

Article

Antioxidant Activity, Physicochemical and Sensory Properties of Stingless Bee Honey from Australia

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Abstract: This study reports on the physicochemical and sensory attributes, total phenolic content, and antioxidant activity of 36 honey samples produced by two different stingless bee species (*Tetragona carbonaria* and *Tetragona hockingsi*) from Australia. The findings reveal moisture content across all samples ranges from 24.9% to 30.8% (w/w), electrical conductivity from 1.02 to 2.15 mS/cm, pH levels between 3.57 and 6.54, soluble solids from 69.2 to 75.1 °Brix, trehalulose concentrations from 6.20 to 38.2 g/100 g, fructose levels from 7.79 to 33.4 g/100 g, and glucose content from 3.36 to 26.8 g/100 g. Sucrose was undetectable in all investigated samples. In a sensory analysis involving 30 participants, Australian stingless bee honey was perceived as having a more pronounced sourness compared with New Zealand Manuka honey. The study reveals considerable variability in the composition of Australian stingless bee honey, influenced by factors such as floral availability, geographical origin, and time of harvest. It also demonstrates the presence of phenolic compounds and antioxidant activity in stingless bee honey, underlining their potential as a natural source of antioxidants. All investigated samples contain trehalulose, which supports the findings of other recent studies that propose this unusual disaccharide as a marker compound of stingless bee honey.

Keywords: stingless bee honey; Australia; physicochemical properties; antioxidant activity; sensory analysis; sugar content; trehalulose; high-performance thin-layer chromatography



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1. Introduction

Honey is a complex natural product that is mainly produced from the nectar of flowers and processed by the digestive enzymes of a variety of bees. It has been used by humans since ancient times as a sweetener, flavouring agent and also for its medicinal properties, particularly for wound healing [1]. There are two main types of commercially available honey: ‘common’ honey, produced by *Apis mellifera*, the European honey bee, and stingless or native bee honey, produced by various stingless bees. Stingless bees, as their name suggests, lack a functional sting and are characterised by their small, compact, dark-coloured appearance. There are approximately 500 species of stingless bees distributed throughout the tropical and subtropical regions of the world, such as Australia, Africa, Latin America, and Southeast Asia [2]. Eleven species of stingless bees (*Tetragonula* spp. and *Austroplebeia* spp.) are found within the tropical northern areas of Australia [3].

Due to their small size, stingless bees are excellent pollinators for crops that have small flower openings and are, therefore, difficult to access by the much larger European honey bees [4]. The honey they produce is a unique product that differs in colour, taste, and viscosity from honey produced by European bees. Its sweetness with an acidic undertone gives stingless bee honey a unique flavour profile [1].

Stingless bee honey contains more than 200 constituents, though it is composed mostly of sugars and water. It also contains small amounts of phenolic compounds, proteins (e.g.,

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Chemical and Technological Characterization of Dairy Products Michele Faccia, 2021-03-02 Milk processing is one of the most ancient food technologies dating back to around 6000 B C A huge number of milk products have been developed worldwide representing a spectacular example of biodiversity and a priceless cultural heritage After millennia of unanimous appreciation as a pillar of human nutrition a series of questions about the desirability of their wide consumption have been raised In the light of the growing threat deriving mostly from the spread of veganism and health consciousness improving milk processing safety and dairy nutritional characteristics as well as deepening their functional characteristics are of a primary exigency This Special Issue contains several articles focusing on this hot topic all of which add knowledge to the field and supply interesting ideas for developing new products and processes *Phenolic Compounds*, 2022-02-23 Phenolics are commonly available compounds in foods beverages and spices They have great importance in all aspects of daily life including industry health and research As such this book presents a comprehensive overview of phenolic compounds and their potential applications in industry environment and public health Chapters cover such topics as the production of these compounds and their uses in environmental sustainability climate change green industry and treatment of human disease

Mathematical and Statistical Methods in Food Science and Technology Daniel Granato, Gastón Ares, 2014-03-03 Mathematical and Statistical Approaches in Food Science and Technology offers an accessible guide to applying statistical and mathematical technologies in the food science field whilst also addressing the theoretical foundations Using clear examples and case studies by way of practical illustration the book is more than just a theoretical guide for non statisticians and may therefore be used by scientists students and food industry professionals at different levels and with varying degrees of statistical skill **Novel Technologies for Enrichment, Extraction, and Determination of Phenolic Compounds in Foods - Volume 1** Runqiang Yang, Yu Xiao, Baoru Yang, 2023-07-04

Future Foods Rajeev Bhat, 2021-12-04 Future Foods Global Trends Opportunities and Sustainability Challenges highlights trends and sustainability challenges along the entire agri food supply chain Using an interdisciplinary approach this book addresses innovations technological developments state of the art based research value chain analysis and a summary of future sustainability challenges The book is written for food scientists researchers engineers producers and policy makers and will be a welcomed reference Provides practical solutions for overcoming recurring sustainability challenges along the entire agri food supply chain Highlights potential industrial opportunities and supports circular economy concepts Proposes novel concepts to address various sustainability challenges that can affect and have an impact on the future generations *Natural Antioxidants* Rituparna Banerjee, Arun K. Verma, Mohammed Wasim Siddiqui, 2017-06-26 In the recent years considerable research has been carried out evaluating natural substances as antioxidative additives in food products leading to novel combinations of antioxidants and the development of novel food products In addition to their antioxidative capacity these natural additives have positive effects on

the human body with documented health benefits This valuable new book provides an overview of natural antioxidants their sources methods of extraction regulatory aspects and application techniques specifically focusing on different foods of animal origin to improve their oxidative stability Non-chemical Methods for Disinfestation of Stored Products M

Loganathan,Jeyan Moses,2025-05-30 This reference book covers traditional and recent technologies in the disinfestation of stored foods Storage of durables is challenging and demands scientific management protocols Chemical fumigants have been used for decades and several reports detail their impact on the environment in addition to other concerns This book focuses on the use of non chemical methods of disinfestation in durables like cereals pulses oilseeds millets and spices It discusses important disinfestation techniques like biological control extreme temperature based approaches insect repellent packaging and nano based techniques The book also covers the detection of pests and some chemical methods of disinfestation It is an important reference for professionals researchers industry personnel and post graduate students in the field of food and grain storage Key Features Focuses on the non chemical methods for grain disinfestation Reviews the rising need for a shift to non chemical methods of disinfestation of stored foods Includes a blend of topics on entomology food engineering food design and regulations Discusses conventional methods of disinfestation as well as chemical approaches Covers topics like extreme temperature based approaches dielectric heating insect traps and use of inert materials **Phytoantioxidants and**

Nanotherapeutics Mithun Rudrapal,2022-08-30 Phytoantioxidants and Nanotherapeutics Discover the medicinal importance of antioxidant herbal medicines phytochemicals and nanodelivery systems for a wide range of diseases Phytomedicine has been and continues to be central to many cultures and societies due to its low toxicity low cost accessibility and efficacy in treating difficult diseases In fact many plant derived bioactive natural products serve as potential sources of drug leads or therapeutic agents in the treatment of a wide range of human diseases When combined with nanotechnology phytomedicine has the potential to affect and impact a tissue specific site which can reduce drug dosage and side effects while improving activity Phytoantioxidants and Nanotherapeutics offers a comprehensive look at the significant role that phytomedicine derived antioxidants play on the field of medicine particularly when combined with the nanotechnology derived drug delivery systems The book thoroughly covers the herbs plant extracts and other dietary elements that may be used as sources of natural antioxidants and similarly highlights the use of phytomedicine derived bioactive compounds including plant polyphenols and flavonoids to reducing the impact of oxidative stress induced human diseases The text also demonstrates the biochemical and therapeutic targets of nanodrugs and discusses nanostructure toxicity while emphasizing the challenges and regulatory issues involved with nanophytotherapeutics Phytoantioxidants and Nanotherapeutics readers will also find A helpful bridge between the cutting edge field of nanotechnology delivery and phytotherapeutics The potential role of bioactive phytochemicals particularly polyphenolic compounds and flavonoids in oxidative stress induced diseases Description of the latest developments on nanotherapeutics of phytoantioxidants for the

treatment of certain chronic human diseases such as cancer inflammations diabetes viral bacterial and parasitic infections nervous system disorders cardiovascular disorders and neurological diseases Phytoantioxidants and Nanotherapeutics is a useful reference for drug manufacturers and drug developers formulation scientists biomedical scientists medicinal chemists phytochemists healthcare providers and academics and researchers

Applications of Heterocycles in the Design of Drugs and Agricultural Products, 2021-06-09 Applications of Heterocycles in the Design of Drugs and Agricultural Products Volume 134 in the Advances in Heterocyclic Chemistry series represents the most definitive series in the field one of great importance to organic chemists polymer chemists and many biological scientists Chapters in this updated volume cover Hydroxy azoles as carboxylic acid bioisosteres Cyclic sulfoxides and sulfones in drug design Thiazoles and topological control in drug design Applications of fused pyrrolidine 3 3 0 heterocycles in drug design 1 4 Disubstituted and 1 4 5 trisubstituted 1 2 3 triazoles in drug discovery and development from the flask to the clinic and Conformationally restricted 3 2 2 and 3 2 1 3 azabicyclic diamines Because biology and organic chemistry increasingly intersect the associated nomenclature is being used more frequently in explanations Written by established authorities in the field from around the world this comprehensive review combines descriptive synthetic chemistry and mechanistic insight to yield an understanding of how chemistry drives the preparation and useful properties of heterocyclic compounds Considered the definitive serial in the field of heterocyclic chemistry Serves as the go to reference for organic chemists polymer chemists and biological scientists Provides the latest comprehensive reviews written by established authorities in the field Combines descriptive synthetic chemistry and mechanistic insight to enhance understanding of how chemistry drives the preparation and useful properties of heterocyclic compounds

Handbook on Spray Drying Applications for Food Industries M. Selvamuthukumaran, 2019-07-12 Spray drying is a mechanical process by which materials in liquid form can be converted into solid form such as powders It is a rapid continuous cost effective reproducible and scalable process for producing dry powders from a fluid material by atomization through an atomizer into a hot drying gas medium usually air The Handbook on Spray Drying Applications for Food Industries deals with recent techniques adopted in spray drying systems for drying a vast array of food products novel and emerging tools used for spray drying of antioxidant rich products optimized conditions used for extraction and production of herbal powders by using spray drying techniques and problems encountered during spray drying of acid and sugar rich foods and also various herbal powders The book discusses the encapsulation of flavors by using the spray drying process providing a comparison with other encapsulation techniques It reviews the retention of bioactive compounds and the effect of different parameters on bioactive compounds during spray drying of juice Moreover the book explains the effect of novel approaches of spray drying on nutrients The book addresses strategies adopted for retention of nutrients and survival of probiotic bacteria during spray drying processing It also identifies packaging material needed for enhanced product stability The safety and quality aspects of manufacturing spray dried food products are discussed Key Features Describes the

design of high performance spray drying systems Highlights the strategy adopted for maximizing the yield potential of various spray dried food products Discusses strategies adopted for retention of nutrients and survival of probiotic bacteria during spray drying process Contains charts procedure flow sheets tables figures photos and a list of spray drying equipment suppliers This book will benefit entrepreneurs food scientists academicians and students by providing in depth knowledge about spray drying of foods for quality retention and also for efficient consumer acceptability of finished products

Antioxidants in Cocoa Dorota Żyżelewicz, Joanna Oracz, 2021-04-07 This Special Issue comprises articles related to the effects of genotype and processing conditions on the phenolic compound profile and antioxidant activity of cocoa derived products isolation and characterization of antioxidant compounds such as polyphenols and melanoidins from cocoa beans and assessment of the antioxidant antioxidative stress and anti inflammatory effects of cocoa beans and cocoa derived products The results of these studies show that it is possible to maintain or increase the biological activity of cocoa beans and their derived products cocoa powder and chocolate by choosing appropriate processing conditions and cocoa genotype and origin The papers published in this Special Issue confirm that cocoa beans and cocoa by products can be considered as an attractive source material for manufacturing of functional foods and nutraceuticals This is because they contain many bioactive compounds mainly polyphenols including flavonoids proanthocyaninidins monomeric flavan 3 ols and anthocyanins and phenolic acids as well as melanoidins Finally the in vitro and in vivo studies demonstrate the importance of cocoa antioxidants for the prevention of oxidative stress and inflammation

Reviews in Ethnopharmacology: 2023 Irina Ielciu, Rajeev K. Singla, Hanganu Daniela, Michel Frederich, 2025-04-15 Frontiers in Pharmacology is delighted to present the Reviews in Ethnopharmacology 2023 series of article collections Reviews in Ethnopharmacology will publish high quality scholarly review papers on key topics in Ethnopharmacology It aims to highlight recent advances in the field whilst emphasizing important directions and new possibilities for future inquiries We anticipate the research presented will promote discussion in the Ethnopharmacology community that will translate to best practice applications in clinical public health and policy settings The Reviews in Ethnopharmacology 2023 collection welcomes full length mini or systematic review papers New articles will be added to this collection as they are published This collection welcomes manuscripts that focus on the following themes 1 Translational potential of traditional medicinal plants in cancer prevention 2 Ethnopharmacology of mental health disorders insights from traditional healing practices and scientific validation 3 Ethnobotanical approaches for combating antimicrobial resistance 4 Traditional medicine in the digital age opportunities and challenges 5 Herbal medicine and chronic disease management a global perspective 6 Ethnopharmacology and sustainable development balancing conservation and community health 7 Ethnopharmacology of traditional Chinese medicine bridging ancient wisdom and modern science 8 Medicinal plants used in Ayurveda exploring traditional knowledge and contemporary applications All the manuscripts submitted to the collection will need to fully comply with the Four Pillars of Best Practice in Ethnopharmacology

you can freely download the full version here Importantly we expect an overview on the composition of the preparations used in the pharmacological experiments or a clinical study reviewed Therefore we also expect that the MS follow the standards established in the ConPhyMP statement Front Pharmacol 13 953205

Non-Thermal Processing Technologies for the Grain Industry M. Selvamuthukumar,2021-08-18 Food can rapidly spoil due to growth of microorganisms and traditional methods of food preservation such as drying canning salting curing and chemical preservation can affect the quality of the food Nowadays various non thermal processing techniques can be employed in grain processing industries to combat this They include pulsed electric field processing high pressure processing ultrasonic processing cold plasma processing and more Such techniques will satisfy consumer demand for delivering wholesome food products to the market Non Thermal Processing Technologies for the Grain Industry addresses these many new non thermal food processing techniques that are used during grain processing and minimize microbial contamination and spoilage Key Features Explains the mechanism involved in application of cold plasma techniques for grain processing and its strategy for inactivation of microbes by using this technique Deals with the effect of incorporation of electric pulses on quality aspects of various grain based beverage products Details the innovative high pressure processing techniques used for extraction of antioxidant from food grains Explores the safety issues and applications of non thermal food processing techniques This book will benefit food scientists food process engineers academicians students as well as anyone else in the food industry by providing in depth knowledge and emerging trends about non thermal processing techniques in various grain based food processing industries

Bioactive Delivery Systems for Lipophilic Nutraceuticals Ming Miao,Long Chen,David McClements,2023-06-26 There is growing interest in the food supplements cosmetics and pharmaceutical industries in improving the healthiness of their products by incorporating lipophilic bioactive substances like oil soluble vitamins A D and E omega 3 fatty acids and nutraceuticals carotenoids curcuminoids and flavonoids However there are many challenges that need to be overcome due to their poor water solubility chemical stability and bioavailability For this reason there is interest in the development of effective encapsulation technologies to increase the efficacy of lipophilic bioactives This book reviews the encapsulation systems currently available for delivering lipophilic bioactives including their preparation functionality and application range including nanoemulsions emulsions Pickering emulsions HIPEs microgels organogels and liposomes Chapters 1 2 review the biological activity of delivery systems and lipophilic bioactives Chapters 3 5 describe the materials and preparation methods used to assemble delivery systems Chapters 6 17 focus on the formation and application of different kinds of delivery systems Chapter 18 discusses future trends in the development of bioactive delivery systems Edited and authored by world renowned scholars the book provides a state of the art overview of the design fabrication and utilization of delivery systems for bioactives that will be useful for academic government and industrial scientists in fields such as pharmaceuticals cosmetics agriculture chemical engineering nutrition and foods

Advances in Natural Polysaccharides and Oligosaccharides:

Purification Techniques, Analysis Methods, and Physiochemical Properties Xiaolong Ji,Qiu Li,Xin Wang,2023-03-07

Methods in food chemistry and food science technology Blanca Hernandez-Ledesma,Pilar Gómez Cortés,2023-06-01

Advances of Science and Technology Mulatu Liyew Berihun,2022-01-01 This two volume set of LNICST 411 and 412 constitutes the refereed post conference proceedings of the 9th International Conference on Advancement of Science and Technology ICAST 2021 which took place in August 2021 Due to COVID 19 pandemic the conference was held virtually The 80 revised full papers were carefully reviewed and selected from 202 submissions The papers present economic and technologic developments in modern societies in 7 tracks Chemical Food and Bioprocess Engineering Electrical and Electronics Engineering ICT Software and Hardware Engineering Civil Water Resources and Environmental Engineering ICT Mechanical and Industrial Engineering Material Science and Engineering Energy Science Engineering and Policy *Green Chemistry* Bela Torok,Timothy Dransfield,2017-11-07 *Green Chemistry An Inclusive Approach* provides a broad overview of green chemistry for researchers from either an environmental science or chemistry background starting at a more elementary level incorporating more advanced concepts and including more chemistry as the book progresses Every chapter includes recent state of the art references in particular review articles to introduce researchers to this field of interest and provide them with information that can be easily built upon By bringing together experts in multiple subdisciplines of green chemistry the editors have curated a single central resource for an introduction to the discipline as a whole Topics include a broad array of research fields including the chemistry of Earth s atmosphere water and soil the synthesis of fine chemicals and sections on pharmaceuticals plastics energy related issues energy storage fuel cells solar and wind energy conversion etc greenhouse gases and their handling chemical toxicology issues of everyday products from perfumes to detergents or clothing and environmental policy issues Introduces the topic of green chemistry with an overview of key concepts Expands upon presented concepts with the latest research and applications providing both the breadth and depth researchers need Includes a broad range of application based problems to make the content accessible for professional researchers and undergraduate and graduate students Authored by experts in a broad range of fields providing insider information on the aspects or challenges of a given field that are most important and urgent *The Future Role of Dwarf Honey Bees in Natural and Agricultural Systems* DP Abrol,2020-07-08 The future role of dwarf honeybees in natural and agricultural systems provides multidisciplinary perspective about the different facets of dwarf honeybees The role of dwarf honeybee *Apis florea* assumes utmost importance in the context of pollinator decline throughout the world threatening stability of ecosystems and global food security *Apis florea* is a low land species of south Asia extending more to the west than other Asiatic *Apis* species It is an important pollinator of crops in hot and dry agricultural plains The book is first of its kind which deals in details on varied aspects of *Apis florea* biology management conservation strategies for protecting biodiversity and enhancing crop productivity The book aims to promote a large diverse sustainable and dependable bee pollinator workforce

that can meet the challenge for optimizing food production well into the 21st century Features Apis florea provides source of livelihood in mountainous areas and marginal farmers This book will for the first time present the beekeeping from the perspective of agricultural production and biodiversity conservation An excellent source of advanced study material for academics researchers and students and programme planners Excellent pollinator of tropical and subtropical crops fruits vegetables etc less prone to diseases and enemies Covering the latest information on various aspects of Apis florea biology this book brings the latest advances together in a single volume for researchers and advanced level students This book will be useful to pollination biologists honeybee biologists in entomology departments students teachers scientists of agriculture animal behaviour botany conservation biology ecology entomology environmental biology forestry genetics plant breeding horticulture toxicology zoology seed growers and seed agencies and shall serve as reference book for students teachers researchers extension functionaries and policy planners

Sprouted Grains Hao Feng,Boris Nemzer,Jonathan W Devries,Junzhou Ding,2024-10-08 Sprouted Grains Nutritional Value Production and Applications Second Edition includes new chapters on sprouted grains as new plant based protein sources Fatty Acids Content and Profiling in Sprouted Grains Amylase Activity in Sprouted Grains and The Role of Sprouted Grains in Human Gut Health As sprouted grains are one of the hottest topics in cereal and grain science this comprehensive reference presents essential reading from grain germination from both a genetic and physiological perspective the nutrients and bioactive compounds present in sprouted grains equipment and technical innovations for processors and manufacturers of sprouted grains and subsequent products and more Fully revised and updated including four new chapters Presents the latest insights into the nutrient and bioactive components of these healthy grains Includes coverage of the technology and equipment used in grain processing Covers the growing list of products developed from sprouted grains Features insights from an internal team of academic and industrial experts

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