharmacy assistant, Freidrich Sertürner, who was little-known-about at that time. His timely discovery has also unrooted research into natural products chemistry and led to the development of modern pharmaceutical industry.

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.

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 3years of such payment) is entitled for these benefits. All members are advised to pay the membership fee for life and become beneficiaries.

PUBLICATIONS OF THE INSTITUTE OF CHEMISTRY CEYLON

Monograph	Title	Author	Price
01	Textile Fibers	Mr T Rajasekeram	Rs.50/-
02	Principles of Food Preservation	Prof U Samarajeewa	Rs.75/-
03	Biotechnology	Prof C P D W Mathew	Rs.75/-
04	Recombinant DNA Technology	Prof J Welihinda	Rs.75/-
05	*Natural Toxins in Foodstuffs	Prof E R Jansz & Ms A S Perera	Rs.50/-
06	Fat Soluble Vitamins	Prof E R Jansz & Ms S Malavidana	Rs.50/-
07	Nucleic Acid and Protein Synthesis	Prof J Welihinda	Rs.75/-
08	Extraction of Energy from Food	Prof J Welihinda	Rs.50/-
09	Corrosion of Materials	Dr A M M Amirudeen	Rs.75/-
10	Vitamin C-Have all its mysteries been Unravalled ?	Prof E R Jansz & Ms S T C Mahavithanage	Rs.75/-
11	*Environmental Organic Chemistry	Prof S Sotheeswaran	Rs.150/- (US \$3)
12	Enzyme Kinetics and Catalysis	Prof (Mrs) S A Deraniyagala	Rs.100/-
13	Insecticides	Prof (Mrs) Sukumal Wimalasena	Rs.95/-
14	Organotransition Metal Catalysts	Prof S P Deraniyagala & Prof M D P De Costa	Rs.75/-
15	Some Important Aspects of Polymer Characterization	Prof L Karunanayake	Rs.75/-
16	*Hard & Soft Acids & Bases	Prof (Mrs) Janitha A Liyanage	Rs.65/-
17	Chemistry of Metallocenes	Prof Sarath D Perera	Rs.65/-
18	Lasers	Prof P P M Jayaweera	Rs.65/-
19	*Life and Metals	Prof (Mrs) Janitha A Liyanage	Rs.75/-
21	*Silicones	Prof Sudantha Liyanage	Rs.65/-
22	*Pericyclic Reactions: Theory and Applications	Dr M D P De Costa	Rs.65/-
23	Inorganic NMR Spectroscopy	Prof K S D Perera	Rs.65/-
24	Industrial Polymers	Prof L Karunanayake	Rs.75/-
25	*NMR Spectroscopy	Dr (Mrs) D T U Abeyunga	Rs.65/-
26	Mosquito Coils and Consumer	Ms D K Galpoththage	Rs.100/-
27	*Atomic Absorption Spectrometry	Prof K A S Pathiratne	Rs.100/-
28	Iron Management on Biological Systems	Prof (Ms) R D Wijsekera	Rs.100/-
29	Nutritional Antioxidants	Prof. (Mrs) Sukumal Wimalasena	Rs.100/-
30	*f-Block Elements	Prof Sudantha Liyanage	Rs.65/-
31	*Scientific Measurements and Calculations	Prof (Mrs) S A Deraniyagala	Rs. 80/-
32	Applications of Organometallic compounds in Organic Synthesis	Dr. Chayanika Padumadasa	Rs. 60/-
33	Organosulfur Compounds in Nature	Prof. S Sotheeswaran	Rs. 200/-

* - Second Edition /new print published on popular demand

CCS Publications

01	Functional Group Analysis in Organic Chemistry	Prof AAL Gunatilake & Prof S Sotheeswaran	Rs. 175/-
02	Zinc Metalloproteins	Prof (Ms) R D Wijsekera	Rs. 175/-
03	Conformational Analysis and Reactivity of Organic Molecules	Prof S Sotheeswaran & Dr. (Ms) H I C de Silva	Rs. 175/-
04	Marine Organic Chemistry	Prof S Sotheeswaran	Rs. 175



General Publications

- ★ Historical Accounts of the Educational Activities (1972 - 2004) (Rs.350/-)
- ★ Polymer Industries of Sri Lanka (Rs. 200/-)
- ★ Industry & Environment (Rs. 200/-)
- ★ Herbal Medicine Phytopharmaceuticals and Other Natural Products: Trends and Advances (Rs. 500/-)
- ★ Chemistry in Sri Lanka (Rs. 150/-)



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	08
FRSC	02
Chem, MRSC	08
MRSC	26
AMRSC	12
Affiliate /Under Graduate.	<u>10</u>
Total Membership as at July 2016	<u>66</u>

2. Committee of Management

The following were elected to the Committee at the 55th Annual General Meeting held in July 2016.

Hony. Chairman - Mr S Perasiriyana
Hony. Secretary - Dr W G Piyal Ariyananda
Hony. Treasurer - Mr. I M S Herath

Committee Members -

Mr. R M G B Rajanayake
 Prof. Sudantha Liyanage
 Dr. Poshitha Premarathne
 Dr. M Sirimuthu
 Dr. P Iyngaran
 Mr. Sulith Liyanage
 Mr. Wasantha Samarakoon
 Mr. Viraj Jayalath

Co opted Members

Dr. M.K. Deeyamulla
 Prof. W S Fernando
 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 Graduateship Examination in Chemistry Levels 3/4 Theory Examination
- (d) Have an exhibition stall in CHEMEX 2017 – Chemistry Exhibition Planned to be held in January 2017

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

Dr Piyal Ariyananda
Hony Secretary

Naming ceremony of the “E R Jansz Laboratory” and Unveiling of Portrait of Professor E R Jansz

A laboratory at the College of Chemical Sciences was named after Emeritus Professor E R Jansz on the 10th of January 2017. A portrait of Professor Jansz was unveiled on the day of the event, in order to felicitate his long and dedicated service to the Institute of Chemistry Ceylon, particularly towards DLTC and GIC programmes. An oration was delivered by Professor Ajith Abeysekara, Emeritus Professor, University of Sri Jayewardenepura. The portrait which was painted by Mr. Mevan Pieris was unveiled by Professor Vijaya Kumar, Emeritus Professor, University of Peradeniya.

Professor Ajith Abeysekara delivering the oration



Section of participants



Professor Jansz opening the E R Jansz Laboratory by cutting the ribbon



Memento presented to Professor E R Jansz by Dr Mohamed Infas



Unveiling of Portrait by Professor Vijaya Kumar



**Professor
Vijaya Kumar**

**Mr. Mevan
Pieris**

**Professor
E R Jansz**