

# CARBOHYDRATE NEWS LETTER

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## From the Editor's Desk

Dear Friends and Colleagues,

Since the dawn of civilization, human beings have made tremendous efforts to alleviate suffering through various ways including the use of Science and Technology. In recent times, the biological revolution has pivoted on Genomics and Proteomics. Momentum is building, however, to do for carbohydrates what scientists have done for Genomes, and are attempting to do for Proteomes; to characterize the entire complement of these sugar chains in a cell, called the Glycome.

Although carbohydrates are ubiquitous in both prokaryotic and eukaryotic cells, an appreciation of their varied functions is only beginning to emerge. These carbohydrates are information rich molecules vital to recognition processes. We have gathered much of what we know about carbohydrate function from interdisciplinary studies involving methods from genetics, structural biology, biochemistry, organic and analytical chemistry and cell biology. Historically, the study of carbohydrates has been challenging because their isolation from natural sources yields only small quantities of often-heterogeneous material. There have been considerable advancement in synthetic methods and instrumental techniques, but in general, procedures used in carbohydrate research are laborious and time consuming, and lack of high-throughput techniques is responsible for the slow pace of carbohydrate research. Now carbohydrate micro-array and atomic force microscopy is being developed to study the interaction between carbohydrates and proteins very effectively.

Carbohydrate modification of glycoproteins and glycolipids is the functional fine-tuning of these molecules. Errors in glycosylation have severe implications and are found associated with common diseases such as cancer, diabetes etc. This definitely implies that there is a tremendous potential for carbohydrate based therapeutics or drugs to combat various disorders. It is necessary to target specific disorders with known molecular basis and to address fundamental problems at the molecular level for the development of carbohydrate pharmaceuticals.

Gums & mucillages, starch, cellulose, other plant polysaccharides and their value added products are widely used in the industry for various purposes. In recent times, starch based biodegradable materials have emerged as promising alternatives to commodity synthetic polymers. The drawbacks of starch, such as poor water resistance and mechanical properties have been improved by using nano-clay in combination with starch. Modified starch and polylactic acid are also being used for laminate films, which have good water resistance and gas-barrier properties. These products are cost effective and biodegradable.

I am thankful to all the members of the advisory committee for their active support in this endeavour. I am very grateful to Encore Natural Polymers Pvt. Ltd., Hindustan Gum & Chemicals Ltd., Lucid Colloids Ltd., Sunita Minechem Industries, for their patronage in sustaining this publication. Thanking all of you,

Asish Kumar Sen

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## Presidential Address\*

Prof. B. P. Chatterjee, I. A. C. S., Kolkata

Good morning.

Dr. Shashi Kumar, IFS, Director (Research), Indian Council of Forestry Research & Education, Sri Uday Merchant MD, Lucid Group, Mumbai, Sri K. K. Choudhury, IFS, Director, Forest Research Institute, Dr. Subhobrata Sengupta, Scientist-G, Indian Institute of Chemical Biology, Kolkata, Dr. P. L. Soni, Head, Chemistry Division, FRI and Secretary, Association of Carbohydrate Chemists and Technologists, India, Prof. Anakshi Khare, distinguished carbohydrate chemists, delegates, ladies and gentlemen. It is my honour as president of the ACCT(I) to deliver the address at this wonderful annual meeting where carbohydrate researchers, scientists and technologists from related fields are present.

Carbohydrate conference is the annual event organized by the ACCT(I) in association with the R & D Institutions and Universities, and was first organized in Ahmedabad Textile Industries and Research Association (ATIRA), Ahmedabad, in 1984, by Dr. H. C. Srivastava, doyen of carbohydrate chemistry. Next year, in 1985, ACCT(I) was formed by Dr. Srivastava as founder president with the idea to make a platform for dissemination of knowledge and exchange of views among scientists, technologists and industrialists. This organization has come up of age now and has been strengthened by its different wings. I mean, more scientists not only in the field of carbohydrates, but from other allied fields too have become members of this organization.

The theme of the conference is 'Recent Trends in Carbohydrate Research and Application'. In earlier conferences, industrial polysaccharides and gums were the most discussed topics. In recent times, the abstract book contains papers related to other areas of carbohydrates such as lectins, biochemistry of carbohydrates, enzymes, modeling of carbohydrate molecules, structure & synthesis of biologically important complex sugars and also a small number of papers on Glycobiology.

Polysaccharides, gums and mucilages have great value not only in industrial application, which is earning revenue, but in biology also. India is one of the largest producers of various gums and mucilages and obviously the products are being used in various industries for diverse purpose. The gum industries in India mainly exports raw materials but, some value added materials are also manufactured. National laboratories, research institutes and R&D of the industries have taken programme for chemical modification to get the desired product for specific applications which could save lot of foreign exchange. The promising raw materials are seed galactomannans from *Cassia* sp. and tamarind kernel powder (TKP) besides well known versatile guar gum, are being explored and Dr. Soni's contribution in this field is worth mentioning.

Carbohydrates are the most important molecules in the initiation of almost all biological processes through

carbohydrate-protein interaction. New carbohydrates or their analogs are still being discovered with new roles in biological processes and diseases. The advent of new methodologies and techniques for the characterization of complex carbohydrate molecules have contributed towards these recent findings. There are many examples. Guar gum is now used in colon specific delivery of drug like metronidazole and tinidazole. Albendazole, used for expulsion of worm, is now attached to guar gum matrix for release at specific site.

I would focus on fascinating world of microbial polysaccharides. The most well known polysaccharides are xanthan, dextran and curdlan. These are only manufactured by some large multinationals and large amount is imported for use in food to 'drilling mud' in oil production. The annual production is 20,000 tons in the world. In India the manufacturing technology has been developed by CFTRI, Mysore. Another bacterial polysaccharide is gellan, a product derived from *Sphingomonas paucimobilis*. Besides used in food, it is widely employed as a gelling agent in plant biotechnology.

Bacterial cellulose from *Gluconacetobacter xylinus* is a high value product of biotechnology. Because of its purity and the orientation of its fiber, it can be used for manufacturing high quality audio membranes. Bacterial cellulose which promotes healing and reduces plasma loss, is also used in wound dressing. It is sold under the brand name Biopol and is especially useful for burns victims and for patients with extensive skin damage. Hyaluronic acid is another bacterial polysaccharide which is used in moisturizers in cosmetic industry for its high hydrating property. Chitosan, a fungal polysaccharide, is used in soap, shampoo and hair spray. It is also used as anti-ulcer, anti-hypertensive, anti-cholesterolemic, anti-obesity drug.

Antigenic polysaccharides coupled to a suitable protein, are used as vaccines. Thus, meningitis vaccines have been prepared in this way. Role of certain microbial polysaccharides in tumor suppression and immunostimulation has been evidenced. Fungal glucan named "Scleroglucan" appears to be effective against cancers.

Today's challenging area is carbohydrate drugs. There are now nearly 40 companies in the world actively pursuing the therapeutic potential of glycobiology. Carbohydrate based therapeutics that are available in the market or under development are mainly focused on (i) anti-inflammatory drugs: Drugs that mimic the carbohydrate receptor (SLeX) on white blood cells, and used to prevent cell adhesion; (ii) carbohydrate based vaccines are being developed to produce immune response against the carbohydrate antigens expressed on cancer cells and thus inhibit the spread of cancer. (iii) in various cardiovascular diseases: a new generation of low molecular weight heparin, with improved safety and efficacy is being developed to treat stroke, myocardial infarction (heart attack), deep vein thrombosis and pulmonary embolism, and (iv) in infectious diseases: Carbohydrates that bind toxins or receptors on bacteria and viruses are being developed to treat or prevent the spread of the disease.



Since glycoconjugates are mostly involved in cell-to-cell communication, they play a key role in modulating our response to stress. It may be psychological stress or physico-chemical stress such as increased temperature, lowered pH, increased calcium ion concentration and decreased oxygen content. Many studies have shown that altered glycosylation resulted in various types of stress such as infection, inflammation and trauma. Level of certain glycoconjugates is also increased during both the active and separative phases of stress.

During psychological stress a particular glycoprotein called "stressin" appears in the blood. Its glycosylation pattern particularly sialic acid content changes during short term or acute stress in several disease conditions such as in enlarged prostate, prostate cancer, infertility, asthma and other inflammatory diseases. In inflammation, in Hodgkin's disease and lymphoma, in pregnancy and often in estrogen treatment, ceruloplasmin, a copper containing glycoprotein level is increased. Psychological stress enhances IgE synthesis causing allergic symptoms. Studies on the change of glycosylation pattern can be monitored by lectins of different specificities and can be used in diagnosis. A long road is ahead for choosing carbohydrate as a front line research.

In conclusion, it is my privilege to thank the organizers, especially Director of FRI, Dr. P. L. Soni for hosting CARBO-XIX at FRI, once again after CARBO XIII in 1998, in this attractive city of Dehra Dun, which is in the valley of the Sivaliks. I extend my warm welcome to all delegates of CARBO-XIX for their participation to make this conference a grand success. I can assure you that your visit will be comfortable and enjoyable.

Thank you. Jai Hind.

\*Edited version

## Convener's Report of the XIX Carbohydrate Conference

The XIX Carbohydrate Conference (CARBO XIX) was held between December 1-3, 2004, at the Forest Research Institute (Indian Council of Forestry Research and Education) Dehra Dun. The Conference was inaugurated by Dr. Shashi Kumar IFS, Director (Research) Indian Council of Forestry Research & Education, Dehra Dun. Shri Uday Merchant, M.D., Lucid Group, Mumbai was Guest of honour at the function. Shri K. K. Chaudhuri IFS, Director, Forest Research Institute, Dehra Dun, welcomed the delegates and invitees. The keynote address was delivered by Dr. Subhabrato Sengupta, DGS, Indian Institute of Chemical Biology, Kolkata. Prof. B. P. Chatterjee, Indian Association for the Cultivation of Science, Kolkata and President of the Association of Carbohydrate Chemists and Technologists, India (ACCTI) addressed the gathering and briefed the members about the activities of the ACCTI. The Inaugural function ended with a vote of thanks by Dr. P. L. Soni, Forest Research Institute, Dehra Dun and Organizing Secretary of the Conference.

The conference was organized with the objective of focusing on the major advances and the phenomenal developments in Carbohydrate Research and Applications and to provide National forum for Scientists, Engineers, Industrialists and Educationists to discuss and exchange ideas on recent developments and chalk out future directions. The theme of the conference was "Recent Trends in Carbohydrate Research and Application". Scientific deliberations were held under 7 scientific sessions viz. Plant and Microbial Polysaccharides, Starch/Cellulose/chitin, Synthesis of Glycosides, Biochemistry and Biotechnology, Lectins/Glycoconjugates, Nutraceuticals and Advances in Carbohydrate Applications.

continued..

## Announcement

### XX<sup>TH</sup> CARBOHYDRATE CONFERENCE

It is indeed a great pleasure to invite you along with your family to the CARBO XX to be held during November 24-26, 2005, at the Chemistry Department, Lucknow University, Lucknow. This ancient city of garden, chikan work, kathak dance, ancient architecture & nawabi culture will provide the most conducive milieu in which stimulating scientific exchange amongst carbohydrate chemists, technologists and industrialists from all over the country can take place. Please do keep these dates free and come to enrich our scientific programme & the scintillating social-cultural evenings.

For more information please contact:

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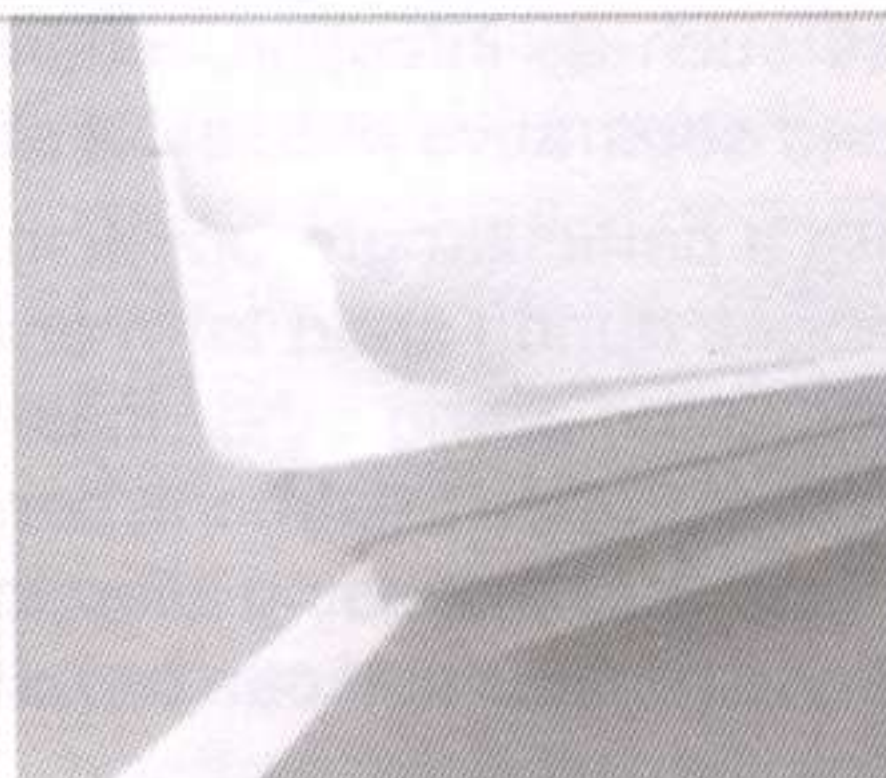
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The scientific programme consisted of plenary lectures, invited lectures, oral presentations and poster session. Among the plenary lectures, Prof. B. P. Chatterjee, I. A. C. S., Kolkata, reviewed the milestones in Lectin Research in biochemistry to biotechnology and Prof. Anakshi Khare, Lucknow University, Lucknow presented chemical synthesis and biological evaluation of anticancer agents of the anthracycline class. Invited lectures, oral presentations and poster presentations gave an account of new vistas in recent trends in carbohydrate research and application. More

than 140 delegates from various R & D organization, universities and industries attended the conference.

ACCTI general body meeting was also held on 1st December, 2004 to elect the new executives for the year 2005 – 2006. The general body has also taken the decision to accept the requests from Prof. Anaksi Khare and Dr. Ashok Kumar Prasad to hold XX and XXI Carbohydrate Conference respectively at the Lucknow University in 2005 and at the Delhi University in 2006.

Dr. P. L. Soni

## Minutes of the Annual General Body Meeting

The Annual General Body meeting of the Association of Carbohydrate Chemists and Technologists (India) was held on 1st December, 2004 at the Forest Research Institute, Dehra Dun. The meeting was attended by 29 members of the Association.

President, Dr. B. P. Chatterjee, gave the introductory speech. Dr. P. L. Soni, Secretary of the ACCT(I), read out the minutes of the previous AGB meeting held during the XVIIIth Carbohydrate Conference at I. A. C. S., Kolkata. The minutes was accepted unanimously: Proposed by Prof. H. C. Trivedi and seconded by Prof. N. K. Mathur.

Dr. P. L. Soni then stated the previous year's activities of the Association. The 'Statement of Accounts-2004' was then presented by the treasurer of the Association Dr. P. K. Gupta. After a brief discussion, Dr. Muralikrishna pointed out that the Income and Expenditure should be shown in two separate columns side by side. Dr. Gupta said that he would make the necessary correction. The Accounts Statement was also accepted unanimously: Proposed by Mr. N. C. Dhuldhoya and seconded by Prof. N. Khare.

The President then initiated the procedure for the election of the new Executive Committee. Dr. Soni said that the previous Executive Committee should resign before the new elections. No nomination was filed before the meeting.

Since there was no representation of industry in the senior executive positions in the past, it was proposed by Dr. Soni to create a Vice-president (Industry) position. The proposal was accepted unanimously. Necessary amendments of the laws of the Association were made.

The members requested Dr. Soni to remain secretary of the Association for another term. But, he expressed his inability to serve as secretary as he is going to retire soon. The house then selected the following executive members for the term 2005-2006 after elaborate discussion.

President:	Dr. P. L. Soni	Vice President:	Prof. H. C. Trivedi
Vice President (Industry):	Dr. N. C. Dhuldhoya	Secretary:	Dr. Asish Kumar Sen
Jt. Secretary:	Prof. Naveen K. Khare	Treasurer:	Dr. P. K. Gupta
Executive Members:	Prof. Ghanshyam Chauhan, Dr. Chitra Mandal, Dr. V. P. Kapoor, Dr. G. Muralikrishna, Prof. Ashok Kumar Prasad and Mr. P. K. Hissaria.		

Prof. Anakshi Khare and Prof. Naveen Khare expressed their desire to host the XXth Carbohydrate Conference. Dr. Ashok Kumar Prasad was also willing to host the same. Dr. A. K. Sen suggested holding the conference at CFTRI, Mysore, as it coincides with the retirement of one of the eminent carbohydrate chemists Dr. R. N. Tharanathan. After some elaborate discussion it was decided that the XXth Carbohydrate Conference will be held at the Lucknow University, Lucknow. Delhi was selected as the venue for the XXIst Carbohydrate Conference. However, since Dr. Hasi Das (who was not present at the conference) also wanted to host the conference in Delhi, the President said that the Convener for the XXIth conference will be chosen after a discussion with Dr. Hasi Das.

Dr. P. L. Soni then proposed to launch the publication of the Journal "Trends in Carbohydrate Research"- which will be published independently and will be self sustained. He said that he would take the sole responsibility of the Journal.

Dr. K. R. Bhattacharya welcomed the proposal but wondered whether he will be able to sustain it economically. Prof. N. K. Mathur opined the same view.

Dr. A. K. Sen, Dr. Chitra Mandal and Dr. G. Muralikrishna expressed their views on publication of papers in the Journal, especially when there is a trend on publishing papers in high 'Impact Factor' journals.

Dr. K. P. S. Kartha said that there should not be more than two issues per year to start with and should accept good review articles. The proposal was well accepted. It was also decided that about 10-12 articles will be published per issue.

Dr. Chitra Mandal said that like Current Molecular Medicine, eminent scientists world wide should be requested to give review articles eminent scientists world wide.

Dr. Ashok Kumar Prasad stressed that there should not be any compromise about the quality of the articles and that the editorial board should be competent enough. It was then decided that Dr. P. L. Soni will be the Editor-in-chief. The editorial board will comprise of one competent person from each discipline of Carbohydrate Chemistry and Biology. If possible some renowned foreign scientists will also be accommodated in the editorial board.

The meeting lasted for one and a half hour and was concluded with a vote of thanks to the chair.



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## NEW MEMBERS

I am privileged to welcome all the new members during January 2003 and October 2005. The full list of members in detail is now available at the website of the Association [<http://www.geocities.com/acctindia>]. Members are requested to send their complete address, telephone no., e.mail address etc. to the editor, CNL, to make the list more meaningful. To strengthen the Association we need more members. So please come forward, motivate your colleagues/friends/students to become members of the Association. Thank you.

No.	Name	Surname	Address	Membership No.
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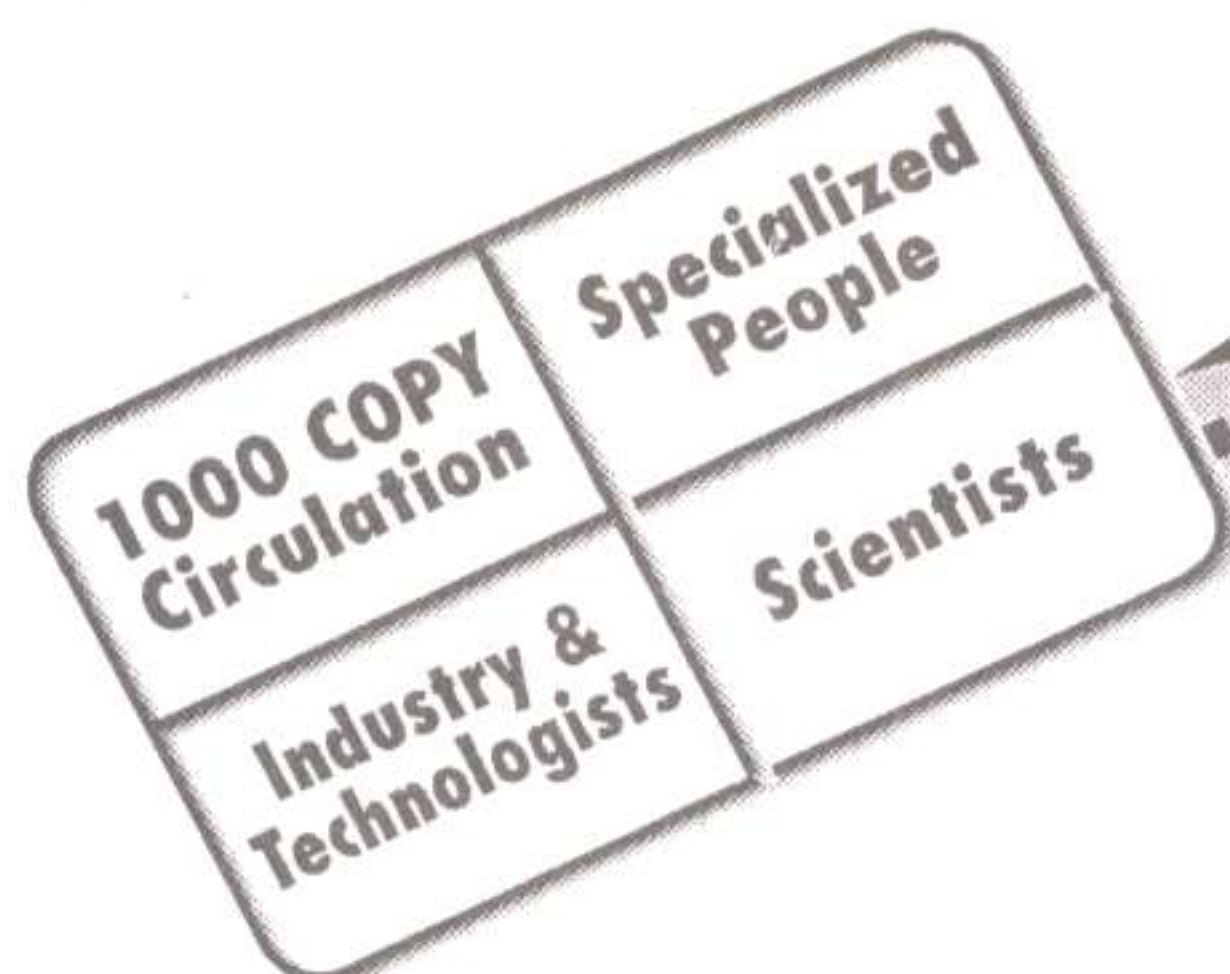
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**- Sarvepalli Radhakrishnan.**



## Life Time Achievement Award

The Association of Carbohydrate Chemists & Technologists (India) is privileged to honour the most successful chemists, biologists and technologists in the country who are working in the area of glycoscience. In the XVIIIth Carbohydrate Conference held in Kolkata, ACCT(I) felicitated Prof. N. K. Mathur, ex-professor, Jodhpur University, Prof. Nirmolendu Roy, Indian Association for the Cultivation of Science, Kolkata, Dr. K. R. Bhattacharya, Central Food Technological Research Institute, Mysore and Dr. V. P. Kapoor, National Botanical Research Institute, Lucknow, with the life time achievement award. In 2004, at the XIXth Carbohydrate Conference held in Dehra Dun, Dr. P. L. Soni, Forest Research Institute, Dehra Dun and Prof. Anakshi Khare, Lucknow University, Lucknow, was awarded the life time achievement award for their excellent contribution to Carbohydrate Chemistry.



**Prof. Anakshi Khare** is one of those rare individuals who has excelled in teaching, natural product chemistry and also in carbohydrate chemistry. She has a brilliant academic career right from high school to post graduate level and has done double Ph.D.: in medicinal chemistry from Lucknow University and in natural product chemistry from London University. She later joined Lucknow University as a lecturer and presently is Professor and head of the Chemistry Department and Dean of the Faculty of Science, Lucknow University.

She also has a remarkable research career. She has nearly 100 research publications, several patents and has written two chapters in the book 'Progress in the Chemistry of Natural Products' besides several review articles. So far twenty two students have received a Ph.D. degree under her supervision.

She has served several national committees under UGC, CSIR and UP Government in various capacities. She is also a member of the editorial board of the international journal 'Journal of Heterocycle Compounds'.

She is a recipient of Commonwealth Fellowship, Full bright Fellowship, NIH visiting scientist and other visiting scientist awards. In acknowledgement of her excellent research contribution in natural product chemistry, she has been awarded Prof. P. K. Bose memorial award by the Indian Chemical Society in 1995.



**Dr. P. L. Soni** is one of the best known carbohydrate chemist in the country. He served Forest Research Institute, Dehra Dun, as Scientist-F and Head of the Centre for Advanced Studies in Chemistry of Forest Produce. His research interest involves Chemistry of Forest Products, Forest Natural product Chemistry and R&D of Carbohydrates.

His remarkable achievements in technology and products development include (i) 'FRI Jigat', which is a better substitute of the barks of *Machilus macrantha* and *Litsea chinensis* which is an essential raw material for the Agarbathi Industry, (ii) the development of a nine step commercial procedure for the production of 'Katha', from *Uncaria gambier* which will help to meet the increasing demand of Katha in pan masala, gutka and other industries, (iii) the development of lipid and protein free Tamarind Kernel Powder for use as a thickener in the food industry, (iv) Development of value added products for various industries from conventional and non-conventional gums and mucilages, (v) technology for the production of alpha cellulose from cotton linter, Eucalyptus, bamboo and bagasse, (iv) the process for development of many commercially viable gums such as Gum Ghati, *Cassiaa tora*, guar etc., and many more. Dr Soni has 15 patents many of which have been commercialized and have garnered nearly seven million rupees as license fee.

His academic interest includes isolation and purification of polysaccharides from various sources and value addition to explore the possibility of use of this hitherto unutilized and abundantly available plant materials in various industries. He has nearly 90 research publications in national and international journals, and more than 30 review articles. He has also written a book and edited nine books. Nine students have done their Ph.D's under his guidance. He has been invited to numerous National and International meetings and conferences. He has served many Scientific Advisory Committees in different capacities. He has been the secretary of the ACCT(I) for nearly 10 Years.

In acknowledgement of his excellent contribution towards the development of new technologies and basic research, Dr. Soni has received many awards and honours which include (i) Vishisht Vaigyanik Puskar, Ministry of Environment & Forestry, Govt. of India, (ii) Forest Research Institute Award, (iii) an honour by the American Biographical Institute, (iv) American Medal of Honour Limited Striking-2003, (v) United Cultural Conventions International Peace Prize etc.



## Honours



**Dr. G. Muralikrishna**, Scientist E-II, Central Food Technological Research Institute, Mysore, received the prestigious 'Laljee Godhoo Smarak Nidhi award and a citation for the year 2002 by the Association of Food Scientists & Technologists (AFST). Dr. Muralikrishna with his active group of seven students is engaged in research on polysaccharides and their degrading enzymes and also on biotransformation of bioactive compounds obtained from cereal bran, to 'vanillin'. Two students who have obtained Ph.D. degree under his guidance are now working in USA as Post-doctoral fellows.

Our heartiest congratulations to Dr. Muralikrishna and best wishes for every success in his scientific endeavour.

## Young Scientist Awards

To encourage young students, the Association of Carbohydrate Chemists & Technologists (India) gives a cash award of Rs. 1000.00 (Rupees one thousand 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 XIXth Carbohydrate Conference, held during 1-3 December, 2004, at the Forest Research Institute, Dehra Dun, papers entitled; 'Emulsifying and surface activity properties of an exo-polysaccharide produced by a marine *Enterobacter cloacae*' by Anita Iyer, Kalpana Mody and Bhavanath Jha and 'Chitooligosaccharides-Preparation with the aid of papain and pronase, and their antibacterial activity' by A. B. Vishu Kumar, M. C. Varadaraj and R. N. Tharanathan, were judged as the best poster presentations.

We express our heartiest congratulation to Mr. A. B. Vishu Kumar and Ms. Anita Iyer.



**A. B. Vishu Kumar** is a Senior Research Fellow at the Department of Biochemistry and Nutrition, Central Food Technological Research Institute (CSIR) Mysore. He is doing his Ph.D. on various aspects of Chitosans under the guidance of Dr. R. N. Tharanathan.

Born in May 1971, he holds excellent academic records. He has passed B.Sc. and M.Sc. from Mangalore University securing 1st rank in B.Sc. and distinction in M.Sc. He has received the 1st and 3rd prize awards for the best presentation at the annual meetings of the Society of Biological Chemists in the years 2003 and 2002 respectively. He holds 4 Patents and has published 12 papers in various journals.



**Anita Iyer** is a Senior Research Fellow at the Central Salt and Marine Chemical Research Institute (CSIR), Bhavnagar. She has obtained her Ph.D. degree on the topic "Studies on marine bacteria and their exo-polysaccharides" under the guidance of Dr. (Mrs.) Kalpana Mody in 2004.

During this period, she has published four research papers. She secured first class in both B.Sc. and M.Sc. from Bhavnagar University. She has attended many national symposiums and presented her research work. Apart from research, she likes music and also likes to make friends.

## Ms. Lucid Colloids Limited Award

To encourage research on hydrocolloids, Ms. Lucid Colloids Limited, Mumbai, offers a cash award of Rs. 5000.00 and a citation for the best paper presentation on hydrocolloids since 2003. At the XIXth Carbohydrate Conference, the paper entitled "Effect of Carboxymethylation of the viscosity and additive properties of Dhaincha seed galactomannan", by Ms. Harsha Joshi and V. P. Kapoor was selected for the award. We express our heartiest congratulation to Ms. Harsha Joshi.



**Harsha Joshi** has completed her Ph.D. work on 'Structural elucidation of seed gums and their pharmaceutical application' from the Phytochemistry Division, National Botanical Research Institute, Lucknow, under the guidance of Dr. V. P. Kapoor. Presently she is working as a Casual Research Fellow at the Food and Fermentation Division, University Institute of Chemical Technology, Mumbai. She obtained her B.Sc. degree from Osmania University, Hyderabad and M.Sc. from Kumaun University, Nainital. She has secured first class through out her academic career.

Born in July, 1976 in Hyderabad, Harsha has an extraordinary talent for arts and culture. She has won many awards for her extra curricular activities and classical dance (Kuchipudi). Her hobbies include singing, dancing, reading and writing. It is her dream is to become the best scientist in her field by doing novel and innovative research work.



# New Sources of Industrial Gums: Part I - Seeds from *Cassia* legumes

V. P. Kapoor

Emeritus Scientist (CSIR)  
National Botanical Research Institute  
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Seed galactomannans are water soluble high molecular weight hetero-polysaccharides of galactose and mannose, which form viscous or colloidal solutions when dispersed or dissolved in water. These are commonly known as seed gums and come under the category of food hydrocolloids. Seed gums are used world over in enormous amount for varied industrial applications notably paper products, textiles, food, petroleum well drilling, pharmaceuticals, mining, cosmetics, explosives and fire-fighting. Their occurrence is limited to leguminous family and the gum is located in the endospermic part of the seeds as cell wall storage component and energy reserve. Galactomannans generally have the fundamental structure consisting of the main chain of  $\beta$ -(1 $\rightarrow$ 4)-D-mannopyranosyl units to which single  $\alpha$ -D-galactopyranosyl units are attached at O-6 as side chain. In spite of having the said basic structure, they differ from each other in physico-chemical properties, solubility characteristics, viscosity behaviour, gelling properties and interaction capabilities. These variations are due to the extent of mannose/galactose ratio, molecular weights, polydispersity and fine structure. The fine structural variation is due to the distribution of galactose molecules as side chain along the main mannan backbone, which may be regular, random or in block pattern.

Guar gum, isolated from the seeds of *Cyamopsis tetragonoloba* Taub, is the main and foremost source of commercial gum and India is one of its main producers. The gum is produced in huge amounts for national and international consumption and has become a commodity

for earning foreign exchange. Jodhpur in Rajasthan has become a prominent centre, which copes up to 50% of international market demand. Indian guar gum is considered at par with the requisite specifications of international standard and acceptable at the global level. The international companies use it as a raw material for the specific production of modified gums for varied industrial applications. The level of modification or derivatization of guar gum in India is very limited and most of the produce is exported in native form. The modification/derivatization of seed gums requires medium level technology which can be easily acquired by effective R&D efforts..

Other sources of Indian commercial gums are dhaincha (*Sesbania bispinosa* (Jacq. W. F. White) and cassia (*Cassia tora* Linn.) gums, which are also produced in substantial amount for different industrial applications. There are other two gums namely carob or locust bean (*Ceratonia siliqua* L.) and tara (*Ceasalpinia spinosa* Linn.), which have immense commercial importance. These tree legumes belong to the Mediterranean Region.

In view of great diversity and availability of legumes in India, an extensive R&D work has been carried out at National Botanical Research Institute, Lucknow to find out new and alternative sources of seed gums. It includes the investigation of about 200 seed species belonging to 20 leguminous genera. The results revealed that genera *Cassia* is the foremost, which contain higher amount of gum content with requisite properties. About 500 species of this genus occur in nature, out of which 40 are found in India. We have collected 20 cassia species from different parts of the country and a detailed study has been undertaken. A preliminary analysis of cassia species is presented in the Table 1.

The endosperm of the seeds is the desirable part for the production of seed gum whereas the rest of the material left after separation of endosperm i.e. seed meal mainly contains protein, pentosan, fiber, oil, medicinal constituents

Table 1 - Chemical analysis of some prominent Indian *Cassia* species.

Sl. No.	Source	Growth Habit	Endosperm %	Moisture %	Crude protein %	Pentosan %	Gum %
1	<i>C. absus</i> Linn.	Herb	33.5	5.1	29.8	11.9	14.6
2	<i>C. alata</i> Linn.	Shrub	44.7	3.3	8.5	9.1	33.0
3	<i>C. angustifolia</i> Vahl	Shrub	50.5	9.2	10.6	9.4	34.0
4	<i>C. didymobotrya</i> Frasen	Shrub	44.0	6.3	11.8	8.9	22.8
5	<i>C. fistula</i> Linn.	Tree	50.5	9.0	17.2	9.0	36.8
6	<i>C. glauca</i> Lamk.	Shrub	—	11.1	19.6	15.5	3.0
7	<i>C. grandis</i> Linn.	Tree	52.5	10.0	7.8	11.9	38.8
8	<i>C. hirsute</i> Linn.	Shrub	57.1	9.0	24.3	11.6	24.0
9	<i>C. javanica</i> Linn.	Tree	46.6	7.8	15.6	10.5	25.3
10	<i>C. laevigata</i> Willd.	Shrub	45.0	6.8	21.8	15.8	18.4
11	<i>C. marginata</i> Roxb.	Tree	61.5	7.9	13.8	12.6	20.0
12	<i>C. multijuga</i> Rich.	Tree	48.4	2.3	12.7	12.2	32.8
13	<i>C. nodosa</i> Buch-Ham.	Tree	53.3	10.1	13.8	10.0	36.0
14	<i>C. occidentalis</i> Linn.	Herb	30.6	10.4	12.8	8.7	30.9
15	<i>C. pumila</i> Lam.	Herb	31.0	9.0	39.3	4.9	16.0
16	<i>C. renigera</i> Wall.	Tree	42.0	7.0	18.3	13.4	20.0
17	<i>C. siamea</i> Lamk	Tree	30.0	9.7	14.8	12.5	24.7
18	<i>C. sophora</i> Linn.	Shrub	24.0	6.7	15.8	14.7	20.0
19	<i>C. surentensis</i> Burn F.	Shrub	42.1	10.0	13.6	7.9	10.4
20	<i>C. tora</i> Linn.	Herb	23.0	8.9	23.9	9.5	20.8



etc. The seed meal is used as cattle or poultry feed because of its high amount of protein (30-45%) content. While identifying the new sources of commercial gums, the endosperm content in the seeds is an important aspect but the technical and economic feasibility of any new source also depends upon the following factors:

1. Habitat of plant species
2. Shape and size of the seeds
3. Availability of seeds and reliability of supply and cost
4. Production cost of gum and constancy of supply
5. Purity status
6. Solubility characteristics and status of insoluble portion
7. Physico-chemical properties, specially viscosity behaviour
8. Possibility of eventual replacement of selected gum by another.

The habitat of the legumes is broadly classified into (i) annual and perennial shrubs and herbs and (ii) trees. Annual crops are considered more preferable than tree legumes because seeds can be obtained through seasonal cultivation in a few months whereas trees require about 5-8 years to grow. For example, guar shrub is considered more preferable than carob tree due to its annual habitat. Guar gum is readily soluble in water whereas carob gum requires mild temperature for dissolution. Carob gum has edge over guar gum in gelling behaviour as it forms pseudo gels and possesses better synergistic interaction with other monomers and polymers. Such characteristic variation is due to varying Man/Gal ratio. The gums having low Man/

Gal ratio (guar, about 2) are readily soluble in water whereas gums having higher mannose content (carob, Man/Gal = 4-5) requires moderate temperature for complete dissolution and forms pseudo gels at higher concentration. The higher mannose content in a galactomannan provides enough blocks of un-branched mannose units for synergistic interactions. Cassia seed gums generally have galactose-mannose ratio around 1:3 and dispersible in water and also form pseudo gels at higher concentrations. Cassia legumes possess enough potential to be used as a substitute/alternative for Mediterranean carob or Tara gums.

For commercial production, the endosperm of the seeds is separated by mechanical means using different grinders followed by pulverizing the separated endosperms. Hence the process depends on the size and shape of the seeds. If the seeds are rich in gum content but very small in size (*Indigofera* species etc.), the separation of endosperm is not technically feasible. The cassia seeds are generally of medium or bigger sizes.

Availability of raw material is an important factor for its commercial exploitation. Most of the Cassia species are cultivated in India for ornamental purposes, construction of avenues and shades along the road sides. The availability of the cassia seeds can be achieved through organized cultivation. Cassia seeds contain higher amount of endosperm gum and their standard specifications are at par with commercial gums. It is the need of the hour that the unexplored cassia plant wealth should be exploited for the commercial production of seed gum.

In the next parts, the possible new sources of seed gums from cassia species will be discussed.

Don't aim for success if you want it, just do what  
you love and believe in and it will come naturally

- David Frost