Current Topics on Bioprocesses in Food Industry

Editors
Christian Larroche
Ashok Pandey
Claude-Gilles Dussap

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Preface

This book presents a selection of communications presented during the First International Congress on Bioprocesses in Food Industries (ICBF-2004). It was held at the University Blaise Pascal in Clermont-Ferrand, France during July 11-13, 2004. The event focussed on recent developments in the area of food science and technology, with particular emphasis on the bioprocesses and products for the food industries. It brought together a multinational body of scientists, engineers and other experts to deliberate on global developments in the fields of food biotechnology, food engineering, and food chemistry and biochemistry.

Besides the scientific presentations made by internationally renowned scientists, this congress provided a platform to the participants to share their thoughts and views to develop possible linkages among them. In this regard, a key event was the round table discussion during the congress, which was organized at the end of the meeting. The panellists were Prof CG Dussap-France (Chairman), Prof CR Soccol- Brazil, Prof EM Papamichael- Greece, Dr SD Pillai- USA, Prof RG Berger- Germany, Dr S Roussos- France, Prof C Webb- UK, Prof A Rinzema, The Netherlands, Dr G Szakacs- Hungary, Prof C Larroche- France, and Prof Ashok Pandey- India (Convener). An active discussion took place, where both panellists and other delegates of the congress participated. One of the main outcome of these exchanges was the decision to build a networking forum with the title: Food Bioprocessing- *A global approach for advancing sustainable production of value added food*. It would work as ICBF Forum. The main scientific area covered by this networking were also examined, and it was considered that these could be as follows: Food and raw materials characterization and properties (Rheological properties, Equilibrium properties: aw, pH, antioxidant, Transport properties, Chemical properties, Sensory properties, Nutritional properties), Biocatalysis and food biotechnology (Microbiology of food, GM foods, Predictive microbiology-food safety and risk assessment, Microorganisms detection, Enzyme and biocatalysis improvement), Bioprocess engineering for food and feed development (Rational process development, Reactor design, Downstream processing, Waste and by-products treatment- environmental care-, Food preservation- oxidative stability, antimicrobials-, Food packaging, Life cycle assessment, Sensors).

To avoid diffusion in goals, it was decided to exclude from this forum three neighbouring areas, i.e. Agronomy (Agricultural Sciences), Health (Medical Sciences), and Environmental Sciences. This means that on related topics, interfaces and relationships must be carefully defined and partitioned. Professor Christian Larroche was requested to hold the responsibility of coordinating the ICBF Forum who would keep in touch

with the partners and look for the networking for scientific projects, exchange of students and faculties through various modes. The decision to hold the next congress, the ICBF-2006 in Greece under the auspicious of the University of Patras, Greece was finally announced.

The book contains thirty-four chapters, which have been divided in six parts. Part 1 contains four chapters, which deal with the production of food from plant sources. These describe cereals for health, *Arthrospira platensis* in advanced life support system, siderophoregenic microorganisms and microalgae. Part 2 has six chapters, which describe various biotransformation processes for terpene, bioflavor, esterification, etc. involving biocatalysts- enzymes or micro-organisms. Part 3 is on the production of enzymes, proteins and other additives and has six chapters, which deal with the bio-additives, industrial enzymes, solid-state fermentation, food grade pigments and mushrooms. Next part of the book (Part 4), which is on the production of dairy products and alcoholic fermentation, also has six chapters. These describe kefir starter culture, catalytic mechanisms of cysteine proeinases, foaming process applied to dairy fermented foods, cheese ripening, wine making and industrial beer. Part 5 of the book is on monitoring, control, modeling and scale-up of bioprocesses and contains six chapters. These chapters describe *Listeria innocua* growth at the surface of foods as a function of the media and process characteristics, software sensors for measurement and control of food bioprocesses, electrochemical measurement system for *in situ* CO_2 measurement, a new pco_2 sensor for monitoring of dissolved carbon dioxide, modeling on fermentation kinetics, and scale-up of bioseparation processes. The sixth and last part of the book has six chapters on miscellaneous topics, which deal with antiphysiological components of coffee pulp, value adding of food and crop waste streams, silage inoculant lactic acid bacteria, drying process for *Lactobacillus plantarum*, food irradiation and gibberellic acid.

We are hopeful that the book would be useful to the readers.

Christian Larroche

Ashok Pandey

Claude-Gilles Dussap

Contents

1

Bioprocessing Cereals for Health

Severino S Pandiella, Hemant M Patel, Zoe Mousia & Colin Webb*
Satake Centre for Grain Process Engineering, School of Chemical Engineering
and Analytical Sciences, The University of Manchester, Sackville Street,
Manchester M60 1QD, UK

There has always been an intimate companionship between the human being and the fermentative activities of micro-organisms. These fermentativse activities have been utilised in the production of fermented foods and beverages. The micro-organisms involved in the fermentation of indigenous cereal-based foods are the surface flora of the seeds. Some of these fermented products may also contain live bacteria or oligosaccharides that could positively affect our gut flora. This has given rise to the so-called pro- and prebiotic foods with their beneficial effects on human health. Most of the newly developed foods with pro- and prebiotic properties are dairy based, and little attempt has been made to use cereals as natural substrates. The use of new technologies en cereal bioprocessing in the production of new functional foods will also be discussed.

Keywords: Cereals, bioprocessing, probiotic, prebiotic, fermentation, lactic acid bacteria, debranning.

1. INTRODUCTION

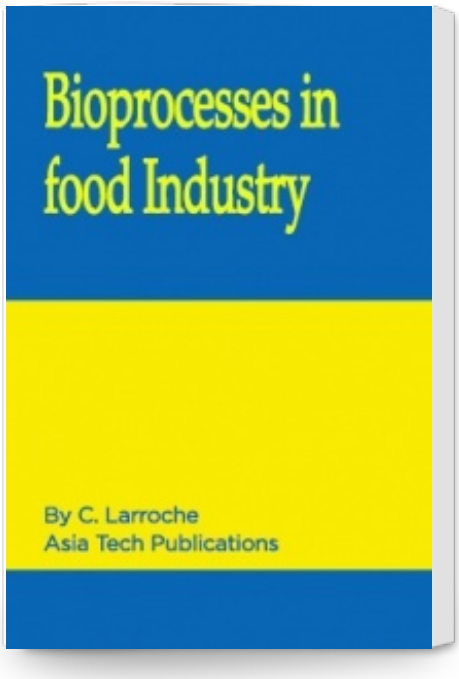
European consumers are becoming increasingly aware of the relationship between diet and disease and have a much better nutritional education. The growing demand for 'healthy' foods is stimulating innovation and new product development in the food industry internationally. A major development in functional foods pertains to foods containing probiotics and prebiotics, which enhance health by promoting the microbial flora in the intestine.

Probiotics are live microbial food supplements, which benefit the health of consumers by maintaining, or improving their intestinal microbial balance. Probiotic strains can be successfully manufactured and incorporated into highly acceptable food products where they can retain their viability and functionality. The concept of prebiotics was introduced after considering the fact that many potentially health-promoting micro-organisms such as bifidobacteria and lactobacilli are already resident in the human colon. Most of the recent developments of pro- and prebiotic foods entering the European market are dairy based. The use of the debranning for the production of better foods will also be reviewed.

2. TRADITIONAL CEREAL-BASED FERMENTED FOODS

There has always been an intimate relationship between the human being and the fermentative activities of micro-organisms on harvested food. These fermentative activities have been utilised in the production

Bioprocesses in food Industry Vol I



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