

BIOCONVERSION OF SECONDARY PRODUCTS OF PROCESSING OF GRAIN CEREALS CROPS

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grain, bran, bioconversion, enzyme preparations, dietary fiber, biomodified bran, functional and technological properties

ABSTRACT

A method has been developed for the production of organic ingredients from secondary products resulting from the high-quality grinding of triticale and wheat into flour, which involves the enzymatic action of amylolytic enzymes to release starch polysaccharides while preserving the native properties of dietary fibers and biologically active substances associated with them. To a large extent, the features of the properties of the obtained ingredients are due to the number and composition of the components of dietary fiber of grain, as well as the morphological features of their structure. It is shown that the viscosity of aqueous colloidal systems at a concentration of soluble dietary fiber of the ingredients 0.5 % increases 11 times; at a concentration of 1.0 % — 30 times, forming a viscous gel-like structure. This allows them to be used for gelling, thickening and stabilization of aquatic food systems. The use of ingredients with a high content of NLP in baking is possible only taking into account their water absorption capacity. A method for the enzymatic modification of secondary products of processing of grain triticale was developed. On the basis of the study of the kinetics and efficiency of the effect of proteolytic and cellulolytic enzyme preparations (EP) and their compositions, optimal conditions for enzymatic modification (the EP dosage is 0.5...0.75 units of PA/g of bran, 0.3...0.4 units of CA/g of bran, the optimum temperature is 40–50 °C, pH is 5.0 and 3.5, the duration of reactions is 1.5 hours) have been determined. The use of cellulolytic EP allowed to increase the amount of reducing substances and soluble protein by 1.5–2.5 times in comparison with the control sample. The biomodified bran obtained using the MEC «Shearzyme 500 L» + «Neutrase 1.5 MG» and «Viscoferm L» + «Diatrym Protacid Extra» has a high degree of hydrolysis of non-starch polysaccharides and proteins, is characterized by a certain ratio of high-, medium-, low-molecular peptides and amino acids, has different functional and technological properties. They can be used in the production of a wide range of general-purpose, functional and treatment-and-prophylactic food products.

1. Introduction

In recent years, there has been an increasing interest in secondary grain processing products as renewable raw materials — promising sources of additional raw materials for obtaining food for human consumption. The amount of secondary raw materials, formed during the processing of grain in flour mills, averages 21.3 % of the volume of flour production. When processing grain in cereals, the amount of secondary raw materials is much larger. For example, when processing wheat in cereals — up to 37 %, of which 30 % falls on the flour, while the content of dietary fiber in these resources varies in a wide range and can reach 49–52 % [1]. In addition, secondary products of grain processing are rich in proteins 14–20 %, macro- and microelements, vitamins of group B, vitamins A, D and E [2, 3].

A promising direction in the development of the grain industry, whose main task is the effective use of all components of grain raw materials is deep processing. In the classical sense, this is the process of dividing the grain into constituents, as a result of which separate fractions of protein substances, for example, gluten, can be isolated, concentrates and protein isolates obtained; various fractions of starch (A, B, C); soluble and insoluble dietary fiber; some other components. The relatively high cost of such drugs is compensated by a high content of the main component, microbiological purity, a reduction in the costs of their storage, and the convenience of using the drugs in the technological process.

Another approach is also possible in the rational use of grain processing products, namely: the use of flour from the peripheral parts of the endosperm of grain, including the aleurone layer and the seed coat, as well as cereal bran, which may be limited to traditional technologies (bakery, confectionery,) for further enzymatic modification and production of valuable components of

special products [4,5,6]. They can be used to enrich and create new products of both general and special therapeutic and prophylactic purposes [7,8,9,10,11].

In the All-Russian Scientific Research Institute of Grain and Products of Its Processing, fundamental and applied research is carried out to develop the basic methods for managing the technological processes of preparing and grinding grain of various crops in order to obtain products with a given chemical composition and properties; study the possibilities of biochemical transformation of secondary products of grain processing (wheat, triticale, oats) into food ingredients containing dietary fibers, while preserving the native structure of dietary fiber and biologically active substances associated with them; develop methods for enzymatic modification of grain processing products (flour of various types, including high content of peripheral parts, bran) using multi-enzyme compositions (MEC) based on proteolytic and cellulolytic enzyme preparations for the production of modified products (protein hydrolysate, structurally modified flour, biomodified bran) with varying degrees and depth of hydrolysis of proteins and non-starch polysaccharides possessing different functional-technological specific properties.

The aim of the research is to develop a model for the biochemical transformation of secondary products of grain processing, in particular triticale, into food ingredients with predicted technological properties on the basis of studying the changes in the technological properties of products, depending on the nature of the feedstock, the chemical composition and the complex of insoluble dietary fibers, and the development of methods for enzymatic modification of triticale bran with the use of modern biotechnological methods. Realization of the set goal will allow to design food products from grain with the specified composition and predicted properties.

Bioconversion Of Cereal Products

**Olena Stabnikova, Oleksandr
Shevchenko, Viktor Stabnikov, Octavio
Paredes-López**



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Bioconversion of Cereal Products B. Godon, Armand Boudreau, 1994 Explains how to obtain a large number of intermediate agricultural products from grains Discusses the overall composition of cereal grains different methods of fractionation the enzymatic processing of carbohydrates and proteins and the microbial processes for the production of food yeast alcoholic beverages alcohol metabolites and highly diverse organic molecules For agricultural chemists food and feed processors chemical engineers and professors and advanced students of the agri food industry *Bioconversion of Wastes to Value-added Products* Olena Stabnikova, Oleksandr Shevchenko, Viktor Stabnikov, Octavio Paredes-López, 2023-08-17 Bioconversion of agricultural and industrial wastes into useful products plays an important role both in the economy and in the prevention of environmental pollution This book presents technological approaches to the biotransformation of different wastes into valuable products and demonstrates developments in the field of organic waste disposal Organized in four parts Bioconversion of Wastes to Value added Products addresses the bioconversion of wastes to a new food products b energy c biotechnological products and d describes the construction of biosensors for food control Features Covers the use of different food waste to enrich meat dairy bakery and confectionery products Presents new technologies for utilization of wastes from the meat dairy and wine industries among others Promotes bioconversion of agricultural wastes into energy such as hydrogen or biogas Proposes the use of industrial wastes to produce exopolysaccharides using bacteria or macromycetes Describes design construction and testing of biosensors for food control The book is an aid to scientists and engineers contributing to manufacturing of useful products from non recyclable wastes as well as the creation of environmentally friendly technologies that protect the environment from potential contaminants **Bioconversion of Waste Materials to Industrial Products** A.M. Martin, 2012-12-06 By covering both the general principles of bioconversion and the specific characteristics of the main groups of waste materials amenable to bioconversion methods this new book provides the chemical biochemical agrochemical and process engineer with clear guidance on the use of these methods in devising a solution to the problem of industrial waste products *Bakery Products Science and Technology* Weibiao Zhou, Y. H. Hui, 2014-08-11 Baking is a process that has been practiced for centuries and bakery products range in complexity from the simple ingredients of a plain pastry to the numerous components of a cake While currently there are many books available aimed at food service operators culinary art instruction and consumers relatively few professional publications exist that cover the science and technology of baking In this book professionals from industry government and academia contribute their perspectives on the state of industrial baking today The second edition of this successful and comprehensive overview of bakery science is revised and expanded featuring chapters on various bread and non bread products from around the world as well as nutrition and packaging processing quality control global bread varieties and other popular bakery products The book is structured to follow the baking process from the basics flour and other ingredients to mixing proofing and baking

Blending the technical aspects of baking with the latest scientific research Bakery Products Science and Technology Second Edition has all the finest ingredients to serve the most demanding appetites of food science professionals researchers and students **Enzyme Technology** Ashok Pandey,2006-04-28 Publisher Description **Food Colloids** Eric Dickinson,Reinhard Miller,Royal Society of Chemistry (Great Britain),2001 Food Colloids Fundamentals of Formulation describes the physico chemical principles underlying the formulation of multi component multi phase food systems Emphasis is placed on the interfacial properties of proteins and the role of protein interactions in determining the properties of emulsions dispersions gels and foams The coverage includes authoritative overviews of conceptual issues as well as descriptions of new experimental techniques and recent food colloids research findings Specific topics include atomic force microscopy aggregation phenomena coalescence mechanisms crystallization processes surface rheology protein lipid interactions and mixed biopolymer systems This book provides essential new material for those active in the field and is suitable for postgraduates and researchers both in industry and academia *Agrochimica* ,1994 1st World Conference on Biomass for Energy and Industry Spyros Kyritsis,2001 The 1st World Conference and Technology Exhibition on Biomass for Energy and Industry held in Sevilla in June 2000 brought together for the first time the traditional European Conference on Biomass for Energy and Industry and the Biomass Conference of the Americas thus creating the largest and most outstanding event in the worldwide biomass sector The conference elaborated innovative global strategies projects and efficient practice rules for energy and the environment at a key stage in the industry s development New concepts and projects were highlighted to increase the social and political awareness for a change in worldwide resource consumption and to promote economically socially and environmentally sustainable development for the next millennium In 2 volumes the Proceedings include some 470 papers essential to an understanding of current thinking practice research and global developments in the biomass sector a vital reference source for researchers manufacturers and policy makers involved or interested in the use of biomass for energy and industry **Innovations in Sustainable Agricultural Systems, Volume 1** Irina Samoylenko,Toshpulot Rajabov,2024-08-31 This multidisciplinary book focuses on the best practices in a range of areas such as I Sustainable development of agricultural production II Intelligent agricultural techniques tools and systems III Sustainability in veterinary practice and IV Economic ecological and social systems for human development This book is a truly interdisciplinary publication useful to scholars social movements practitioners and members of governmental agencies and private companies Sustainable agricultural systems are crucial for ensuring food security conserving natural resources and mitigating climate change Innovations in this field play a key role in improving agricultural practices to make them more environmentally friendly economically viable and socially responsible By implementing the innovative approaches and technologies sustainable agricultural systems can help address the challenges facing agriculture in the twenty first century and build a more resilient and sustainable food system for the future *Biotransformation of Waste Biomass into High Value*

Biochemicals Satinder Kaur Brar, Gurpreet Singh Dhillon, Carlos Ricardo Soccol, 2013-09-24 Agro industrial wastes are end products emerging after industrial processing operations and also from their treatment and disposal e.g. solid fruit wastes and sludge. The agro industrial wastes are often present in multiphase and comprise multicomponent. Nevertheless, these wastes are a goldmine as they possess valuable organic matter which can be diverted towards high value products ranging from polymers to antibiotics to platform chemicals. There have been plenty of books published on bioenergy, enzymes, and organic acids among others. However, this emerging field of biochemical has not yet been covered so far, which is an important entity of the biorefinery model from waste biomass and needs to be understood from fundamental applied as well as commercial perspective, which has been laid out in this book. *Biotechnology For Sustainable Energy And Products*

Prakash Kumar Sarangi, Sonil Nanda, 2019-10-10 The apprehensions relating to global warming, climate change, and increasing energy demands have led to significant research for the development of sustainable energy and products from biomass by utilizing modern biotechnological tools. This book is an innovative collection of 14 chapters broadly focussing on biofuels, biomaterials, biopolymers, and other industrially relevant commodities produced from agricultural biomass, forest residues, algae, food processing wastes, and other biogenic refuse. The book aims to serve as a reference book for academic and industrial researchers in finding new pathways to link food security and energy demands with the help of novel biotechnological interventions. This book highlights state-of-the-art aspects based on biotechnology involved in transportation sector, food industry, agriculture, biorefining, and material science. **Refinery Products and Product Improvement**

Processes James G. Speight, 2024-04-18 This book focuses on the various refinery products, product improvement processes, and solvent processes that are used in the refining industry and the processes used in product improvement to ensure products meet sales specifications. This accessible book is written for engineers, scientists, students, and academics wanting an update on crude oil processing and insight into the direction of the industry. Key features: Describes the development of technologies for a variety of feedstocks, including heavy feedstocks, utilizing advanced pre-treatment processing and hydrotreating. Presents the initial refining processes and prepares for the new changes and evolution of the industry, including the role of biomass in the future refinery. Analyses catalyst deactivation mechanism for developing optimum technologies for processing feedstocks with low reactivity. Includes an extensive glossary which will be beneficial for non-technical readers. **Biotechnological Advancements in Biomass to Bioenergy Biotransformation**

Manikant Tripathi, Sukhminderjit Kaur, 2025-07-31 This edited volume focusses on the advancements in the production technologies, challenges, and perspectives for converting wastes/biomass to energy. It discusses sustainable solutions to contemporary challenges of simultaneous bioenergy production and waste management. One of the biggest environmental concerns today is waste generation and management due to the growing population and industrial expansion. Hazardous chemicals from industrial processes, agriculture, and the medical sector result in high pollution levels contaminating water, air, and soil. This

pollution poses a significant threat to the environment and human health Advanced technologies using microorganisms nanomaterials and molecular approaches offer environmentally friendly solutions to these issues Agro wastes including fruit and vegetable wastes can be viable resources for green energy production promoting greener and circular economic strategies This book highlights advances in bioprocesses for a sustainable environment energy production from waste bioremoval of hazardous pollutants meta omics approaches bio based technologies for resource recovery bioeconomy models nano biosensors and bionanotechnology in waste site restoration Readers will gain insights into recent sustainable progress and future applications of advanced biotechnological approaches to waste management This book is highly recommended as reference literature for a diverse community of professionals scientists researchers biotechnologists environmentalists industrialists environmental biotechnologists students undergraduate and postgraduate and innovators involved in developing strategies to address the challenges of current environmental issues

Microbial Enzymes in Bioconversions of Biomass Vijai Kumar Gupta, 2016-10-25 This volume summarizes our current knowledge on different biomass converting enzymes and their potential use in converting biomass into simple sugar to generate bioenergy and other value added co by products It consists of 13 chapters and is divided into three parts cellulases hemicellulases and lignocellulose

oxidoreductases Written by international experts the contributions offer clear and concise descriptions of both standard and new technologies It is an invaluable reference resource for undergraduates post graduates researchers and practitioners in the field of microbial enzymes for biofuel and biorefinery applications

Biomarkers of Toxic Metals Vanda Maria Falcão Espada Lopes de Andrade, 2023-08-04 The current exposure of human populations to toxic metals makes the prevention and control of such exposures crucial Biomarkers are undoubtedly recognized as vital tools to achieve these goals This book is for researchers toxicologists physicians pharmacologists and those working in governmental regulatory agencies and other public health fields The first part of this book covers general aspects of biomarkers of toxic metals while parts 2 and 3 cover biomarkers of xenobiotic metals and essential metals with potential for toxicity respectively In part 4 novel approaches to metal biomarkers are focused

Advances in Glutamic Acid Research and Application: 2012 Edition, 2012-12-26 *Advances in Glutamic Acid Research and Application 2012 Edition* is a ScholarlyBrief that delivers timely authoritative comprehensive and specialized information about Glutamic Acid in a concise format The editors have built *Advances in Glutamic Acid Research and Application 2012 Edition* on the vast information databases of ScholarlyNews You can expect the information about Glutamic Acid in this eBook to be deeper than what you can access anywhere else as well as consistently reliable authoritative informed and relevant The content of *Advances in Glutamic Acid Research and Application 2012 Edition* has been produced by the world s leading scientists engineers analysts research institutions and companies All of the content is from peer reviewed sources and all of it is written assembled and edited by the editors at ScholarlyEditions and available exclusively from us You now have a source you can cite with authority confidence and credibility More information is

available at <http://www.ScholarlyEditions.com> **Colored Cereals** Sukhvinder Singh Purewal, Ram Sarup Singh, 2025-03-28

Colored cereals are becoming a substance of research interest due to their unique color and health benefiting properties. Colored grains are being utilized in the preparation of antioxidant rich food products. **Colored Cereals: Properties, Processing, Health Benefits and Industrial Uses** discusses numerous aspects of colored cereals and explores their properties, processing techniques, health benefits, and industrial applications. Furthermore, it serves as a vital resource for researchers, industry professionals, and students working on different aspects of colored cereals. **Features:** Discusses information related to the biochemistry of colored cereals; Highlights comprehensive information on different aspects of colored grains; Explores the research and innovations aimed at enhancing the nutritional and agronomic traits; Discusses the specific environmental and agricultural requirements; Explores crucial techniques and practices for preserving the quality and nutritional value of colored cereals; Discusses the extraction, identification, and health benefits of natural pigments; Highlights practical ways to incorporate natural pigments into cereal-based products. With this book, readers gain insights into the current market trends, research directions, and future potential of colored cereals, inspiring further development in this field. Renowned experts in agriculture, food science, and nutrition have curated this comprehensive volume. Their collective expertise ensures a thorough and insightful exploration of colored cereals, making this book an indispensable reference for anyone interested in this dynamic area of study. **Cereals: Novel Uses and Processes** Grant M. Campbell, Colin Webb, Stephen L.

McKee, 2013-06-29 So long as a person is capable of self-renewal, they are a living being. Amiel Cereals have been the source of life to the human race, providing nutritional and material needs since the dawn of civilization. As with all dynamic industries, the Cereal Industry has renewed itself in the past as the millennium approaches; it is on the brink of another renewal in which the versatility and providence of cereals are being rediscovered, but in new and exciting ways. Cereals are richly diverse: over 10,000 varieties convert minerals and the energy of the sun into a bursting catalog of functional and versatile biomolecules and biopolymers. Processing technology allows these components to be accessed, separated, isolated, and purified, while chemical science allows modification for even greater diversity and specificity. The last century has seen the move from cereal to oil-based chemical and materials industries. But cereals contain a greater variety and functionality of macromolecules than oil. Starch, protein, bran, and straw, already diverse across cereal varieties, can be fractionated into more specific elements, modified chemically to enhance function, or used as feedstocks in fermentation-based bioconversion systems to produce a range of bulk and fine chemicals for industries as diverse as food, pharmaceuticals, plastics, textiles, pulp, and paper, transport, composites, and boards, adhesives, and energy. Cereal Crop Utilization, 1994 *Smart Food Industry: The Blockchain for Sustainable Engineering* Eduardo Jacob Lopes, Leila Queiroz Zepka, Mariany Costa Deprá, 2024-02-13 *Smart Food Industry: The Blockchain for Sustainable Engineering* Volume II Current Status, Future Foods, and Global Issues reviews the literature and scientific frameworks to present a kind of sustainability compass. Disruptive approaches around

potential sustainable foods are also widely investigated in order to be an alternative route for the industrial future. Thus, this book proposes new concepts and strategies to face future sustainability challenges that are on the horizon and can impact the next generation of foods. Divided into three parts, this book discusses the i) status of sustainable food industry, ii) next generation and future technology for sustainable foods, and iii) policy, social, economic, and environmental aspects in food industries. Given the book's breadth, it provides readers with an invaluable reference resource for students, researchers, graduates, and professionals in general who wish to gain knowledge about the engineering and food processing area so as to achieve sustainable food production.

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