

# **New Horizons in Biotechnology**

*Editors*

**Ashok Pandey**

**Christian Larroche**

**Carlos Ricardo Soccol**

**Claude-Gilles Dussap**



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in

# **Biotechnology**

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## Preface

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This book is the outcome of the selected invited papers presented by the world leaders in the international conference on New Horizons in Biotechnology (NHBT-2007) held at Trivandrum, India during November 26-29, 2007. This was the fourth Convention of the Biotech Research Society (BRSI) and also the fourth major biotechnology event being organized by the National Institute for Interdisciplinary Science and Technology (formerly Regional Research Laboratory), Trivandrum, providing a much wider platform where people meet periodically. Earlier three conferences were held in 1997 (ICBF-97), 2001 (NHBT-2001) and 2003 (ICB-2003), which were highly successful and provided unique opportunities for the participants to collaborate and network with different groups and persons.

NHBT-2007 focused on recent developments on the frontier areas of Biotechnology, and brought together scientists, engineers and other experts from across the world to deliberate on global developments in the fields of Industrial Biotechnology, Medical Biotechnology, Environmental Biotechnology and Food & Agriculture Biotechnology. It was planned as a major event to be held at Trivandrum during with the participation of a large number of active researchers from all over the world. It was envisaged that this conference would not only provide a unique platform to the participants from industries and academic institutions to share their thoughts and views to develop possible linkages among them, but also served the purpose of global networking among them and helped in creating a nucleus of interface research.

The scientific program of the conference included five mini-symposia on Nanobiotechnology, Advances in Food Safety, Molecular Ecology, Biofuels and *Mycobacterium* Research; and 22 sessions on Industrial Biotechnology, Environmental Biotechnology, Medical Biotechnology and Food & Agricultural biotechnology, in which 103 experts from different countries presented their research works. In addition to this, 467 posters were presented by the contributory authors on different topics. The presentations by the invited speakers were held in three parallel sessions and about 120 posters were presented daily. A total of about 625 delegates from all over the world attended the conference.

The conference organizers place on record their thanks to the members of the International Organizing Committee and International Scientific Committee for their help and efforts in shaping up the scientific program of the conference. They gratefully acknowledge the support and participation of national and

international organizations and agencies, which extended financial sponsorship to the event. Without their support and participation, it would have not been easy to make suitable arrangements for the conference, including the publication of this book. They also place on record their thankfulness to the Director and the scientific, administrative and technical staff of the NIIST for their support for this event. They acknowledge that the event was showcased with the enormous efforts and hard work put behind by the *TeamBiotech* of the NIIST, especially by the students of the Division, suitably supported by the scientists and technical staff of the Division.

The book comprises selected articles from the invited speakers based on their talks in the conference with an aim to collate the most recent developments on their topics. The entire presentation has been divided in four sections comprising 27 chapters. Part A has articles on Industrial Biotechnology and has thirteen chapters on various topics. Part B of the book deals with the Environmental Biotechnology and comprises six chapters. The third part of the book, i.e. Part C is on Food & Agricultural Biotechnology and contains four chapters. The fourth and last part of the book is on Medical Biotechnology, which has four chapters.

The text is supported by numerous clear, informative diagrams and tables.

The book would be of great interest to the post-graduate students and researchers of applied biology, biotechnology, microbiology, biochemical and chemical engineering.

*Editors*

**Ashok Pandey**  
**Christian Larroche**  
**Carlos Ricardo Soccol**  
**Claude-Gilles Dussap**



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# **Part A**

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## **Industrial Biotechnology**

# Structural vagary in Guar gum

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**Arup Mukherjee and Sreyasree Basu**

Department of Chemical Technology, Calcutta University

92, A.P.C.Road, Kolkata - 700009, India

E.mail: hdct1@yahoo.co.in, amct@caluniv.ac.in

## 1. INTRODUCTION

Guar-gum (I) is a galactomannan biopolymer obtained from the seeds of guar plant *Cyamopsis tetragonolobous*. Chemically, Guar-gum (GG) consist of a (1-4) linked  $\beta$ -D-mannopyranosyl (M) polymer backbone partially substituted at O -6 with  $\alpha$ -D-galactopyranosyl (G) side groups (Crescenzi *et al.*, 2004). Unlike other galactomans like Tara gum (*Caesalpinia spinosa*) and Locust bean gum (*Ceratonia siliqua*), GG structure is very compact having M:G ratio of 2:1. This has perhaps provided a significant robustness into the GG polysaccharide backbone. GG is difficult to be metabolized in physiological metabolizing process and is mostly hydrolyzing by specific gut microflora (Chaurasia *et al.*, 2006). Additionally, GG have found diverse applications for its unique physicochemical properties. GG is used in crude oil explorations as ground filler oil drilling mud due to its surface activity and hydrated rheology (Darley & Gray 1988). GG is also used in cosmetics and in pharmaceuticals as a moisture retaining gel and for colon specific drug delivery. GG is widely used in ice creams for unique water crystallization inhibition properties and also for mouth feeling food quality improvements (Gupta & Ako 2005). Structure chemistry of GG remains much less explored and understanding of structure associated bio-macromolecule properties are rare. A detailed study was thus perceived to understand the biopolymer assembly in native state that might in turn be the responsible cause for diverge physicochemical properties of GG.

## 2 EXPERIMENTAL

Guar gum (GG) was obtained as a gift sample from the manufacturer Hindustan gum company, India. Plant gums are often associated with amines, amino acids and salts. GG sample powder was thus systematically washed in alcohol, water and isopropanol and was used upon drying in 30% moisture at 25°C. Samples were preserved in air tight containers at room temperature. Quality checks were routinely performed in CHN analysis, gel permission chromatography (GPC) and the FT-IR was matched.

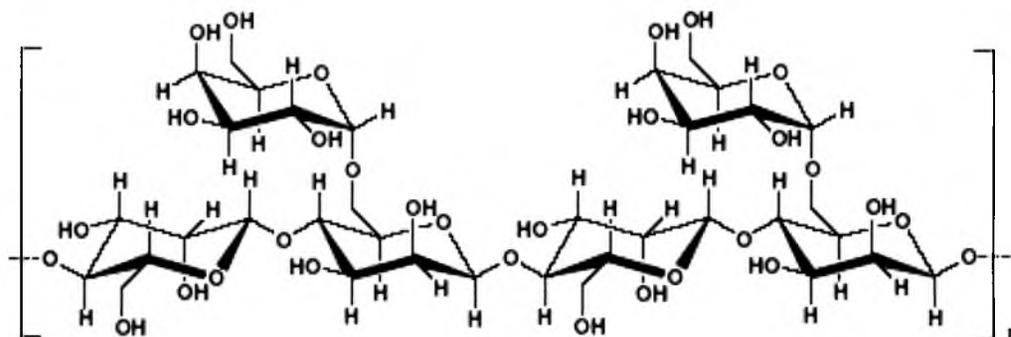


Fig. 1. Guar-gum GG (I).

## 2.1 Physico-chemical characterization of Guar gum.

### 2.1.1. Solubility studies

Solubility quality can provide some insight in material physico chemical properties. Solubility of GG (I) was studied using 10mg weighed quantities in 2ml different solvents using water, hydrochloric acid, sodium hydroxide, N,N, Dimethyl formamide and phosphoric acid mixture (DMF/H<sub>3</sub>PO<sub>4</sub>), Dichloromethane and Chloroform (Wells 1988).

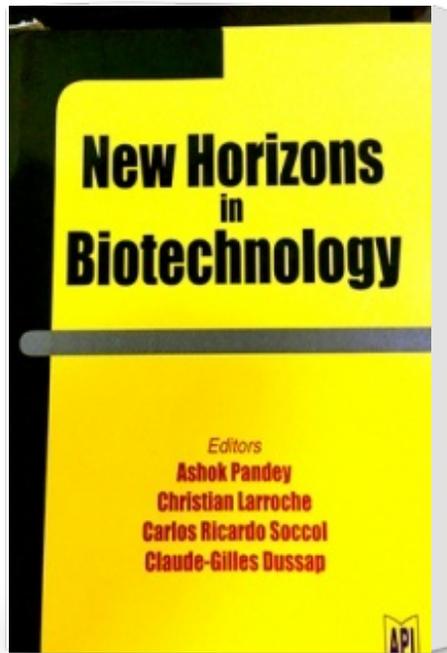
### 2.1.2. Viscosity and surface tension experiments

Surface tension lowering in water due to GG was studied as this center in one of the principle application area. 0.1% w/v Aqueous solution of GG in carbon dioxide free distilled water was used for determination of surface tension lowering of water in Dynamic Contact Angle Meter and Tensiometer (DCAT), Data Physics, Germany and were tabulate in Table 1. The viscosity of a 2% w/v aqueous solution of GG prepared in HPLC grade water was measured using number LV-2 to LV-4 spindle in a Brookefield viscometer, model LVT, Brookefield, USA. The results were compared against the standard viscosity sample supplied by the manufacturer. The viscosity resultants were recorded at 30°C and tabulated in table 1.

### 2.1.3. Percentage composition (C,H,N) analysis

Percentage C,H,N analysis was carried out by combustion technique in the CHNS analyzer model CHNS -932, M/s Leco corporation, U.S.A to understand the presence and composition of different elements. GG Samples weighed in semi micro balance Paul Bunge, model 23, Humburg, Germany were taken in tin cups and were completely combusted in a stream of oxygen from a cylinder. Evolving element oxides were monitored in instrument IR devise and compared against standard supplied samples of acetophenon and cysteine supplied by Leco corporation.

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Author : Ashok pandey

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