

CARBOHYDRATE NEWS LETTER

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Editor

Dr. R.P. Tripathi

CSIR-Central Drug Research Institute
Lucknow.

Tel. : 0522 - 2612411-418; Extn. : 4462

Mob. : 9415004443

E-mail : CNL.ACCTI@gmail.com

rpt.cdri@gmail.com

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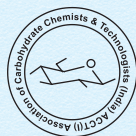
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FROM THE EDITOR'S DESK ...

Carbohydrate, the molecule responsible for our growth and development, the source of our energy and our existence by virtue of its role in the reproductive cycle, has off late emerged as one of the most vital components of the entire life process. But for long, genes and proteins kept enjoying the status and privilege of being the only class of smart molecules responsible for the intricate and sophisticated information system. On the other hand, carbohydrates remained serenely satisfied being recognized as the mere structural and energy molecule. But, with time and the advancement of the world-wide scientific research, glycobiology research gained a slow but significant momentum. Its only in the twentieth century that the unique structural diversities of the carbohydrate moieties caught the eye of the budding scientific community. The further analyses and studies truly overwhelmed the major scientific minds who thoroughly established the involvement of glycochemistry in various subtle biological events. The outcome of the extensive glycobiology research has made it clear that the mystery of life can only be understood if the intrinsic mechanism of carbohydrate interactions with other biomolecules unfolds properly. This has earned a berth for glycobiology in the elite 'omics' group designated as 'Glycomics'.

After being recognized and identified as the information and signal carriers, carbohydrate-carbohydrate and carbohydrate-protein interactions proved pivotal for cellular recognition, signaling and adhesion. Thereby, these interactions proved to be of central importance for bacterial infection and immune response. Thus, improving on the studies of carbohydrate protein interactions and their importance and also depending on the cell surface carbohydrate decoration, carbohydrate-based vaccines have been formulated and used efficiently to combat deadly attacks. To cite an instance, it is well known that the event of cancer, which arguably is the most potential threat to humanity in the coming years, triggers an altered carbohydrate modification in the tumor micro environment which differs significantly from the normal tissue. Thus, the race is on to exploit this alteration for making drugs that can specifically attack the cancer tissues without affecting the normal tissues. With the knowledge that the different glycoforms are responsible for cell growth, cell signaling and cell death through various recognition pathways carbohydrate molecules are expected to have the potential of manipulating the events of inflammation, metastasis and apoptosis.

The potential biological applications automatically have raised the requirement of carbohydrate molecules in large quantities and purest possible form. It is difficult to satisfy this growing need by extracting carbohydrate structures from the available natural resources. Therefore, synthetic carbohydrate chemistry has emanated as the key to the development of future Glycomics. Based on this requirement, development of the synthetic strategies for making giant carbohydrate molecules has materialized as a challenging task. However, modern instrumentation and rigorous scientific practices have made it possible to make significantly large and complex carbohydrate molecules in large quantity and with extreme purity. Of course, there are still scopes for further development and improvement in the area of synthetic carbohydrate chemistry before the aspired dream of carbohydrate based drugs reaches its expected shape. In addition to the requirement of glyco-structures for biological applications, carbohydrates serve as a source of naturally available chirality. Therefore, simple monosaccharide units are also being used extensively for generating specific chiral centres for asymmetric synthesis of drug or drug-like molecules.

Coming to the human society we live in, the development of this society depends on three basic needs: food, cloth and shelter. In this respect, carbohydrates happily surprises us as being the most abundant and essential component of all three. This is where the industry gets its huge and diverse scope to explore the potential of carbohydrates for the future growth in economy and development of the society. Continuous value addition to the basic raw materials is the key to develop smarter but cheaper materials required for the growth of the running generation. It requires round the clock experimentation and development of technology with continuous exchange of thoughts and studies from the the scientific community. Thus, there is a clear requisite for a platform to coagulate glycochemists, glycobiologists and glycotecnologists with the people from food, textile, furniture and pharmaceutical industries to explore the wide spectrum of glycoscience as a whole to the best possible extent.

In this prospect, we want to raise our voice to urge people to join hands under the umbrella of Association for Carbohydrate Chemists and Technologists India (ACCTI) for a bright future.

Greetings and best wishes.

BALARAM MUKHOPADHYAY

Associate Editor, Carbohydrate News Letter



Lucid Colloids Ltd.

Corporate Office

401A Navbharat Estates, Zakaria Bunder Road, Sewri West, Mumbai 400015, India
Tel: 091-22-24158059, Fax: 091-22-24158074, 091-22-24158075

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Presidential Address

Respected Prof. Vijayan, Mrs. Shailaja Merchant, Prof. Siddhartha Roy, Dr. P. L. Soni, Prof. Naveen Khare, Dr. Rajan Vedasiromoni, Dr. P. Jaisankar, distinguished colleagues, friends, dear students, ladies and gentlemen.

I take this opportunity to welcome you on behalf of the executives of ACCT(I) and the organizing committee.

The journey of the Association began from ATIRA, Ahmedabad, in 1984 when the late Dr. H. C. Srivastava founded this association. He was the founder president of the Association. After him, the association grew further under the leadership of my very able predecessors Prof. N. K. Mathur, Prof. B. P. Chatterjee, Dr. P. L. Soni and Prof. H. C. Trivedi.

The Association's main mandate and contribution has been to bring Academicians & Technologists to one platform for the exchange of ideas, the solving of R&D problems and also to encourage budding scientists towards new inventions. Towards this step, you will see many young scientists presenting their work at this symposium. In India we have many talented students and researchers but, in general, lack of curiosity has confined us within four walls. The colour and vigor of the outside world remains unseen, we remain crippled and unable to think in a novel manner. We have to have originality and analytical thinking - only then will we be able to see path breaking discoveries from this great nation. I would not blame the education system - I would rather say that we need to change our attitude.

Science is an ever changing subject. Today Einstein's theory has been challenged. The days of individualistic research are over. Science is now beyond boundaries. Interdisciplinary research is the essence of today's science. But, unless we have respect for each other, trust each other, we will never be able to bring about the desired results. We must seriously think about this.

Discoveries are ultimately translated to applications and then to products. Unfortunately, our interaction with the industry for the future growth of the country is not satisfactory and we have to find a solution. Again the same question returns - we have to have trust and faith in each other.

There is no dearth of Government research funding these days. Our present Government has realized that unless we are technologically strong we will never be able to promote ourselves and break out of the developing country status. In the coming 12th 5 year plans, we are expecting a substantial increase in research funding.

However, in the west, where research culture is very strong, the research funding mostly comes from the industry. That is how students develop links with the industry both at the undergraduate and post-graduate level. They get the chance to work on pressing areas, get the training to work in the industry, get the opportunity to overcome the challenges and think in a novel manner that is ahead of times and at the same time increases their chances of employment. Unfortunately, In India, industry

sponsored research projects are negligible. There is scope to think about this.

The journey of sugar chemistry took its first steps with the discovery of the structure of D-Glucose by Emil Fisher in 1888 which won him the Noble prize in 1892. But, if I am not wrong, the discovery of pneumococcal polysaccharides as vaccines against pneumonia by the legendary Avery and Heidelberger opened a totally new frontier for carbohydrate chemists. Today, we know that life begins with the interaction of cell surface oligo- or polysaccharides with appropriate counterparts. I am talking about cellular interactions. Almost in every biological process we find sugar molecules involved. In every disease- be it infectious or systemic -you see that in some way or the other sugar molecules play a major role. That is why the Theme of this conference is "Carbohydrates at the Interface of Chemistry and Biology". Although carbohydrates are referred as sweet molecules, their chemistry and biology are very complex because of their structural complexity. It is extremely important that we know the structure and chemical characteristics of these complex oligo or polysaccharides in order to understand biological activities. Some we have understood, but there is much more that remains tacit. This is the challenge for budding researchers and the chemical biologists.

Apart from the role of carbohydrates in biology, the use and applications of gums & mucilages, plant polysaccharides etc. are ever increasing. According to rough estimates, carbohydrates represent approximately 90% of the annually re-growing biomass of about 250 billion tons, only about 3-4% of which are used by humans. Once upon a time we had great natural product scientists in India. Today there are hardly any. If the root of a tree is cut, do you think the tree will survive? I request the top level policy makers to think about this. In the past, Kolkata was the epicenter of carbohydrate chemists. It has been destroyed. There is hardly any group in India that is working on natural carbohydrate products. And by not doing that, we are unable to utilize the enormous natural resources.

Today and in the next two days, you will get the opportunity to listen to the work of accomplished scientists as well as young and upcoming scientists. We are honoured that Prof. Vijayan has agreed to be deliver the key note address. I am sure all these lectures will enrich us, expose us to the diverse world of carbohydrates. I look forward to your active participation in CARBO XXVI and wish you a pleasant stay in Kolkata.

Thanking you all.

Dr. Asish K Sen
President, ACCTI and
Convener, CARBO-XXVI

Invitation to CARBO XXVII

The organizing committee of the XXVIIth Carbohydrate Conference (CARBOXXVII) and the Association of Carbohydrate Chemists and Technologists (India) cordially invite you and your colleagues to participate in the meeting to be held at CFTRI, Mysore from December 13th to 15th, 2012. The theme of the conference is : **Prospects and Perspectives of Glycoscience and Allied Technologies.**

For details about the conference, please contact the conveners: Dr. Vasudeva Singh, Head, Department of Grain Science and Technology, CFTRI, Mysore - 570020; Telephone: 0821-2510843 [O], 0821-2510155 [R]

09901992971 [M]; Fax: 0821-2517233; E. mail: singhva2003@yahoo.co.in or Dr. G. Muralikrishna, FAFST(I), Department of Biochemistry and Nutrition, CFTRI, Mysore-570020; Telephone: 0821-2514876 [O]; 0821-2516531 [R]; 09480382199 [M]; Fax 0821- 2517233; E. mail: krishnagm2002@yahoo.com or carboxxvii@gmail.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 XXVII at the beautiful city of Mysore.

Benzotriazole- mediated Highly Facile Synthesis of Carbohydrate-containing Molecules of Promising Chemotherapeutic Potential

Dhananjay Kumar, Bhuwan B Mishra, Divya Kushwaha and Vinod K Tiwari*

¹Department of Chemistry, Banaras Hindu University, Varanasi-221005, India.

E-mail: tiwari_chem@yahoo.co.in

In past few decades the search of novel carbohydrate based libraries of great chemotherapeutic values has enticed the major focus in chemical biology and medicinal chemistry. Tremendous efforts have been made in searching for efficient synthetic methodologies to access small molecules of privileged structures for complete biological, medicinal, and pharmacological investigations.¹ Benzotriazole methodology, a versatile, useful, and one of the most successful synthetic protocol investigated so far, has now grown from an obscure level to very high popularity since it can easily be introduced into a variety of reactions, facilitates numerous transformations, sufficiently stable during reaction and finally removed easily at the end of the reaction sequence.²

Our interest and experience in benzotriazole mediated synthesis of promising new chemical entities encouraged us to search simple, facile and high yielding protocols for the synthesis of a variety of carbohydrate-containing molecules as promising pharmaceutical leads. We have previously reported a practical synthesis of diverse quinazolinones (**1** and **2**) of great medicinal value using benzotriazole chemistry.³⁻⁵ Despite the interesting chemistry and diverse pharmacological properties of dithiocarbamates, its preparative methods are still

limited, hence we developed a facile one-pot synthetic protocol for an easy access to dithiocarbamates by reaction of mercaptans, amines, and *bis*-(benzotriazolyl)-methanethione in the presence of amidine base under mild reaction conditions.^{6a} A similar chemistry was also employed for the development of numerous *N/S/N*, 5-glycosyl dithiocarbamates (**3**).^{6b} Limitations associated with the reported methods for amide bond formation e.g. use of hazardous chemicals, low reaction yields, requirement of strong basic catalyst and strictly anhydrous condition, expensive and limited availability of coupling reagents, less stability of activated acids etc. warrant to search a simple, short, and high yielding synthetic methodology. In this context a facile and high yielding synthesis of novel glycosyl carboxamides (**4**) with sugar in furanose/pyranose form using benzotriazole methodology has been developed under mild conditions.⁷ This method is advantageous over the existing one and would further be extended for the development of carbohydrate based novel scaffolds and natural and/or unnatural glycopeptides. Additionally, a novel, one-pot and highly facile protocol has been devised for direct oxidative formation of a series of novel carboxamides from glycosyl ulose using dicetoxyiodobenzene (DIB) in presence of ionic liquids (ILs) at room temperature.⁸

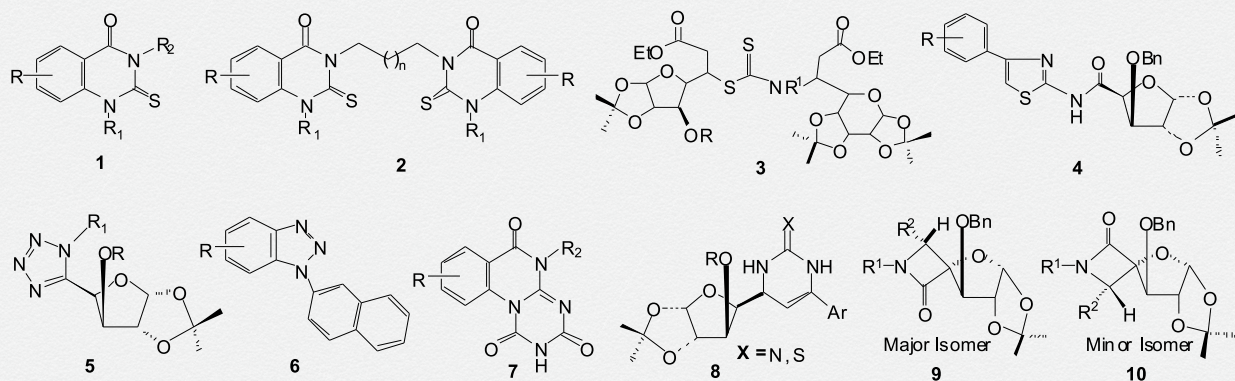


Fig. 1: Developed prototype compounds 1-10 using benzotriazole chemistry

Moreover, a series of glycosyl tetrazoles (**5**) also have been developed using a modified procedure. Developed glycosyl carboxamides with sugar in furanose/pyranose form using benzotriazole methodology has successfully been used to achieve glycosyl tetrazoles under mild conditions.⁹ Because of interesting chemistry associated with benzotriazole, we have developed a facile and high yielding protocol for diverse benzotriazoles (**6**) through intramolecular *N*-arylation of different *o*-chloro-1,2,3-benzotriazenes using CuI/Cs₂CO₃.¹⁰ Further, in continuation of this interest, we developed an efficient, novel, short and high-yielding one-pot protocol for the synthesis of diverse quinazolinone based fused-azauracil heterocycles (**7**) through cyclodesulfurization and intramolecular cyclization of thioquinazolinone using silver cyanate.¹¹ The method is extended successfully in carbohydrate

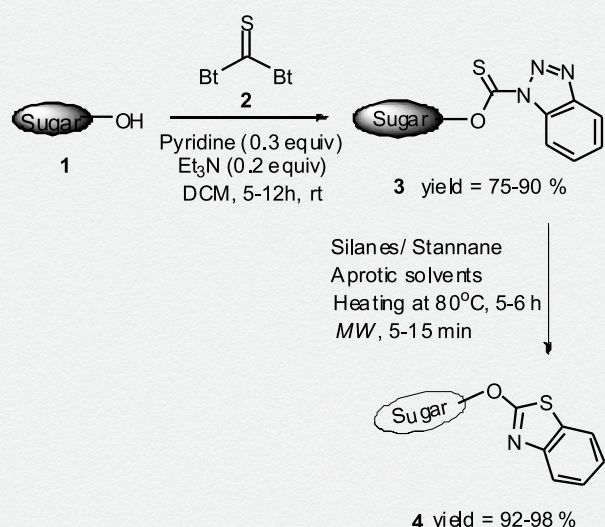


Fig. 2: synthesis of Glycosylated benzothiazole via disruption of the benzotriazole ring

chemistry. Furthermore, *N*-acylbenzotriazoles successfully used to overcome selectivity problem in Staudinger [2+2] cycloaddition reaction for the synthesis of spiro-8-lactams (**9** & **10**) through the coupling with different imines.

Keeping our keen interest in the development of benzotriazole mediated novel methodologies; we are looking forward for glycosylation process and total synthesis of some interesting natural products. In our recent investigation to achieve deoxy sugars using benzotriazole methodology, a very interesting chemistry was noticed, the highly stable benzotriazole ring on treatment with silanes/stannane underwent free radical β -scission of *N*-*N* bond and furnished sugar-fused benzothiazole by the loss of molecular nitrogen (Fig. 2 and 3).

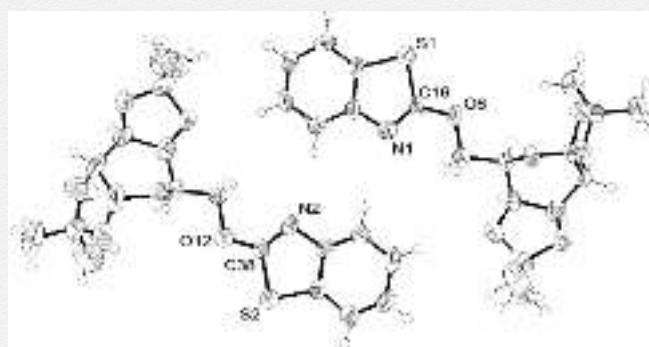


Fig. 3: ORTEP drawing of developed 6-O-(Benzothiazol)-1,2;3,4-di-O-isopropylidene-a-D-galactopyranose

Acknowledgement

We thank CSIR and UGC, New Delhi for the funding and Dr. R P Tripathi for the encouragements. I must thanks Dr. Raju R Kale, Post doctoral Fellow at Carbohydrate Research Centre, Academia Sinica, Taiwan for the establishment of benzotriazole chemistry in our laboratory at Banaras Hindu University.

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Functional Properties of Different Forms of Maize Flour Along with SEM Studies and their Usage in the Preparation of Biscuits

Malleswari,P., Shruthi Pandey, Sudha, M.L*., Vasudeva Singh**

Sathyendra Rao, B.V. and Srinivas, A.

*Department of Grain Science and Technology, *Flour Milling and Baking Technology,*

*CSIR-Central Food Technological Research Institute, Mysore-20. e-mail: singhva2003@yahoo.co.in***

Commercial maize in the form of whole grain, grits were size reduced to different particle size flour before and after thermal/hydrothermal treatments and biscuits were prepared from them. Some of the functional properties studied revealed that whole grain flour was brightest w.r.t colour, it had highest fat and ash content (~ 4, 1.1%); grits had least ash and fat content (0.3, 1.3%); protein content in these varied from 11 to ~ 12%. Toasted grits showed highest swelling power (~ 16) and whole kernel had highest solubility (~ 28%) at boiling water temperature. Total amylose content in all types of flour varied from 21 to ~ 23 % (d.b) and soluble amylose content varied from 12 to 13 %. Significant changes in total amylose and soluble amylose were not noticed after toasting. Pasting profile of these flour in a Brabender Micro-Viscograph revealed that gelatinization temperature remained almost same in all the type of maize flour (73-74 °C), peak viscosity was low in native corn and grits flour compared to toasted ones. Hot Paste

Viscosity (HPV) and Cold Paste Viscosity (CPV) values were less in raw flour which increased after toasting to different extent, however the values for setback and total set back decreased to various extents. With increase in surface area of the flour i.e finer the particles, the diameter of the biscuits were 52.3 to 51.7 mm, thickness of these biscuits increased from 3.4 to 3.9 mm. However in toasted material, with increase in surface area, the diameter remained same (~ 51 mm) but the thickness decreased from 5.3 to 4.4 mm. Spread factor increased from 62 to 88%, but the breaking strength decreased from 7.5 to 6 N. Scanning Electron Microscopy (SEM) of the respective flour in raw and processed form, before and after preparation of biscuits were also studied, and SEM revealed the status of starch granules, cell wall material and protein bodies. Sensory studies by subjective methods, indicated that the biscuits prepared from toasted whole grain of maize were highly acceptable.

Award Winners of CARBO XXVI - 2011



Life Time Achievement Award - 2011

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. Vasudeva Singh was awarded this Life Time Achievement Award for the year 2011 at CARBO XXVI held at IICB Kolkata, on Nov. 23-25, 2011.



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 starting from harvesting, threshing, processing including preservation of high moisture paddy, drying, curing, parboiling of rice. Even processing of rice to products viz. expanded, flaked and popped rice, their *in-vitro* digestion pattern, changes in properties of rice flakes before and after preparation in a small scale industry. Studies on Scented rice, its quality informing about different types of scented rice based on total and insoluble amylose, viscometry behavior, scent detection at leaf, seed, matured seed and milled rice level. Then onwards worked on isolation of starch from food grains, their chemical modification, changes in properties at granular and molecular level (Doctoral work). Post-Doctoral work on preparation of biodegradable plastics from isolated starches from indica, japonica (non-waxy and waxy) rice by acetylation at lower and higher degree of substitution. 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 for commercial exploitation have been carried out. Latest work being development of ready to cook and ready to eat products [halwa mix, semolina mix, whole grain mix for porridge, beverage, flakes, popped grain mix, low carbohydrate digestible (diabetic) food, each of these products were from multigrains] with retention of maximum nutrients compared to the less nutrient contents products available commercially.

Published 55 papers in National (21) and International (34) peer reviewed journals. Presented around 50 posters, in which 42 were at National and 8 were at International level. Delivered Invited (14 National and 3 International) and Oral lectures (12). 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 following National and International journals

1. *Journal of Food Science and Technology*, 2. *Trends in Carbohydrate Research*, 3. *Oryza*, 4. *International*

Journal of Food Science and Technology, 5. *Journal of Food Science*, 6. *Food and Bio-Process Technology*, 7. *Journal of Applied Polymers*, 8. *African Journal of Food Science and Technology*, 9. *Carbohydrate Polymers*, 10. *LWT Food Science and Technology*, 11. *Food Research International*, 12. *Carbohydrate News Letters*, 13. *Starch*, 14. *International Journal of Food Properties*

Course Co-ordinator and Faculty member of M.Sc Food Technology, conducted by CFTRI, Mysore in association with University of Mysore. Handling classes on Physical properties, morphology, physico-chemical properties of rice; Starch isolation from food grains, their physical and chemical modification and their properties; Rice Products. Faculty member of the training courses conducted by HRD dept. of CFTRI, Mysore.

Guided 50 candidates of M.Sc Food Tech, M.Sc Bio-Tech., B.Tech in Bio-Tech., B.Tech in Applied Bio-technology from different Universities for their Dissertation and Investigation topics. Also worked as a co-guide to 2 Ph.D candidates, whose degrees have been awarded recently. 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, which can be readily commercially exploited as PDRU documents are available at CFTRI Institute level.

Principal inventor of a patent (Grant no. 199772, by Singh et al, Dec. 2006), process and PDRU document on fermented dry mix of dosa and idli. This process has been commercialized to about 25 entrepreneurs in India and the product is exported to different countries. Another principal innovator of international patent on "preparation of homogeneous film from protein and starch by chemical modification" at Japan (1998-99).

Member and co-chairman of several committees at the Institute level viz. Ph.D registration, Projects monitoring, Stores and Purchase disposable items.

Served as a Treasurer of Association of Food Scientist and Technologists (India), executive member of CFTRI School Education Society, Mysore. Also Worked as a Treasurer and key member during 3rd National Carbohydrate Conference (1987 at Mysore, main Convener of 17th National Carbohydrate Conference (2002) at Mysore. At present working as one of the Convener of 27th National Carbohydrate Conference to be conducted at CFTRI, Mysore during 13-15th, Dec. 2012.

Worked as a Head of the Dept. of Grain Science and Technology (2009 Jan. - 2012 Aug) holding the designation of Senior Principal Scientist and continued in this designation at present.

Lending technical support to Indian Institute of Crop Processing Technology, Tanjavur and Ministry of Food Processing and Technology in formulating their R & D programs as an Executive Member.

Also participating with MSSRF (M.S. Swaminathan Research Foundation), Chennai, in their endeavor in establishing a "Rice Bio-Park" at Myanmar.

Award for the 'Best Paper Published in TCR' 2011



Dr. Ghanshyam S. Chauhan, Professor of Chemistry at Himachal Pradesh University has been awarded Seond 'Best Paper published in TCR journal' entitled as **"Pectin-based hydrogels as colon-specific delivery carriers for mebeverine hydrochloride"** Vol. 2, No. 3 (2010) 45-51 authored by Ravi Kumar, Amit Kumar, Ghanshyam S. Chauhan, at 26th Carbohydrate Conference held at IICB, Kolkata, 2011. The award is given every year by the Association of Carbohydrate Chemists and Technologist's (India) and includes a citation and a cash award of Rs. 20,000.00 (Rupees twenty thousand only).

The article described mebeverine hydrochloride, a spasmolytic agent with local anesthetic effect, controlled-release behavior from a series of environment-sensitive and biodegradable pectin-based hydrogels. The release behavior of the drug was observed to be affected both by the structural and the environmental factors and had a differentiated behaviour in different simulated GIT regions. The maximum drug was loaded on the poly(AAmPSA)-based hydrogel series, and the maximum drug release was observed at pH 8.1 from all the hydrogels. The pattern of the release behavior was observed to be uniform irrespective of the structure of the hydrogels, as the mechanism of the drug release changed from 'diffusion-controlled' to 'chain relaxation-controlled' with the change of the pH from 2.0 to 8.1.

Dr. Ghanshyam S Chauhan, Professor, Department of Chemistry, Himachal Pradesh University, completed B.Sc. degree (first class first) from Punjab University (India), M.Sc. (with gold medal), M.Phil (1982) and Ph.D. (1986) degrees from Himachal Pradesh University, Shimla (India). He was UNESCO fellow at Charles University and Institute of Macromolecular Chemistry, Prague (1990-1991); SERC Fellow at NCL, PUNE (India) (1997-1998), and Brain Pool Fellow of Korean Foundation of Science and Technology, at Gyeongsang National University, Republic of Korea (2008). He is Coordinator of Departmental Research Support Programme of UGC to the Department of Chemistry, HP University and of the UGC.

He has vast experience of research, consultancy and teaching and has executed many research projects, research guidance, peer-reviewing large number of high reputed journals, published around 200 papers and presented 125 papers in conferences and has high h-index and i-10 index. His research interests are wide and diverse with contribution ranging from green chemistry, synthesis of functional polymeric supports for water and enzyme technologies, and his contribution is also of interdisciplinary nature as he works on green chemistry, bioactive polymers and organic synthesis, making deep impact on green and clean alternatives (both products and processes), especially, at the interface of polymer chemistry and environment; and biotechnology and polymer science, and most importantly, he has research commitments both to science and society.

Second "Excellence in Carbohydrate Research" award - 2011



Dr. R.P. Tripathi, Senior Principal Scientist, Deputy Director, Medicinal and Process Chemistry Division, Central Drug Research Institute, Lucknow has been awarded Second Excellence in Carbohydrate Research by the ACCTI at 26th Carbohydrate Conference held at IICB, Kolkata. The award is given every year by the Association of Carbohydrate Chemists and Technologist's (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 is: M.Sc. (Gorakhpur University), M.Phil, Ph. D.(Delhi University). His area of Specialization: Organic Chemistry: Oxygen and nitrogen heterocycles, Nucleosides, carbohydrates, asymmetric synthesis, Combinatorial Chemistry, Medicinal Chemistry: Development of new anti TB molecules, antiparasitic agents (malaria, filarial, leishmania, trypanosome), antivirals, Tuberculosis, diabetes, and antitoxinants.

His Membership of scientific bodies are: Life member Indian Chemical Society, Indian medicinal chemists association, UP association of advancement of science and technology, Society of biological chemists of India, Member of Association of Carbohydrate Chemists & Technologists of India, Editorial Board Member ARKIVOC, Trends in Carbohydrate Research, Medicinal Chemistry - An Indian Journal, Associate Editor Carbohydrate News

Letter, Editorial board member International Journal of Drug Design and Delivery Reviewer for a number of International Scientific Journals and books Member of different Selection Committees and Research Boards. Visiting member abroad: France, INSA Exchange Programme, University of Rennes 1, Rennes, France 2006 Pretoria, South Africa ICS-UNIDO Programme-2010. He has more than 120 research publications in journal of high reputation with citation of >1000 and H-Index-17. He has given more than 25 invited lectures in different universities and institutes. He has Supervised 17 Ph. D. Students, with 9 Ph.D. currently working with him. Projects Handled or in Hand: NIH USA, VW Foundation Germany, DRDO, ICMR, DBT New Delhi. He also supervised 14 Short Term/Long Term Training students. Honors and Awards : Best paper award by Indian Pharmacological society of India, Most Cited paper award by Elsevier: Bioorganic & Medicinal Chemistry, INSA Visiting Scientist Fellowship, Second best poster award Euro-India First International Conference on Holistic Medicine, Best poster award: CARBO-XXIII „08" held at Bhavnagar University. "Excellence in Carbohydrate Research Award" First eTCR award 2009 by Association of Carbohydrate Chemists and Technologists of India at Shimla University. List of Patents filed or in process : Dr. Tripathi has 20 National/International patents. He also wrote two book chapters.

Second C. G. Merchant Memorial Lecture - 2011

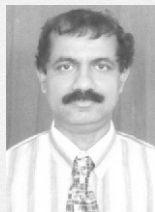


Dr. T. Emilia Abraham, Scientist G (retired), Chemical Sciences and Technology Division National Institute for Interdisciplinary Science and Technology, Council of Scientific and Industrial Research (CSIR), Thiruvananthapuram gave Second C. G. Merchant Memorial Lecture at 26th Carbohydrate Conference, held at IICB, Kolkata. An honorarium of Rs. 10,000.00 is given to the speaker along with traveling allowance.

The honor is sponsored by Leucid Hydrocolloids, Mumbai. Her area of research consists Starch chemistry and technology, Stabilization and immobilization of starch enzymes, Drug delivery using micro and nano particles of starch and gums, Modified biopolymers (starch and gums), Edible films from polysaccharides, Post harvest technology of grains and tubers, Nutraceuticals from edible gums and hemicelluloses, Process for the extraction of Inulin from chicory roots, Depolymerization

of starchy and nonstarchy polysaccharides, Zero calorie stable transparent colourless gels from Tamarind seeds and Production of alcohol from starchy sources. She has more than 85 research papers to her credits which are published in National/International journal of high repute. She has also 20 patents (4 - US, 4 - EP). She also received DAAD long term fellowship (1982 - 83), DBT National Associateship (1994 - 95), DBT Overseas Associateship (1995). She guided 12 PhD students and peer reviewer of several international journals as Elsevier, American Chemical Society, Wiley-VCH, FAO, Academic Press. Dr. Emilia is also Life-Member of several professional societies as Association of Food Scientists and Technologists (India), Society of Biological Chemists, Association of Carbohydrate chemists and Technologists, Nutrition Society of India, Root Crop Society of India-executive committee member, Kerala Academy of sciences, Biosensor society of India.

4th Dr. H.C. Srivastava Memorial Lecture - 2011



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 4th Dr. H.C. Srivastava Memorial Lecture is given by Dr. KP Ravindranathan Kartha, at 26th Carbohydrate Conference held at IICB, Kolkata, 2011.

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.

MINUTES OF THE ANNUAL GENERAL BODY MEETING - 2011

The Annual General Body meeting of the Association of Carbohydrate Chemists and Technologists (India) was organized by the Indian Institute of Chemical Biology, Kolkata on 23.11.2011 at 6.00 PM. More than fifty members of the Association attended the meeting along with the participants and guests attending the XXVI Carbohydrate Conference.

President, ACCT(I), Dr. AK 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 XXV Carbohydrate Conference which was organized by the Chemistry Department, H.P. University, Shimla on Nov. 11, 2010. 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 Nov. 22, 2011 in the evening 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 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 Mr. NC Dhuldhoya and seconded by Prof. GS Chauhan. Prof. Naveen Khare, Hon. Editor of the Carbohydrate News Letter (CNL), then placed the 'Statement of Accounts' of CNL (Issue - 12) which was accepted unanimously, proposed by Dr. BR Sharma and seconded by Prof. GS Chauhan. 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.

In the last Silver Jubilee GB Meeting, it was proposed

that a new award in the age group of 36 to 45 years of Rs. 10000.00 in the memory of Dr. H.C. Srivastava would be initiated which will be sponsored by Local Organising Committee of the annual forthcoming Carbohydrate Conferences. A committee is formed by the President, ACCTI which looked after framing the guidelines for this award. The members of the committee are Drs. K.P.R. Kartha (Chairman), V.S. Parmar, B. Joshi, R.P. Tripathi, Ashok Prasad & Naveen Khare (Member Secretary).

The members have also endorsed the view of EC Members that Dr. RP Tripathi would be the next Editor of CNL. It was proposed by Dr. Vasudeva Singh and seconded by Dr. Chitra Mandal.

Owing to the problem of frequent hacking of the website of the Association, it was decided by the members of the Association to have the increased band width website with more security features. Dr. AK Sen and Dr. PK Gupta were given this responsibility to contact the vendor Mr. Mishra, D'Dun to upgrade the current website www.accti.in and sort out this issue.

The members are also of the view that there is an urgent need to increase the life membership of the Association. Following members take the responsibility to bring in the new members to the fold of Association, Prof. GS Chauhan (10 members), Dr. Chitra Mandal (5 members), Dr. RP Tripathi (7 members), Dr. Vasudeva Singh (5 to 10 members), Dr. B. Ray (5 to 10 members) and Dr. T. Mohan Das (3 to 4 members).

The members also discussed the proposal of Prof. Loganathan to modify the name of the Association to Association of Carbohydrate Scientists & Technologists of India for wider prospective. After much deliberation, it was resolved that unless the Bylaws of the present Association are changed the modification in name will not have legal sanctity.

Dr. Asish K. Sen & Prof. N. Jayaraman then described the

status of the International Carbohydrate Conference to be held in 2014. The Members discussed about the successful hosting of International Carbohydrate Symposium (ICS) in 2014. Dr. A. K. Sen was also requested to communicate to Drs. Kamberling & Mukund Gurjar for future strategies and also look after the Satellite symposium for ICS 2014 and which he agreed to work vigorously. Members have also unanimously agreed to form the core group which will be responsible for the successful conduct of the ICS-2014. The members of the core group are Prof. BP Chatterjee, Dr. AK Sen, Prof. Jayaraman, Prof. Loganathan, Prof. GS Chauhan, Dr. MK Gurjar, Prof. KPR Kartha, Prof. Ashok Prasad, Prof. T. Pathak, Dr. RP Tripathi, Dr. Anup Mishra, Dr. C. Mandal, Prof. HC Trivedi, Dr. PV Salimath, Dr. Surolia, Prof. CP Rao, Prof. YD Wankar, Dr. TK Chakraborty, Prof. Naveen Khare (Member Secretary).

It was also discussed by the members that the venue of next XXVII Carbohydrate Conference (CARBO XXVII) which may be at CFTRI, Mysore under the dynamic leadership of Drs. PV Salimath, Vasudeva Singh and G. Muralikrishna. These gentlemen are asked to contact their present Director to make the venue final and inform the President & Secretary, ACCTI accordingly without further delay.

The general body of the association congratulated Drs. Vasudeva Singh, GS Chauhan, R.P. Tripathi for receiving the Life Time Achievement Award, second eTCR award and second Excellence in Carbohydrate Research award, respectively. The GB also thanked Dr. KPR Kartha and Dr. T. Emilia Abraham for giving the third Dr. H.C. Srivastava memorial lecture and third Mr. C.G. Merchant memorial lecture, respectively.

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

Prof. Naveen Khare (Secretary, ACCTI)

Report of the XXVIth Carbohydrate Conference held at the Indian Institute of Chemical Biology, Kolkata on November 23-25, 2011

The XXVI Carbohydrate Conference was inaugurated by Prof. M. Vijayan, DAE Homi Bhaba Professor, Indian Institute of Science, Bangalore, as the chief guest. The inaugural function was presided over by Prof. Siddhartha Roy, Director, CSIR-IICT, Kolkata, who welcomed the gathering. Dr. Asish Kumar Sen, President of the ACCT(I) and also the convener of the conference addressed the gathering. Dr. Naveen Khare, the secretary of the Association, briefly narrated the activities of the Association. Dr. P. L. Soni, Advisor to the Association addressed the gathering on the present trends of carbohydrate research in India. Mrs. Shailaja Merchant, Executive Director, Lucid Colloids Ltd, Mumbai, the guest of honour spoke on the current trends in Indian gum industry and its prospects. Vote of thanks was given by Dr. P. Jaisankar. The Souvenir was released by Prof. M. Vijayan.

The theme of the XXVIth Carbohydrate Conference was "Carbohydrate: Confluence of Chemistry and Biology". Scientific deliberations were held under 8 scientific sessions viz., Structure & Synthesis, Chemistry & Biochemistry, Gums and Mucilage, Glycobiology, Panel discussion were held on present and the future prospects of Indian gum industry etc. The key-note address was delivered by Prof. M. Vijayan. The H. C. Srivastava Memorial Lecture and C. G. Merchant Memorial Lectures were delivered by Prof. K. P. R. Kartha, NIPER-Mohali and Dr. Emilia Abraham, Scientist, CSIR-NIIST respectively. The second excellence in carbohydrate research was awarded to R. P. Tripathi, CSIR-CDRI, Lucknow. The second eTCR award for the best published article in TCR in 2011 was awarded to Prof. Ghanshyam Chauhan, Shimla University. Besides this there were seven plenary lectures, twelve Invited lectures and nine oral

presentations by senior and young carbohydrate scientists from various parts of India. Sixty-seven posters were presented in the conference. The Abstract of all oral and poster presentations was published in the abstract booklet. Nearly two hundred and seventy five delegates from all over India participated in the conference.

Prof. M. Vijayan delivered a lecture on "The Structure and Interaction of Threefold Symmetric Lectins: New Insights and Initiatives". In this lecture he emphasized on the recent studies on structure, origin and sugar specificity of b-prism I and b-prism II fold lectins. The lecture on 'Carbohydrate and Beyond-from Design to Synthesis' delivered by Dr. Tushar Kanti Chakraborty, Director, CSIR-CDRI, Lucknow, illustrated the synthesis of structurally complex and biologically active natural products. Dr. Chitra Mondal, Scientist-H, CSIR-IICB, Kolkata, spoke on 'Carbohydrate as Third Language of Life: Mysteries Unveiled in Erythrocyte Biology. Dr. P. Salimath, Scientist-G, CSIR-CFTRI, Mysore, spoke on Biochemical understanding of changes in Glomerular basement membrane (GBM) constituents during diabetes and modulation by diet. The panel discussion was chaired by Dr. P. L. Soni. Several scientists and technologists from various industries participated in the discussion. As the requirement of Guar gum etc. for industrial application is growing very fast, the need for the alternative source was felt. It was also felt that value addition of natural gums for various application will be beneficial to the gum industry.

The Life Time Achievement Award of ACCT(I) was awarded to Dr. Vasudeva Singh, Scientist, CFTRI, Mysore, for his outstanding work in the field of Rice technology. The ACCTI young scientist award was given to Mr. Anandi Singhamahapatra, IIT-Madras and Mr. Somnath Mukherjee, IISER, Kolkata based on their poster/oral presentations. The Lucid Colloid Award was awarded to Mr. Debasis Das, University of Calcutta, Kolkata.

In the valedictory session, a panel discussion was held where the role of carbohydrates in biology and its future prospects in India was discussed. Several scientists participated in the discussion which lasted for more than one hour. The need for intense research to understand the structure-function activities of carbohydrates/glycoproteins in various biological systems was felt. The members felt that chemical biology of carbohydrates is a vital area to understand the crucial role

carbohydrates play in a living system. The panellists felt and recommended the following areas where special emphasis should be given.

Recommendations :

- Development of environment friendly methodologies for the synthesis of biologically active oligosaccharides and glycoconjugates through the use of enzymes, one-pot synthesis etc.
- Chemical modification and value addition of galactomannans and studies on the properties of the derived products for industrial application.
- Modified carbohydrates for development of biodegradable materials for industrial use.
- Development of new gums and mucilages for industrial application.
- Studies of role of carbohydrates and glycoconjugates in disease process and their potential therapeutic application.
- Application of sugar specific lectins for diagnostic purpose.
- Studies on structure and function of polysaccharides from terrestrial and aquatic plant, animal and microbial sources.
- Identification of new microbes and development of controlled condition for microbial synthesis of polysaccharides useful for food and allied industries.
- Changes in the structure and function of starch and polysaccharides during the processing steps and their application in food processing industry.
- Application of health beneficial carbohydrates especially oligosaccharides, arabinoxylan, food fibers etc.

In his concluding speech, Dr. Asish Kumar Sen, President of ACCT(I) and convener of the CARBO-XXVI, thanked all the participants for their participation and for making the conference a grand success. He also thanked all the speakers and eminent scientists for the excellent presentations which enriched the conference.

Convener,
Dr. Asish Kumar Sen
Organizing Committee

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ASSOCIATION OF CARBOHYDRATE CHEMISTS & TECHNOLOGISTS (India) EXECUTIVE COMMITTEE MEMBERS (2011-2012)

Advisor : Dr. P. L. Soni

Science Advisor
Carbohydrate Polymer Natural Product and Non-wood
Produce Utilization
Forest Research Institute, Dehra Dun - 248006.
E-Mail: soniplin@yahoo.co.in
Ph.: 0135-2773736

President : Dr. Asish Kumar Sen

Additional Director
Department of Chemistry (Carbohydrate)
Indian Institute of Chemical Biology, Kolkata - 700 032
E.mail: aksen@iicb.res.in / asihsksen@yahoo.com
Ph. (O) 033-473-3491/0492, Extn. 720 or 033-
24995720/24298869
(R) 033-422-6623; (M) 09433068074; Skype:
asish.kumar.sen.iicb

Vice President (Academic) : Prof. K. P. R. Kartha

Professor, Department of Medicinal Chemistry,
National Institute of Pharmaceutical Education &
Research
Sector 67, S.A.S. Nagar (Mohali) 160062
E-mail: rkartha@niper.ac.in. Ph: +91(0)-172-214682-87

Vice President (Industry) : Mr. Bharat Joshi

Ex. Director, Encore Natural Polymers (P) Ltd.
227/233 GIDC industrial estate,
Naroda, Ahmedabad - 382 330. India
E-mail: bjoshi@encoregroup.net, brjoshi00@yahoo.com
Ph: +91-79-22822548-22822559, handy: +91-9898943399

Secretary: Prof. Naveen Khare

Chemistry Department,
University of Lucknow,
Lucknow-226 007, Uttar Pradesh
E-mail: CNL.ACCTI@gmail.com/nkhare58@gmail.com
Mobile: +919415006072

Jt. Secretary: Prof. Ashok Prasad

Department of Chemistry, University of Delhi
Delhi-110007
E-mail: ashokenzyme@yahoo.com. Ph. (O) 011-
27662486

Treasurer: Dr. P. K. Gupta

Head, Cellulose and Paper Division,
Forest Research Institute (FRI),
(Indian Council of Forestry Research & Education)
PO-New Forest, Dehra Dun - 248006,
Uttarakhand, India
E.mail: guptapk@icfre.org
Phone: +91-135-2224390, 2224386(O); Cell: +91-
9358126046

Executive Members:

Dr. R. P. Tripathi

Professor, AcSIR, Senior Principal Scientist
CSIR-Central Drug Research Institute

Medicinal and Process Chemistry Division
(Council of Scientific & Industrial Research)
Lucknow -226 001, U.P, India
Website: <http://rptripathi.com>
E.mail: rpt.cdri@gmail.com, rp_tripathi@cdri.res.in,
rpt.cdri@yahoo.co.in
Phone: 0522-2612412-418, Extn: 4462, 4311
Fax: 91-522-2623405; 091-(522)-2623405/ 2623938

Mr. N. C. Dhuldhoya

Manager (R&D), 468, Chadha Mansion, 4th Floor, S.V.P.
Road
Opp. M. V. High School, Mumbai - 4000 04
E.mail: ndhuldhoya@lucidgroup.com
Mobile: 9821041534
Tel: 91-22-4158059 Extn. 208

Mr. P. K. Hissaria

Sunita Hydrocolloids (P) LTD.
(An Indo-American Joint Ventured Company)
E-394, MIA, Phase II, Basni
Jodhpur 342005, (Rajasthan)
E.mail: pkhissaria@shplindia.com. Ph: +91-291-
2740075/2740270

Dr. Hasi Das

Additional Director
Institute of Genomics & Integrative Biology,
Delhi. E.mail: hasi hdas@igib.res.in

Dr. Vasudeva Singh

Head, Department of Grain Science and Technology
Central Food Technological Research Institute
Mysore - 570 020.
E.mail: singhva2003@yahoo.co.in.
Ph: 0821 - 2510843 (O), 0821 - 2510155 (R)

Dr. Balaram Mukhopadhyay

Assistant Professor, Indian Institute of Science Education
and Research-Kolkata (IISER-K)
Mohanpur Campus, P.O. BCKV Campus Main Office,
Mohanpur Nadia 741252, West Bengal.
E.mail: sugarnet73@hotmail.com

Dr. T. Mohan Das

Assistant Professor, Department of Organic Chemistry
University of Madras, Guindy Campus, Chennai 600025
E.mail: tmdas_72@yahoo.com. Ph: 044-2202814

Dr. Rekha Singhal

Department of Food Engineering and Technology
Institute of Chemical Technology
University of Mumbai, Matunga
Mumbai-400019
E-mail: rekha@udct.org

Dr. Y. S. Savitha

Grain Science and Technology Department
Central Food Technological Research Institute
Mysore - 570 020.
Ph: 0821-2510843

HONOURS / AWARDS



Dr. G. Muralikrishna, FAFST(I), Scientist-F (Senior Principal Scientist), Department of Biochemistry and Nutrition, CSIR-CFTRI, Mysore, Karnataka, India was promoted to Scientist-G (Chief Scientist) position which is next to Director's cadre. He has contributed significantly in the area of carbohydrates and their degrading enzymes. He has published more than 60 publications in highly peer reviewed International Journals. He was granted US and Indian patents and guided 8 Ph.D candidates. At present 6 more are working for their Ph.D degrees on various aspects of prebiotics and dietary fibre components. He is the life member of ACCT(I) and one of the conveners of CARBO-27, being held at CSIR-CFTRI, Mysore from Dec 13th-15th 2012.

Mrs. Savitha Prashanth, CSIR-SRF working at CSIR-CFTRI for her Ph.D under the guidance of Dr. G. Muralikrishna, was awarded the best poster award (III prize) for the presentation entitled "Arabinoxylans from finger millet bran- Purification and Structural characterization" authored by **M. R. Savitha Prashanth & G. Muralikrishna** in the area of nutraceuticals and functional foods in the International Symposium on recent trends in processing & safety of specialty and operational foods, held at DFRL, Mysore from 23-25 November 2011.

BEST TEACHER AWARDS

Prof. Naveen Khare, Secretary, ACCTI has brought laurels to the ACCTI as he was selected for the Order of Merit for

Best Teacher Award by the Chemical Research Society of India (www.crsi.org.in). The felicitation ceremony was held on July 21, 2012 at Hotel Clarks Awadh. The President of the Society, Prof. S. Chandrasekaran, IISc, Bangalore gave away the citation and books on Chemistry to the awardees. This Mid Year Meeting 2012 of Chemical Research Society of India (CRSI) was organized by Medicinal & Process Chemistry Division, C.D.R.I., Lucknow at Hotel Clarks Awadh, Lucknow on July 21-22, 2012. The CRSI participates in the study, practice, teaching and promotion of chemistry. The main objectives of the CRSI



are to recognize, promote and foster talent in chemistry and chemical sciences and to improve the quality of chemical education at all levels. The CRSI organizes conferences, seminars, workshops, symposia and other related programmes to facilitate and promote research in all branches of chemistry".

ACCTI YOUNG SCIENTIST AWARDS, 2011

To encourage young students, the Association of Carbohydrate Chemists & Technologists (India) gives cash award of Rs. 2500.00 (Rupees two thousand and five hundred 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 XXVI Carbohydrate Conference held at IICB, Kolkata from Nov. 23-25, 2011, paper entitled "Carbohydrate derived Non-covalent Organic Framework Stabilized by C-H...O Interactions" by Anadi Singhamahapatra and D. Loganathan of IIT, Chennai was judged as Best Poster Presentation. The paper entitled "Synthetic and Supramolecular Carbohydrate Chemistry" by Somnath Mukherjee and Balram Mukhopadhyay, IISER, Kolkata was judged as the Best Oral Presentation. We express our heartiest congratulations to Mr. Anadi Singhamahapatra and Somnath Mukherjee.



Anadi Singhamahapatra is working as a Ph.D. scholar (CSIR-JRF) in the Department of Chemistry, IIT, Madras under the supervision of Prof. D. Loganathan, since 2008. His Ph.D. work is based on "Synthesis and Structural Investigation of Glycans and Glycopeptides". He completed his B.Sc. from Vidya Sagar University, West Bengal in the

year 2002-2005 with Chemistry Hons. He obtained his master degree from IIT, Madras in the year 2005-2007. Now, he is actively engaged in scientific research work related to Carbohydrates especially Glycans and Glycopeptides.



Somnath Mukherjee is working as Post Doctoral Research Fellow (joined at Sept. 10, 2012) with Dr. Kana M. Sureshan, School of Chemistry, IISER, Thiruvananthapuram, Kerala, India. He obtained his Ph.D. from IISER, Kolkata under the supervision of Dr. Balaram Mukhopadhyay. His Ph.D. work is based on "Synthesis and Supramolecular

Chemistry of Carbohydrate Derivatives and Development of Methodologies". He completed his B.Sc. from Burdwan University, West Bengal in the year 2007. He obtained his master degree from the same University in the year 2009. Somnath published 6 papers in journals of high repute. Beside this, he received several awards in various conferences. Somnath has keen interest in musical instruments, singing and dancing.

LUCID COLLOID AWARD-2011

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 XXVI Carbohydrate Conference held at IICB, Kolkata from Nov. 23-25, 2011, a poster entitled "New galactomannan derivative for one step biocide coating" by Debasis Das and Arup Mukherjee from University of Kolkata was selected for the award. We express our heartiest congratulation to Mr. Debasis Das.

FOLLOWING ARE THE ABSTRACTS OF YOUNG SCIENTIST AWARDEES AT CARBO XXVI Carbohydrate Derived Non-Covalent Organic Framework Stabilized By C-H...O Interactions

Anadi Singhamahapatra and Duraikkannu Loganathan*

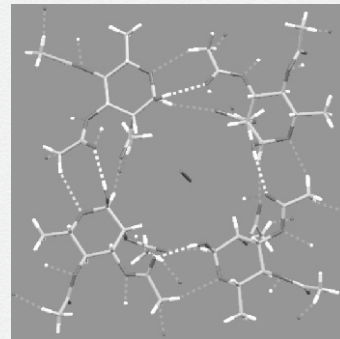
Department of Chemistry, Indian Institute of Technology, Madras, Chennai - 600036

Email: loganath@iitm.ac.in

Synthetic porous materials such as metal organic frameworks (MOFs) and covalent organic frameworks (COFs) have tremendous scope for potential applications in the area of separation, adsorption, catalysis and molecular recognition. Although lesser known in literature, organic frameworks stabilized by non-covalent organizations such as π - π stacking interactions, hydrophobic contacts and H-bonds, have greater propensity for structural rearrangement and polymorphism because they are assembled via weaker and less directional non-covalent forces in comparison with covalent and coordinative frameworks. Here in his present work we have synthesized carbohydrate based non-covalent organic framework assembled via C-H...O interactions. 6

Deoxyhexoses are frequently found on the cell surface of pathogenic bacteria and L-Rhamnose (Rha) is a component of outer cell membrane of Mycobacterium tuberculosis. As part of our research program aimed at developing anti-bacterial drugs, 2,3,4-tri-O-acetyl- α -L-rhamnopyranose (1) was synthesized. Single crystal X-ray analysis of compound 1 was performed and the structure was solved in the space group I4₁, a rather rare one to find in the reported sugar crystal structures.

The present study has unraveled a unique molecular assembly driven by a combination of one regular hydrogen bond and five C-H...O interactions in the crystal structure of 1. Each molecule of 1 is interconnected to 4 molecules by regular H bond and C-H...O interactions. The resultant crystallographic synthon gains a gigantic valency of 48, half of which are satisfied by mutual interactions among these while the remaining 24 enable the synthon to expand the network indefinitely in three dimensions. The outcome of this expansion is the exquisite molecular assembly consisting of channels of ~ 8 Å diameter. Compounds such as 1 can be used for adsorption and separation of small molecules. Efforts are pursued in our lab to develop specialty biodegradable porous materials derived from other renewable carbohydrate sources.

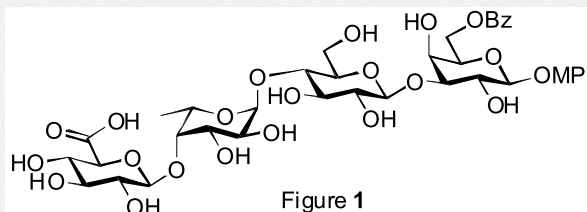


Synthetic and Supramolecular Carbohydrate Chemistry

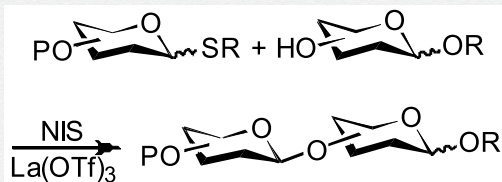
Somnath Mukherjee, Balaram Mukhopadhyay

Department of Chemical Sciences, Indian Institute of Science Education and Research-Kolkata,
Mohanpur Campus, Mohanpur, Nadia 741252
carbo.som@gmail.com

Carbohydrate is one of the most important class of biomolecules in nature. The creation of novel functional biocompatible materials from naturally abundant carbohydrates is very important for the advancement of carbohydrate chemistry, material science, biotechnology,

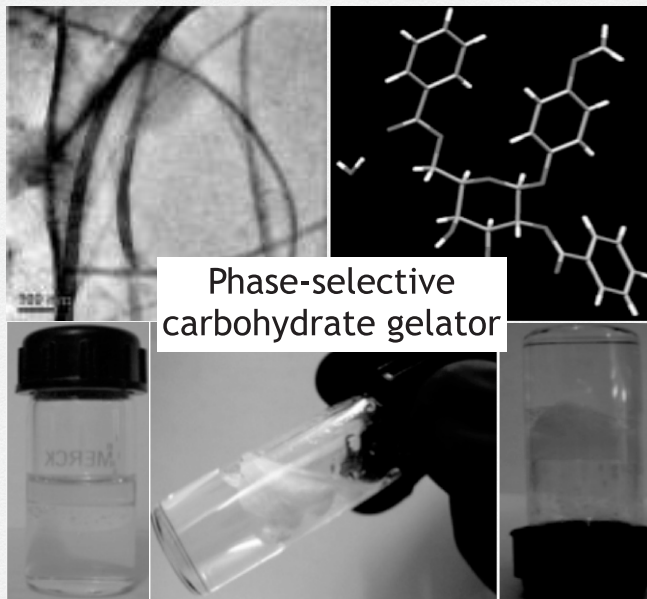


and the biomedical field. Glyco-conjugate in various form are known to be involved in various biological processes. Arguably various carbohydrate structures can be isolated from nature to elucidate their biological implications. However, to know the better insight of the role of carbohydrates in biological pathways, it is necessary to synthesize precise carbohydrate structures by chemical means. Sugar being ecofriendly and owing to the presence of relatively simple and well studied synthetic methodologies in carbohydrate chemistry requisite molecular design is possible in sugar scaffold and that make it simple, cheap and easy to synthesise supramolecular synthon (such as sugar derived LMOGs) for making soft materials in the field of material sciences. The



Scheme 1. La(OTf)₃ promoted glycosylation

presentation will describe the activities in our laboratory towards total syntheses of biologically important



oligosaccharide related to the repeating unit of the O-antigen from *Rhodococcus* sp. RHA1 (1)¹ with the development of methodologies for glycosylation (Scheme 1)² and sugar derived phase-sective^{3,4} Low molecular Weight organogelator capable of solidifying oil from oil water mixture.

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