

CARBOHYDRATE NEWS LETTER

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FROM THE EDITOR'S DESK ...

The chemistry and biology of carbohydrates is an emerging field of interest, especially in the post-genomic era. The importance of carbohydrates and their conjugates in several biological processes including energy storage, transport, modulation of protein function, intercellular adhesion, malignant transformation, signal transduction, and viral and bacterial cell surface recognition, underlie a significant pharmaceutical potential and now recognized to provide welcome carbohydrate-based lead molecules for investigation. To a great coverage, carbohydrates exert their influence in the body by interacting selectively with proteins, frequently on cell surfaces. Fundamentally, these interactions narrate the glycome, the complete set of carbohydrates in an organism, to the proteome, its complement of proteins. In the past few years, the field of functional glycomics has developed to better understand these interactions, for example many glycan-binding proteins are found to involve in immune system recognition. Now it is becoming clear to many scientists that most mammalian proteins are glycosylated, and microbial systems and plants can have their own unique monosaccharide building blocks and special ways they can be interconnected and branched into unusual structures.

In the current era of genomics, proteomics, glycomics and other -omics, the exponential enhancement in potential therapeutic targets is placing an ever-increasing demand on access to novel and diverse chemical libraries. Structural intricacies of carbohydrate molecules and their preference to form varied linkages, substitutions, and branching patterns have fascinated many generations of chemists, as have the three-dimensional phases of carbohydrate interactions with other biomolecules. The steadily increasing biochemical knowledge in this area has further added to the increasing importance of the field now referred to as "glycobiology" or, more generally, "glycoscience". Though, most of the emphasis over the last 50 years or so has been on two other classes of important biopolymers, namely nucleic acids and proteins. However, in the "post-genomic era", complex carbohydrates can no longer be neglected.

Carbohydrates present both potential and problems, one of the classic challenges in the field of carbohydrate chemistry is that carbohydrate-based compounds and conjugates are notoriously hard to synthesize. Progress has continued on strategies to simplify and automate oligosaccharide synthesis and to facilitate the construction of larger and more complex glycopeptides and glycoproteins. In addition to advancing the construction of oligosaccharides, chemists are also making strides in the ability to assemble glycopeptides and glycoproteins. These are important synthetic targets, not only from a basic research standpoint but also because they play essential biological roles. Moreover, lack of carbohydrate-based drugs is not surprising considering that our understanding of fundamental glycobiology is a rather recent development. Hence, there is an urgent need of a "dialogue" between synthetic glyco-chemists, glyco-biologists and representatives of pharmaceutical companies in order to "conjugate" the synthetic expertise with a deep knowledge of the biological targets and pharmacology.

In this endeavor, the CARBO Conference is a timely attempt by ACCTI to discuss recent developments in medicinal carbohydrate chemistry and ask to people to join the ACCTI to shape their future in carbohydrate chemistry which is a very hot area right now.

Greetings and best wishes

RAMA PATI TRIPATHI

Editor, Carbohydrate News Letter



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Lucid Colloids Ltd. is a premier producer of Guar and other hydrocolloids for 32 years with a 50-year knowledge database inherited from its parent company Indian Gum Industries Ltd (IGI).

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Xanoluc™	Xanthan gum.
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Presidential Address

CARBO-XXVII, CSIR-Central Food Technological Research Institute, Mysore

December 13-15, 2012

Respected Prof. Ram Rajasekharan, Director, Central Food Technological Research Institute, Mysore, Mr. Uday Merchant, Managing Director, Lucid Colloids Ltd., Mumbai, Dr. P. L. Soni, Dr. P. V. Salimath, Prof. Naveen Khare, Dr. Vasudeva Singh, Dr. G. Muralikrishna, distinguished guests, academicians, industrialists, technologists and my beloved students.

I take this opportunity to welcome you on behalf of the executive committee members of the Association of Carbohydrate Chemists and Technologists India.

The Association was formed in 1984 under the leadership of Dr. H. C. Srivastava and it is almost as old as the International Carbohydrate Organization. Under the leadership of Dr. Srivastava and other members including Dr. Soni, who is on the dias today, the Association continued to grow.

The main purpose of this Association is to bring Scientists, Technologists and Industrialists together for some meaningful research. A conference like this one is organized every year for this purpose. The Association has its own website and publishes a yearly news letter. Most importantly the Association publishes an International Journal called 'Trends in Carbohydrate Research'. Dr. Soni will be talking about this.

Until 1946, sugar molecules were considered to be the source of energy and sweetness. But, the discovery, by Avery and Heidelberger, that the pneumococcal polysaccharide can be used for vaccination against pneumonia changed this concept. Today we all know that the carbohydrate, the second-most abundant biomolecule in nature, plays the most crucial role in almost all biological processes - cellular interaction, drugs or enzyme-inhibitors and many more.

Thus, to understand the chemistry of these molecules, the structure determination of sugar polymers or glycoproteins has become extremely important. Synthesis of biologically important oligosaccharides or neo-glycoproteins has also become absolutely essential. Synthesis of novel sugar molecules or molecules containing sugar residues and evaluation of their biological properties as drug candidates is the recent trend in carbohydrate research.

To carry out productive research it is absolutely essential that the biological study of these new molecules is carried out for the benefit of mankind. Earlier this was not easy due to lack of mutual trust and research interest. But now, realizing this requirement, the Council of Scientific and Industrial Research (CSIR) has come up with new programmes, which I believe will be highly beneficial.

And not only in biology, carbohydrates have tremendous use in various industries. The use of guar gum has increased rapidly. Therefore, we need the development of other gums like TKP or starch from various sources and to process them for industrial applications. Today, we are very fortunate to have Mr. Uday Merchant with us as Chief Guest. He will enlighten us about the present scenario of gums and their derivatives, as used in the Industry.

The role of carbohydrates in biology and their application in the Industry is well established. But we should not forget the basic science behind all this. It is essential that we continue our research in developing new methodologies and new technologies, which I am sure, will bring about new inventions or products.

The application and use of carbohydrates in various areas is ever-increasing. The translation of discoveries into products is extremely important in the present day scenario. Scientists, Technologists and Industrialists should work together to achieve fruitful results. This conference at CFTRI-Mysore can be a good platform.

As a scientist, I personally believe that only meaningful and fruitful work can bring success and fame. The Association is with you and will help you in all respects within its resources, whenever required. Although this Association is continuously gaining popularity, we must increase our visibility. I invite all of you here to be member of the Association.

The visibility I was talking about will come automatically if our research is productive. I can see many accomplished scientists and budding energetic students sitting here. The country needs you for path-breaking discoveries.

In the next two days, you will get the opportunity to listen to lectures by accomplished scientists as well as young and upcoming scientists and students in the form of oral presentations and poster presentations. I am sure this will enrich us and expose us to the diverse world of carbohydrates.

I would like to end here, and welcome you once again to this august gathering.

Thank you,
Asish Kumar Sen,
(President, ACCTI)

Invitation to CARBO XXVIII

The organizing committee of the XXVIII Carbohydrate Conference (CARBOXXVIII) and the Association of Carbohydrate Chemists and Technologists (India) cordially invite you and your colleagues to participate in the meeting to be held at FRI, Dehra Dun from January 20-22nd, 2014. The theme of the conference is: **“Challenges in Chemistry and Biology of Carbohydrates”** For details about the conference, please contact the organizing secretaries:

Dr. Vineet Kumar, Scientist-F Chemistry Division FRI, Dehra Dun- 248006 Uttarakhand, India, Tel: [O] +91-135-

2224210 Mobile: +91 9410555335 E-mail: drvineet@gmail.com: and

Dr. Praveen K Gupta, Scientist-E Head, Cellulose and Paper Division FRI, Dehra Dun- 248006, Uttarakhand, India. Telephone: [O] +91-135-2224386 Mobile: +91 9358126046 E-mail: guptatcr@yahoo.com:

Details about the conference will also be available on the website of the association: <http://www.accti.in>. We look forward to your active participation in CARBO XXVIII at the beautiful city of Dehra Dun.

Glycoconjugated Porphyrins and their Promising Application in Photodynamic Therapy

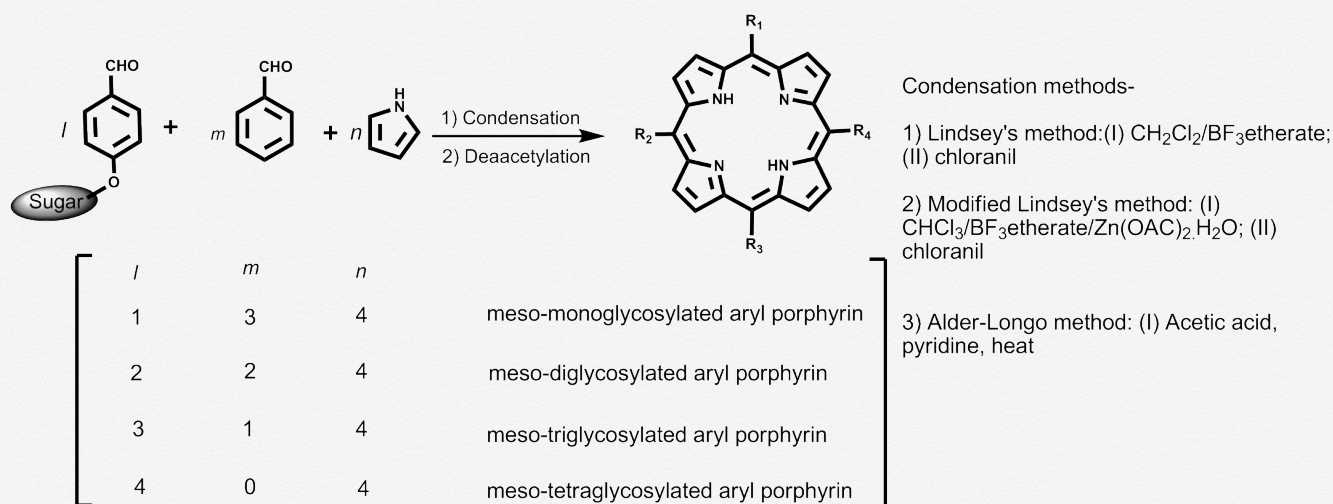
Divya Kushwaha and Vinod K. Tiwari*

Department of Chemistry, Centre of Advanced Study, Banaras Hindu University, Varanasi-5, India

*Email: tiwari_chem@yahoo.co.in

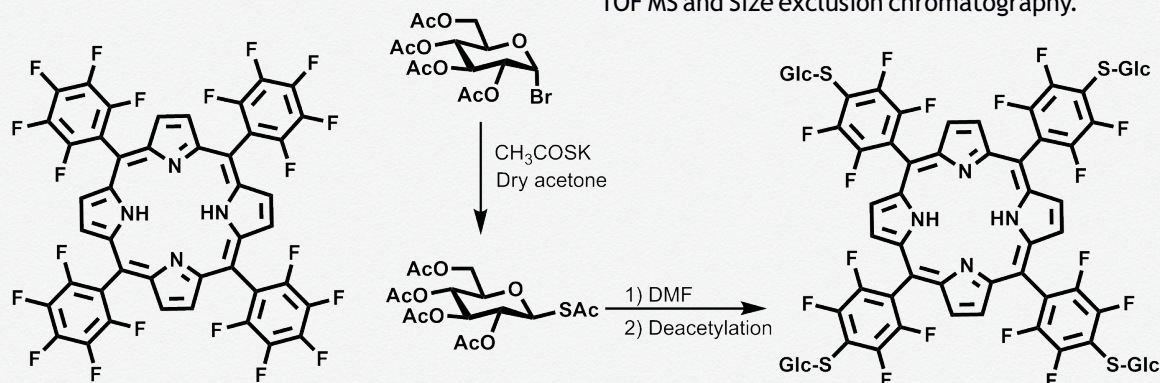
Porphyrin and their derivatives are naturally occurring abundant molecules as they are essential component of several bio-molecules (hemoglobin, cytochromes, vitamin B-12, chlorophyll etc.) that participate in biological processes ranging from oxygen transport to photosynthesis, from catalysis to pigmentation changes.¹ Various porphyrin based molecules exhibiting fascinating properties have been designed by suitable substitution of this macrocycle. Among the potential applications of the porphyrin variants, photodynamic therapy (PDT) is an interesting one and has been immensely explored in glycoconjugated porphyrins.² PDT is a non invasive approach of cancer treatment where porphyrin acts as a photosensitizer that upon exposure to a particular wavelength of light generates lethal singlet oxygen to kill tumor cell. The sugar moieties installed over this hydrophobic porphyrin provides the water solubility to the entity. In addition to this, multiple representations of saccharides onto the photosensitizer increases their selectivity towards tumor cell receptors via carbohydrate-

mediated cell recognition processes. This way, the whole glycoconjugated porphyrin system can act as a promising PDT sensitizer and therefore; the development of glycoporphyrin derivatives is important. However, the main challenge in their synthesis is the lack of expeditious methodologies. Till date almost all the developed porphyrin glycoconjugates have been synthesized either by condensation of carbohydrate-containing benzaldehydes with pyrrole or by the insertion of protected sugars over the pre-synthesized macrocycle framework. From the former approach porphyrin is obtained in two steps including condensation of carbohydrate benzaldehyde with pyrrole under trifluoroacetic acid or BF₃-etherate catalysis to porphyrinogen and then their oxidation with DDQ or chloranil.³⁻⁵ With the use of two different types of aldehydes in particular stoichiometric ratios meso-substituted porphyrins containing variable number of sugar substituent can be achieved. Though, this method often results in lower yields of target compounds.



Scheme 1. Synthesis of glycosylated porphyrins having variable number of sugar substituent

Another route of glycoporphyrin synthesis involves introduction of sugars over the pre-formed porphyrin core by the use of various coupling methodologies. The yield in this case depends on efficacy of improvised coupling strategy.



Scheme 2. Synthesis of porphyrin-carbohydrate conjugates

For example, in several efforts promising PDT sensitizer has been prepared by the S-glycosylation of pentafluorophenyl groups of porphyrin by the reaction with *N,N*-dimethylformamide (DMF) and diethylamine at ambient temperature.⁶ Similarly, in many instances carbohydrates are successfully linked through porphyrins by Cu(I) catalyzed click reaction.⁷

So far, there are many reports available in literature where very promising PDT sensitizers based on glycoporphyrin system have been developed by connecting sugars through the hydrolytically resistant C-, S- or N-glycosidic linkages.⁷ Additionally, most of them comprises of tri- and tetraglycosylated substituents to the meso positions of porphyrin.⁸ However, reports on porphyrin glycodendrimer that contains large number of sugar moieties is scarce and yet to be explored.

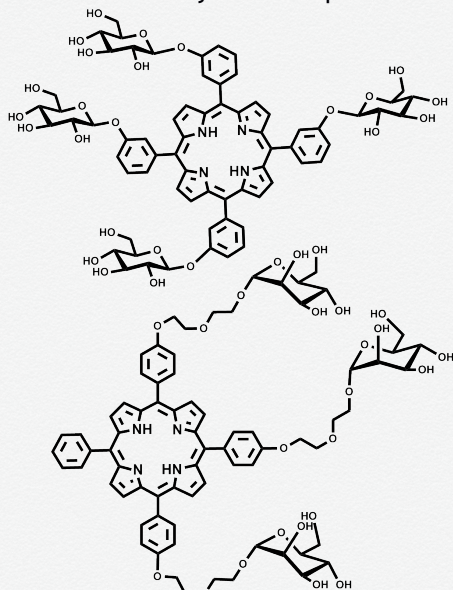


Figure 1. Some Glycoporphyrin sensitizers

In this context, we have prepared porphyrin-cored glycodendrimers by adapting convergent synthetic strategy using Cu(I) catalyzed click reaction. Azide-functionalized glycosylated dendrimeric wedges have been coupled with alkyne-functionalized meso-positions

of porphyrin using click reaction for the access of dendrimers featuring multivalent sugar moieties at the periphery. The complete structural elucidation of developed dendrimers is done by ¹H, ¹³C NMR, IR, MALDI-TOF MS and Size exclusion chromatography.

Furthermore, absorption-emission behavior of dendrimers under the influence of dendritic environment is also examined which displayed insignificant changes as compared to the porphyrin core.⁹

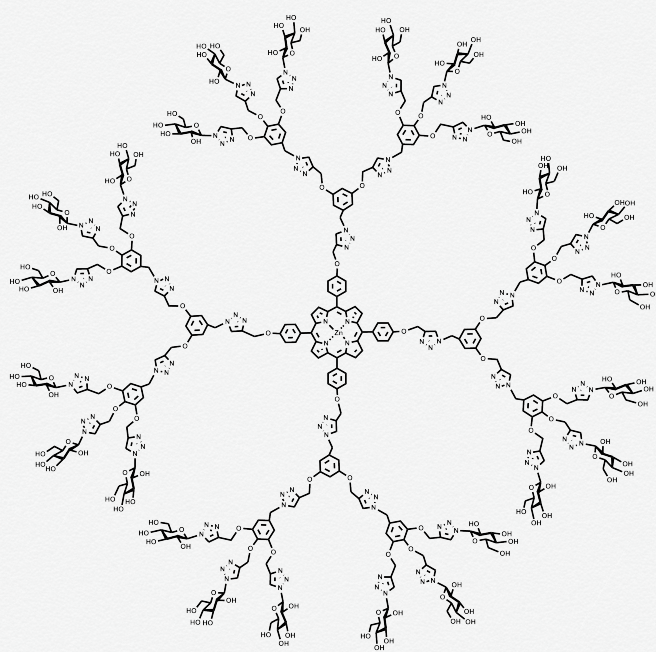


Figure 2. Developed Porphyrin based Glycodendrimer

Acknowledgement: VKT thanks to CSIR, New Delhi for funding the project.

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Proximate Composition and Physico-Chemical Studies of Indian Genotypes of Maize (*Zea mays* L.)

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Maize varieties (18 numbers) were procured from VPKAS, Almora, Delhi and Directorate of Maize Research, ICAR, New Delhi, India. They were milled in Mc-Gill polisher after tempering with water. The milled products consisted of large and small grits, meal and bran. Total Amylose equivalent in large grits varied from 17 to 32% (db), in small grits 14 to 36% (db). Soluble amylose equivalent in large as well as small grits varied from about 10 to 20% (db). On lines of rice classification, based on only total amylose equivalent, tentatively these maize varieties have been classified into ten high amylose varieties (27-35%), seven intermediate amylose varieties (23-25%) and one low amylose variety (~ 16%). Among these 18 varieties, a few of the samples were selected based on their genotypic attributes of dent and flint kernel types and speciality traits viz., high-quality protein corn, popcorn, baby corn and sweet corn. Proximate composition of these genotypes were studied

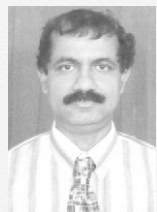
whose moisture content varied from 8 to 13% (wb), protein: from 10 to 14%, fat: from 4 to 6%, ash: from ~1 to ~2% and carbohydrate (by difference): from 70 to 73%. Cooking behavior in a Brabender amylograph indicated that their Gelatinization temperature (GT) varied from 71 - 75 °C, peak viscosity: from ~ 270 to 450 BU, hot paste viscosity and cold paste viscosity varied from ~ 260 - 350 BU and 500 to 760 BU respectively. A few of the genotypes showed least break down (5 to 10 BU) indicating that they behave like cross linked starches, set back values indicated that they undergo high retrogradation (~ 240 - 410 BU) on hydrothermal or thermal treatment. Phytochemical studies involving estimation of soluble and bound polyphenol contents, carotenoids, tocopherols, free radical and hydrogen peroxide scavenging activities, ferric reducing power and anti-oxidant capacity studies of these genotypes of maize are in progress.

Award Winners of CARBO XXVII - 2012



Life Time Achievement Award - 2012

The Association of Carbohydrate Chemists and Technologists of India (ACCTI) is privileged to honor the most successful chemists, biologists and technologists in the country who are working in the field of Glycoscience by giving them Life Time Achievement Award comprising of a Plaque, Citation, Shawl and Cash award of Rs. 25,000 from Lucid Colloid group, Mumbai annually. Recently **Dr. K. P. Ravindranathan Kartha** was awarded this Life Time Achievement Award for the year 2012 at CARBO XXVII held at CFTRI Mysore, on Dec. 13-15, 2012.



KP Ravindranathan Kartha is Professor in the Department of Medicinal Chemistry. He received his MSc from the University of Calicut and PhD from Gujarat University (working at ATIRA, Ahmedabad). After his PhD in the year 1984, he joined CFTRI, Mysore as a Scientist in the Department of Grain Science & Technology and remained there until 1986. During the period of 1986-2003, except for a short period between 1992-94 during which period he remained at the RRL Jammu, India, he held academic/research positions in Gifu University, Gifu, Japan; National Research Council, Ottawa, Canada; University of St Andrews, St Andrews, Scotland and the University of East Anglia, Norwich, England after which he took up his current post in NIPER.

His major interests are in the area of application of synthetic carbohydrate chemistry to solving problems in cell biology and in the isolation, characterization and exploration of biological activity of natural products. Structural/Functional characterization of (and application of Chemotaxonomy to) Ayurvedic formulations and development of pharmacopoeial standards for their quality control and evaluation.

Published more than 68 papers in National and International peer reviewed journals of high repute. Written around 7 book chapters in several books. Dr. Kartha is Vice President of Association of Carbohydrate Chemists and Technologists and Editor, Asia-Pacific, Trends in Carbohydrate Research. Dr. Kartha hold the following positions in past at NIPER Mohali : Chairman, Library Committee and In-Charge Library, Member Standing Purchase Committee-II, Chairman Standing Purchase Committee-II, Chairman Central Instrumentation Committee, Member Senate and Member/Chairman of various other institutional committees from time to time

Responsibilities currently being held at NIPER:

Chief Warden NIPER Hostels, Chairman Pharmaceutical Heritage (PH) Committee and In-Charge PH Center Chairman, Safety Committee, And Member/Chairman of various other institutional committees from time to time.

Award for the 'Best Paper Published in TCR' 2012



Dr. Ashok K Prasad, Professor of Chemistry at University of Delhi has been awarded Third 'Best Paper published in TCR journal' entitled as "Diastereoselective Acetylation Studies on 4-C-Hydroxymethyl-1, 2-O-isopropylidene-3-O-alkyl- β -L-threo-pentofuranose: Key Precursor for Biocompatible Sugar-PEG Copolymers" Trends in Carbohydrate Research 3, 42-50, 2011, authored by D. Mathur, K. Bohra, S. Bhatia, M. Kumar, P. Verma, R. K. Saxena, V. S. Parmar, A. K. Prasad, at CARBO XXVII held at CSIR-CFTRI, Mysore, 2012. The award is given every year by the ACCTI and includes a citation and a cash award of Rs. 20,000 only (Rs. Twenty Thousands only).

Dr. Prasad, did his B.Sc. and M.Sc. from Bihar University, M.Phil (1987) and Ph.D. (1990) from Delhi University, (India). Research Associate at Ranbaxy Research Laboratories (1990-91), Senior Research Associate at DU (1991-92). DANIDA fellow at University of Southern Denmark (1992-96), Scientist B at Delhi University (1996-2001), Visiting Associate Prof. at University of Southern Denmark. Associate Prof. DU (2001-2009), Full Prof. DU 2009. DST-DAAD Visiting Research Scientist, Max Planck Institute, Dortmund, Germany, Visiting Scientist at CAM,

UMass Lowell, MA, USA, CSIR-CNR Visiting Research Scientist at ICB, Catania, ICB, Naples and University of Rome, Italy.

Research Interest: Nucleic Acid Chemistry: Novel Synthesis of modified nucleosides of biological importance; Biocatalysis and Biotransformations: Green Synthetic Methodology Development; Chemistry of Natural Products: Isolation of Bioactive compounds; and Synthesis of Bioactive Heterocyclic Compound.

Research Publications: 178, Patents: 7, PhD Thesis Supervised: 15, Invited Lectures 105; Presented 178 Research poster. Handling four Research Projects funded by DU-DST, DRDO, DBT and IGSTC New Delhi.

Honorary Diploma for Scientific Achievements and International Scientific Collaboration by Russian International Charitable Foundation "Scientific Partnership", Moscow, Russia (March 2013).

Member of "International Society for Nucleosides, Nucleotides and Nucleic Acids", France. Life member of "Indian Science Congress Association", Calcutta. "Chemical Research Society of India (CRSI)", Bangalore. "Association of Carbohydrate Chemists and Technologists (India)". "Indian Society of Chemists and Biologists", Lucknow. "Biotechnology Research Society of India".

Third "Excellence in Carbohydrate Research" award - 2012



OBITUARY: The Association of Carbohydrate Chemists and Technologists (India) deeply mourns the sad and untimely demise (9 Feb 2013) of Professor **D. Loganathan**. He always gave his utmost to the Association and helped in making it a great platform for bringing together all researchers of the

carbohydrate field. His immense contributions to the field by way of his publications shall always guide us and show us the way towards excellence in carbohydrate research & development. The executive body and the members of ACCT(I) pray to the almighty that his soul rests in peace and the members of his family have the strength and courage to bear this immense loss.

ACCTI has lost a quite capable and knowledgeable person in the field of carbohydrate chemistry. We had lot of hopes on him in the future events of the Association.

Vasudev Singh

The news of the untimely demise of Prof. Loganathan is indeed shocking. I pray almighty for his soul to rest in peace and also to give enough strength to the bereaved family to sustain from this great loss.

C P Rao

Oh, it is extremely sad news. We had great memories with Dr. Loganathan at ACCTI and remember his noble character. I pray almighty for his soul to rest in peace and his family to have great strength to overcome this loss.

Bharat Joshi

Dr. Loganathan was a very cooperative & intelligent academician and will always be remembered by all specially by ACCTI. May god give his family the strength to overcome this huge loss.

Naveen Khare

Dr. Loganathan (Now Late), Visiting Professor, TAG-VHS Diabetes Research Centre, Chennai, Former Professor, Department of Chemistry, Indian Institute of Technology Madras, has been awarded Third Excellence in Carbohydrate Research by the ACCTI at XXVII Carbohydrate Conference held at CFTRI, Mysore. The award is given every year by the Association of Carbohydrate Chemists and Technologists (India) and includes a citation and a cash award of Rs. 20,000.00 (Rupees twenty thousand only). The award is sponsored

by M/s. Sunita Hydrocolloids Pvt. Ltd., Rajasthan. His educational qualifications are: Ph. D. (Indian Institute of Bombay in year 1985 in Organic Chemistry), He worked as : Research Assistant at Hindustan Lever Research Centre, Bombay, India 1985, Research Executive at Research Centre, Hoechst India Limited, Bombay, India 1985-87, Postdoctoral Research Associate, Division of Medicinal and Natural Products Chemistry, College of Pharmacy, Medical School, The University of Iowa, Iowa City, USA 1987-90. Postdoctoral Research Fellow, Department of Biological Chemistry, Medical School, The University of Michigan, Ann Arbor, USA, 1990-92. Assistant Professor, Department of Chemistry, Indian Institute of Technology Madras, 1993-2000. Associate Professor, 2000-03. Professor, 2004-12. His area of Specialization was: Recognition of glycan (carbohydrate) components of cell surface glycoproteins and glycolipids (an important event in inflammation, cancer, viral infections). Elucidation of the structural basis of cell surface glycoproteins and glycolipids interactions a fundamental and challenging problem in glycobiology research. His research program was focused on the synthetic and biophysical aspects of carbohydrates. Dr. Loganathan has more than 57 research publications in journal of high repute as Journal of American Chemical Society (JACS), Tetrahedron, Tet. Lett., Tet. Assym., Glyconj. J., Glycobiology etc. He has given more than 29 invited lectures in different universities and institutes. He has Supervised 9 Ph. D. Students, Dr. Loganathan has 3 patents.

Third C. G. Merchant Memorial Lecture - 2012



Dr. P. V. Salimath, Director S&T unit and Scientist in the Dept. of Biochemistry and Nutrition in CFTRI Mysore, gave Third C. G. Merchant Memorial Lecture at XXVII Carbohydrate Conference, held at CFTRI, Mysore. An honorarium of Rs. 10,000.00 is given to the speaker along with traveling allowance.

Dr. Salimath obtained his M.Sc. degree in Biochemistry from Karnatak University, Dharwad in 1977. Ph. D. from University of Mysore. Post-doctoral research fellow at Max-Planck Institute for Immunobiology, Freiburg, Germany (1981-83). Worked on Structure-function relationship of bacterial lipopolysaccharides. Joined CFTRI as Scientist in the Department of Biochemistry and Nutrition. Since 1984 he has established his own research group in the area of Glycobiology. Worked at Harvard Medical School, Boston, USA (1992), at La Jolla Cancer Research Foundation (1993). At Harvard Medical School he worked on effect of high glucose in cell culture model using radioisotopes. At CFTRI he has contributed significantly to the area of Food Carbohydrates and in recent years he is working on Glycobiology related complications during diabetic nephropathy and the role of diet. He has more than 90 research publications of International repute and has 6 patents and one of them is granted US patent. He is a fellow of the Association of Food Scientists and Technologists. He has trained several students for Ph. D degree and are well placed.

Dr. Salimath gave his talk on the "Biomedical applications of polysaccharides", an abstract of his talk is given below:

which are found in abundance in nature. They are present in all living organisms, both plant as well as animal and are known to perform diverse functions and in recent years are being exploited for biomedical applications. Modified polysaccharides such as phosphorylated carboxymethyl-cellulose and phosphorylated amidic carboxymethyl-cellulose are both used to prepare 3D scaffolds and functionalize titanium oxide surfaces with the aim to improve the osseointegration with the host tissue. Polysaccharides such as hyaluronic acid and chondroitin sulfate are known to serve structural and functional roles. Hydrogels composed of chondroitin sulfate modified to varying degrees with (meth)acrylate groups are being optimized for specific cartilage regeneration operations. In recent years, polysaccharides isolated from marine sources are being increasingly explored for biomedical applications such as drug delivery and preparation of bioadhesives. These bioadhesives seem to be good candidates for bone or soft tissue gluing applications in surgery. Polysaccharides are also finding important applications in a fast progressing area of nanotechnology which is being used in bioengineering for various biomedical applications. Nano-adhesive plasters comprising polysaccharides such as chitosan and alginates are being developed for treatment of injuries and surgical procedures. Tissue engineering is another area where polysaccharides are known to play vital roles. They not only provide scaffolding to the cells but also provide necessary cues for cell growth. It can thus be defined as a substrate favoring cell adhesion, proliferation and differentiation. Thus polysaccharides by their inherent heterogeneity give ample scope for various biomedical applications.

Fifth Dr. H. C. Srivastava Memorial Lecture - 2012



Dr. H. C. Srivastava Memorial Lecture was given by the eminent Carbohydrate scientist and the speaker is honoured with medal and a cash award of Rs. 10,000.00 by the Association. The 5th Dr. H.C. Srivastava Memorial Lecture is given by **Dr. Vinod K. Tiwari**, at XXVII Carbohydrate Conference held at CFTRI, Mysore, 2012.

Dr. V. K. Tiwari is associated with Banaras Hindu University since 2005 as Assistant Professor of Organic Chemistry. He worked on Carbohydrate based biodynamic agents at Central Drug Research Institute, Lucknow, India (Mentor: Dr. R. P. Tripathi) since 2000 and awarded PhD from JNU, New Delhi (2004). He has Postdoctoral research work with Prof. A R Katritzky, Director at University of Florida, USA. He worked on 'Chemoenzymatic synthesis of Complex Carbohydrate based Molecules' as visiting post-doctoral fellow (Mentor: Prof. Xi Chen) at University of California, Davis, USA (2007) then on "Novel Intramolecular Glycosidic Bond Formation Methodology" as visiting Scientist with Prof. Richard R Schmidt, Professor at Universität Konstanz, Germany. He was offered a

Lectureship at Bundelkhand University, Jhansi (2004-2005) before being appointed in BHU. His research interest is focus on different aspect of Carbohydrate chemistry and organic synthesis. He delivered numerous invited lectures at different university/institutes in India (over 50), USA, and Germany. He supervised five PhD thesis, ten M.Sc. dissertation, and successfully completed three major research projects from DST, UGC and CSIR. He recently managed as facilitator to publish special Arkivoc issue to honor Prof. Schmidt. He has over 85 publication including 8 Patents and 7 invited book chapter of high national and international repute (Elsevier, ACS, Wiley, Bentham, Springer etc). His research received many prestigious awards mainly Dr. D. S. Bhakuni Award, Indian Chemical Society (2004); Young Investigator Prize (2004); DST Fast Track Research for Young Scientist (2005), Most Cited Paper Award (2006); Vidya Ratan Award and Gold Medal (2008), NESAG Gold Medal (2010), Dr Arvind Kumar Memorial Award (2010), UP CST Young Scientist Award (2010), Prof. R C Shah Memorial Award, The Indian Science Congress Association (2011), Dr. Ghanshyam Srivastava Memorial award (2012), Indian Chemical Society, etc.

MINUTES OF THE ANNUAL GENERAL BODY MEETING - 2012 AND EC MEETINGS HELD ON 12.05.2013 AND 06.10.2013 at FRI, DEHRA DUN

The Annual General Body meeting of the Association of Carbohydrate Chemists and Technologists (India) was organized by the Central Food Technological Institute, Mysore at 6.20 PM at Assembly Hall on 13.12.2012. More than sixty four members of the Association attended the meeting along with the participants and guests attending the XXVII Carbohydrate Conference.

President, ACCT(I), Dr. Asish K. Sen gave the introductory speech while Prof. Naveen Khare, Secretary of the ACCT(I), then read out the minutes of the previous AGB meeting held during the XXVI Carbohydrate Conference which was organized by the Indian Institute of Chemical Biology, Kolkata on 23.11.2011 at 6.00 PM. The minutes were accepted unanimously as proposed by Dr. B.R. Sharma and seconded by Mr. N.C. Dhuldhoya.

Prof. Naveen Khare then described the previous years' activities of the Association and the agenda finalized by the EC members. The meeting of the Executive Committee members was held on 12.12.2012 at 10.30 AM and for six hours with a break of lunch where the EC members exchanged their views for the betterment of the activities of the Association.

In absence of the treasurer of the Association, Prof. Khare, Secretary, ACCTI presented the audited 'Statement of Accounts' of the ACCT(I). After brief discussion, the 'Statement of Accounts' was accepted by the members. It was proposed by Dr. Vasudeva Singh and seconded by Prof. CP Rao. Prof. Naveen Khare, then Hon. Editor of the Carbohydrate News Letter (CNL) placed the 'Statement of Accounts' of CNL (Issue - 13) which was accepted unanimously, proposed by Dr. Vineet Kumar and seconded

by Mr. NC Dhuldhoya. The CNL is currently published once a year on 'no loss no gain' basis. The publication of the CNL is partially sponsored by the ACCT(I) and also from the earnings from the advertisements of Lucid Colloids, Hindustan Gum & Chemicals Ltd., Sunita Hydrocolloids P. Ltd. and Encore Natural Polymers P. Ltd. The members also requested the industrial houses to come forward to sustain the CNL. To make up the deficit in statement of account of CNL, Mr. Bharat Joshi has advised to raise the number of contributors for advertisement in CNL while Mr. NC Dhuldhoya suggested to increase the financial support from Tamarind Industries also for advertisement. He also proposed to raise the rate of full color page advertisement to Rs. 5000.00 and full black/white page to Rs. 3000.00 which was seconded by Dr. Brij Raj Sharma.

Dr. RP Tripathi, Editor, CNL, proposed the name of Mr. Arya Ajay, the life member of Association, to be included as Associate Editor of CNL. This was seconded by Dr. T. Mohan Das.

Members also showed concern about the less interaction existing between participants of academia and industries in Carbohydrate Conferences. Dr. Vasudeva Singh was given this responsibility to increase and invite new people from Industry to the ambit of future Carbohydrate Conferences for which he was given two months' time.

Members also discussed about the venue of next year XXVIII Carbohydrate Conference (CARBO XXVIII). It was deliberated that it may be held either at FRI, Dehradun or any of the institutions at Lucknow while CARBO XXIX may be held at IIT, Mumbai under the dynamic leadership of

Prof. CP Rao.

It was also decided that the change of address of the life members of ACCTI should be posted on the ACCTI website. All the life members are requested to inform the website in charge for their change of address so that ACCTI website is updated regularly with the changed new addresses.

Dr. Asish Sen, President, ACCTI updated the members about the development and outcome of the meeting held at IISc, Bangalore on 18.03.2012 regarding hosting of International Carbohydrate Symposium-2014 at IISc, Bangalore in collaboration with International Carbohydrate Organization. This meeting at IISc, Bangalore was attended by Prof. S. Chandasekaran, Dr. M. K. Gurjar (on Video), Prof. N. Jayaraman, Prof. Naveen Khare, Prof. D. Loganathan, Dr. P. V. Salimath, Dr. A. K. Sen, and Prof. A. Surolia. In connection of Emergent EC Meeting held on 14.10.2012 at Delhi University, the members were also updated about the decision of expulsion of the ACCTI members, Prof. N. Jayaraman and Dr. MK Gurjar which was accepted by Dr. SN Moorthy and seconded by Dr. Brij Raj Sharma. It is also resolved that the names of Prof. Jayaraman and Dr. Gurjar be dropped from the editorial board of TCR. The members were unanimous in understanding and categorical that for the pride of India and promotion of Carbohydrates Research, the ACCTI will not interfere in the organization of ICS-2014 at IISc, Bangalore and members also wished a great success to ICS-2014.

It has been decided that to bring the visibility of ACCTI, twenty renowned scientists from Academia and Industry should be invited from India and Abroad to the forthcoming CARBOS. Simultaneously, the EC members are also requested to recommend the names of accomplished scientists and technologists so that they may be conferred as Fellow of ACCTI (F-ACCTI).

It is also proposed that a special ACCTI symposium may be organized either at Delhi or Dehradun to invite eminent Carbohydrate Researchers around the world. Prof. Ashok Prasad was given responsibility to find out the viability to hold this kind of India International symposium. In this continuation, an emergent meeting of

EC Members were held on 12.05.2013 at FRI, Dehradun where following EC Members were present - Dr. P.L. Soni, Dr. Asish Sen, Dr. KPR Kartha, Dr. Ashok Prasad, Dr. PK Gupta, Dr. Vineet Kumar, Dr. Varshney and Dr. Naveen Khare. It was resolved that a mega event for CARBO XXVIII should be organized at FRI, Dehradun with a theme 'Challenges in Chemistry and Biology of Carbohydrates' (CARBO-XXVIII) at Forest Research Institute, Dehradun, India from January 20-22, 2014 just after the main event at Bangalore. This mega event should include mostly Carbohydrate Scientists from abroad as invited speakers. These foreign delegates would be invited by Local Organizing Committee and their local hospitality will be borne by the Association.

It was also decided in this EC Meeting that a new Industry award would be initiated by ACCTI to be called as "ACCTI Excellence in Carbohydrate Entrepreneurship Award".

The EC Members again met on Oct. 06 and 07, 2013 at FRI, Dehradun to decide about the names of foreign speakers and organization of this India International mega event. Members also proposed to reduce the life membership fee for foreign delegates to USD 100.00. It was also decided that this kind of International Conference would be held once in three years with option to hold it outside India like in Bankok, South Korea etc. The EC Members also opined that Dr. Asish Sen may be made Asia-Pacific Editor of TCR replacing Dr. KPR Kartha.

The general body of the association congratulated Drs. KPR Karta, Ashok Prasad, D. Loganathan for receiving the Life Time Achievement Award, third eTCR award and third Excellence in Carbohydrate Research award, respectively. The GB also thanked Dr. Vinod Tewari and Dr. PV Salimath for giving the fifth Dr. H.C. Srivastava memorial lecture and third Mr. C.G. Merchant memorial lecture, respectively.

The General Body meeting lasted for nearly two hours and was concluded with a vote of thanks to the chair by Naveen Khare.

Prof. Naveen Khare
(Secretary, ACCTI)

Report of the XXVII Carbohydrate Conference held at the CSIR-CFTRI, Mysore from December 13-15, 2012

The XXVII carbohydrate conference was held between December 13-15, 2012, at CSIR-Central Food Technological Research institute, Mysore. The conference organized with the objective of focusing on Prospects and perspectives of glycoscience and allied technologies, was inaugurated on 13th December by the Chief Guest Shri. Uday Merchant, Managing Director, Lucid-Hydrocolloids, Mumbai. Dr. P. V. Salimath, Chairman, Carbo-XXVII welcomed the gathering and briefed about the theme of the conference.

Dr. G. Muralikrishna, Convenors, Carbo-XXVII

introduced the dignitaries who then inaugurated the conference by lighting the lamp. Dr. Ashish K Sen, President ACCT(I) presented a report on the ACCT(I) activities and Dr P. L Soni, Adviser ACCT(I), and Executive Editor, TCR spoke about TCR e-Journal. Mr Uday Merchant released the souvenir and spoke about the prospects of the Indian Gum Industry. Prof. Ram Rajsekharan, Director, CSIR-CFTRI gave the presidential address and emphasized the need for low digestible Carbohydrates with health benefits. Prof Naveen Khare, Secretary, ACCT(I) announced the ACCT(I) awards for 2011. Prof. K. P. R.

Kartha received Lifetime achievement award and Prof. Loganathan (in absentia) received Excellence award. Dr. Vinod Kumar Tiwari received the H. C. Srivastava Memorial Young Scientist award. Dr. P. V. Salimath received the C. G. Memorial award and Dr. Ashok Prasad received TCR best paper award. Vote of the Thanks was proposed by Dr. Vasudeva Singh, Convenor, Carbo-XXVII.

The conference covered nearly 46 lectures including 2 plenary, 4 award, 14 invited lectures, 16 oral presentations and 9 presentations by the students selected for best poster awards. Scientific deliberations were held under six technical sessions. The first technical session on structure and synthesis focused on the use of carbohydrates outside its traditional role as nutrient. The talks highlighted on the use of sugar derivatives as drug carriers, synthesis of branched oligomers, synthesis of thio-linked disaccharides mimics of the acceptor for glycosyltransferases and synthesis of inhibitors to improve the stability and enhancement of their affinity towards galectin-3. The second session deliberated on Glycobiology.

The focus was on glyco-selective proteins, glycoproteins, molecular design of sugars and sulphated polysaccharides. The third session on Starch, Cellulose, Gums and Mucilages emphasized their biomedical applications, structural aspects, and their modifications for various end uses. The fourth session on Food processing and Nanoscience deliberated on gellan and agar gel systems, modified polysaccharides in flocculation, polysaccharides based bio-adhesives, extrusion cooking etc. The fifth technical session was the oral presentation by the selected students. The sixth

grain nutrition and the link between carbohydrates and diseases like diabetes and Rheumatoid Arthritis were discussed. The plenary lecture by Prof. B. P. Chatterjee focused on understanding glycoproteomics for disease markers. Prof. C. Pulla Rao in his plenary lecture deliberated on the use of glycoconjugates and glycol-selective proteins.

Dr. Bharath Joshi and Dr. Brijesh Sharma spoke from industry side and emphasized the need to develop more products from carbohydrates both from industrial and health point of view.

Valedictory function started with a welcome by Dr. Vasudeva Singh. Dr. B. R. Lokesh, Chairman Technical Committee and Dr. R. Subramanian, Chairman Poster Committee presented the respective session reports. Presidential address was given by Dr. P. V. Salimath. Dr. P. L. Soni and Dr. Asish K. Sen expressed their appreciation for the Mysore Chapter for ably conducting the symposium. Later on Prof. Naveen Khare announced the following awards;

The ACCT (I) young scientist award was given to Mr. Vivek K. Sharma, University of Delhi and Mr. Anindya Basu, CSIR-CFTRI based on their poster/oral presentation. The Lucid colloid award was awarded to Ms. Swathi B. Jadhav, Institute of Chemical Technology, Mumbai.

The Conference ended with vote of thanks by Dr. G. Muralikrishna.

Conveners,
Dr. Vasudev Singh
Dr. G. Muralikrishna

ACCTI Membership Fee

Application along with subscription fee (only by DD or M.O.) in favour of "Association of Carbohydrate Chemists & Technologists (India)" payable at Dehradun to be sent to Hon. Treasurer, Dr. P.K. Gupta, Chemistry Division, Forest Research Institute, P.O. New Forest, Dehradun-248006, U.A.

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Academician	Rs. 2005.00 (one time only including Admission fee of Rs. 5.00 only)
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OPENING CEREMONY OF CARBO XXVII at CSIR-CFTRI, Mysore



HONOURS / AWARDS

The Association of Carbohydrate Chemists and Technologists of India (ACCTI) is giving honor to a person by selecting them as Fellow of ACCTI. Recently **Dr. Vasudev Singh** and **Mr. Uday Merchant** are selected as Fellow of ACCTI at CARBO XXVII held at CFTRI Mysore, on Dec. 13-15, 2012.



Dr. Vasudev Singh, born on 7th March 1953, brought up and educated at Mysore city, Karnataka State. Graduation (1973) post-graduation (Industrial Chemistry, 1975) and Doctorate (Ph.D in Food Science, 1996), all from the University of Mysore. Post doctoral fellow during 1998-99, at the National Food Research Institute, Tsukuba, Japan. Worked on rice grain processing. Post-Doctoral work on preparation of biodegradable plastics from isolated starches from indica, japonica (non-waxy and waxy) rice. Development of shelf stable under milled brown rice with retention of about 50 to 60% nutrients compared to milled rice from brown rice. Further work on preparation of noodles (non-gluten cereals) from rice, maize, sorghum, finger millet, pearl millet and their processes. Latest work being development of ready to cook and ready to eat products. Published 55 papers in National (21) and International (34) peer reviewed journals. Presented around 50 posters. Delivered Invited (14 National and 3 International) lectures. Worked as Chairman, co-chairman of several technical sessions at the Conferences conducted by Association of Carbohydrate Chemists and Technologists, India. Working on the editorial board of Trends in Carbohydrate Research. Reviewer of several National and International journals.

Guided 50 candidates of M.Sc Food Tech, M.Sc Bio-Tech., B.Tech in Bio-Tech., B.Tech in Applied Bio-technology.

Worked as a co-guide to 2 Ph.D candidates. At present guiding 4 candidates for their Ph.D degree.

Life member of Association of Carbohydrate Chemists and Technologists, India; Association of Food Scientists and Technologists, India and Nutrition Society of India.

Principal innovator of 6 food grain processes and key member of 15 processes.



Mr. Uday Merchant, Graduated as a Bachelor of Commerce from Mumbai University, Sydenham College of Commerce and Economics, 1979. Joined the Family businesses in 1979 and over the years rose from the ranks to become Executive Director of Indian Gum Industries Limited in 1987. Currently Chairman and Managing Director of Lucid Group comprised of: Lucid Colloids Limited, Lucid Colloids Middle East FZE (Sharjah, UAE), Lucid Colloids America Inc, Lucid Colloids Europe Ltd, Taiyo Lucid Pvt. Ltd. (Joint Venture between Lucid Colloids and Taiyo Kagaku, Japan), Lucid Agro Pvt. Ltd, Lucid Flavitalia Pvt. Ltd, Lucid Technologies Pvt. Ltd.

Managing Trustee, Chaturbhuj Gordhandas Foundation (Regd. Charity Trust) Patron, Indian Guar Gum Manufacturers Association, Association of Carbohydrates Chemists and Technologists, India, Member, Association of Food Scientists and Technologists, Institute of Food Technologists, USA, Guar Product Committee, NCDEX, Advisory Board, Food Ingredients India, CEO Forum, FIEO, Food Safety and Standards Advisory Committee, FICCI.

31 years experience in manufacturing and marketing of Guar Gum, Hydrocolloids and Derivatives. Widely traveled and read, both for business and recreation. Hobbies include reading, Photography, Tennis and Cricket.



Prof. (Dr.) H. C. Trivedi, Former Vice-Chancellor, Bhavnagar University, Bhavnagar, Gujarat State, India Ex-Prof. & Head, Post Graduate Department of Chemistry, Sardar Patel University, Vallabh Vidyanagar, Gujarat State, India. Former Vice-President & President of Association of

Carbohydrate Chemists & Technologists (ACCTI), India Ex-Visiting Professor, The Technical Institute of Physics and Chemistry, Chinese Academy of Sciences, Beijing, China, has been honored by the following designations:

1. Nominated as the Visitor's Nominee (the President of India) on the selection committee for the purpose of filling up of the posts in the Basic Sciences Group under the institute by advertisement or by promotion in the 20 old National Institute of Technology (NITs) for a period of three years with effect from 15th May 2013.
2. Nominated as the Senate Member at the Sardar Vallabhbhai National Institute of Technology (Deemed University), Surat during 2013 - 2016.
3. Appointed as an Ombudsman at the Entrepreneurship Development Institute of India, Bhat, Gandhinagar, Gujarat during 2012-2015.

ACCTI YOUNG SCIENTIST AWARDS, 2012

To encourage young students, the Association of Carbohydrate Chemists & Technologists (India) gives cash award of Rs. 5000.00 (Rupees Five Thousands only) and a citation for the best oral/poster presentation at the Carbohydrate Conference every year. Only research scholars, research associates etc. (below the age of 30) are eligible for this award.

At the XXVII Carbohydrate Conference held at CFTRI, Mysore from Nov. 13-15, 2012, paper entitled "Design and synthesis of LNA based mercaptoacetamido-linked nucleoside dimmers" by Vivek Kumar Sharma, Dr. Sunil K. Singh and Dr. Ashok K. Prasad Delhi University was judged as Best Poster Presentation. The paper entitled "Production of prebiotic isomaltooligosaccharides by transglucosylation of maltose using microbial α -glucosidases" by Anindya Basu and Gobinath D, Prapulla SG, CFTRI Mysore was also judged as another Best Poster Presentation. We express our heartiest congratulations to Mr. Vivek Kumar Sharma and Mr. Anindya Basu.



Anindya Basu is working as Research scholar (SRF) under the guidance of Dr. S. G. Prapulla at Fermentation Technology & Bioengineering Department CFTRI Mysore. His Ph.D. work is based on "Studies on The Fermentative Production of Isomaltooligosaccharides using α -Glucosidase from Microbes". He completed his B.Tech.

from Heritage Institute of Technology, in the year 2010. He obtained his master degree from National Institute of Technology, Karnataka in the year 2012. Now, he is actively engaged in scientific research work related to Carbohydrates.



Vivek K. Sharma is working as research fellow under the supervision of Prof. Ashok Prasad at Delhi University since 2009. His Ph.D. work is based on "Chemo-enzymatic Synthesis of C-4'-Spiro- & Locked-ribonucleosides and Efficient Route to Mercaptoacetamido- & Triazolo-linked Sugar Modified Nucleoside Dimers". He completed his B.Sc. from Hansraj College, University of Delhi in the year 2007. He obtained his master degree from the same University in the year 2009. Vivek published 6 papers in journals of high repute. Beside this, he received several awards in various conferences. Vivek likes to play Cricket.

LUCID COLLOID AWARD-2012

To encourage research on hydrocolloids, Ms. Lucid Colloids Limited, Mumbai, offers a cash award of Rs. 5000.00 (Rupees five thousand only) and a citation for the best paper presentation on hydrocolloids since 2003. At the XXVII Carbohydrate Conference held at CFTRI, Mysore from Dec. 13-15, 2012, a poster entitled "Screening of polysaccharides for preparation of α -amylase conjugate under optimized conditions to enhance stability and storage life" by Swati B Jadhav, Rekha S Singhal from Food Engineering and Technology Department, Institute of Chemical Technology, Mumbai was selected for the award. We express our heartiest congratulation to Ms. Swati B Jadhav.



Swati B Jadhav pursuing her Ph.D.(Science) in Biotechnology at Food Engineering and Technology Department, Institute of Chemical Technology, Matunga, Mumbai under the supervision of Prof. Rekha S. Singhal. Her research interest includes Glycobiology: Enzyme-protein interactions, Enzyme modifications for improvement of activity and stability, Functional, thermodynamics, structural and kinetic analysis of enzymes, Improvement of storage stability of enzyme, Medium (solvent) engineering for enzymatic reactions, Inhibition of enzyme. Projects handled: (1) Enzyme modification for improvement of stability of α -amylase (2) Modification in laccase to make it more suitable for textile applications (3) Improvement of enzyme storage lifetime (4) Enzymatic oligomerization of catalin using laccase (5) Covalent and non-covalent interactions of alcohol dehydrogenase with polysaccharides. She published 5 research articles in journal of repute and also wrote a book chapter.

FOLLOWING ARE THE ABSTRACTS OF YOUNG SCIENTIST AWARDEES AT CARBO XXVII

Production of Prebiotic Isomaltooligosaccharides by Transglucosylation of Maltose using Microbial α -Glucosidases

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Prebiotics by definition are the 'Non-digestible food ingredient that beneficially affects the host by selectively stimulating the growth and/or activity of one or a limited number of bacteria in the colon and thus improves host health'. Isomaltooligosaccharides (IMO), a potent prebiotic have received special attention because of their mild taste (69-70% in sweetness compared to sucrose), high temperature and pH stability, low viscosity and low water content. The present study describes the screening of a number of fungal cultures for alpha-glucosidase with high transglucosylation activity. Among the fungal strains screened, PFS 08 (an isolate from paddy field) was tested positive for alpha-glucosidase (0.137 units/mL) with high transglucosylation activity. The glucosidase (0.1 U/mL) from PFS 08 was further used for the production of IMO from three different substrates viz., pure maltose, malted

barley syrup (Wort) and maltose syrup produced from potato starch using extract of germinated paddy grains as enzyme source. IMO production was found to be 43%, when pure maltose (40%) in citrate buffer (0.05 M, pH 5.5) was transglucosylated with glucosidase (0.1 U/mL) from PFS 08 at 55°C for 24 h. IMO produced mainly consisted of panose (32%), isomaltose (5%), and tetrasaccharides (6%). Alternatively when malted barley syrup or wort was used as source of maltose, 39% of IMO was produced consisting of 18% of panose and 21% of isomaltose. In yet another strategy, maltose syrup produced from potato starch using endogenous enzymes of germinated paddy was used as the substrate and the IMO production was found to be 34%, which mainly consisted of panose (26%), maltotriose (3%), tetrasaccharides (5%) and traces of isomaltose. Products were further characterized by ESI/MS.

Design and Synthesis of LNA based Mercaptoacetamido-Linked Nucleoside Dimers

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The last two decades have witnessed an upsurge in the synthesis of several modified nucleic acid derivatives. The intentions have been to synthesize therapeutically suitable and commercially viable nucleic acid analogues. Oligonucleotide-based antisense strategies represent a unique paradigm for the treatment of a wide variety of human diseases states. The novel utility of these agents resides in their ability to selectively prevent the expression of a particular disease-associated gene in a sequence specific manner. Successful drug development based on this technology requires the synthesis and use of chemically modified oligonucleotides that render stability to nucleolytic digestion, enhance cellular uptake, and hybridize with high affinity and specificity toward the target mRNA. Ongoing synthetic studies into this broad class of compounds have focused on the chemical modification of the backbone, sugar, and base functionalities of natural DNA. One such modification in the sugar moiety has resulted in locked nucleic acid (LNA) where the furanose conformation is locked in an N-type (C3'-endo) form by the introduction of a 2'-O,4'-C methylene-linkage. LNA has been found to be very useful

for antisense applications, since incorporation of one or more LNA monomer unit(s) into an oligonucleotide shows extraordinary thermal stability when hybridised with either DNA, RNA or with LNA itself. We have designed and synthesized the five atom thioacetamido-linked LNA based dimers I, II, III and IV (Figure-1). The detailed synthetic scheme will be presented during the poster session.

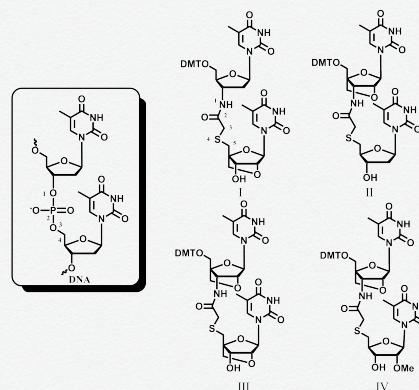


Figure 1: Thioacetamido-linked LNA based dimers

Screening of Polysaccharides for Preparation of α -Amylase Conjugate under Optimized Conditions to Enhance Stability and Storage Life

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The influence of enzyme polysaccharide interaction on enzyme stability and activity was elucidated by covalently binding dextran to a model enzyme α -amylase. The conjugation process was optimized for all process parameters and found to affect the stability of α -amylase. Enzyme conjugated under optimized conditions showed 5% loss of activity but with enhanced thermal and pH stability. Nine polysaccharides differing in structure and chemical nature were screened for their ability to conjugate with α -amylase by covalent binding for enhancing the thermal and pH stability of α -amylase. Among these polysaccharides, agar, dextran, pectin and xanthan showed better results, however, dextran stood

out among all the polysaccharide for providing both thermal and pH stability to α -amylase. α -Amylase conjugated with agar, dextran, pectin and xanthan showed antimicrobial property with added preservative (0.2% sodium benzoate) in liquid formulation of α -amylase challenged with *Bacillus subtilis* and *Escherichia coli*. Dextran was the only polysaccharide which showed significant reduction of microbial growth of challenged organisms and aerobic flora without any preservative added. Aerobic flora could flourish well in the liquid α -amylase, but low temperature (4°C), dextran, and preservative showed synergistic effect in efficiently increasing the storage life of liquid α -amylase.



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Editor in Chief, TCR

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