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Unearthing the Multifaceted Potential of *Opuntia spp.*: A Comprehensive Exploration

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Abstract. Unearthing the Multifaceted Potential of *Opuntia spp.*: A Comprehensive Exploration. Book review of *Opuntia spp.*: Chemistry, Bioactivity and Industrial Applications, Mohamed Fawzy Ramadan, Tamer E. Moussa Ayoub, Sascha Rohn (Ed.), 1059 pages, 2021, Springer Nature Switzerland AG, 978-3-030-78443-0

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"*Opuntia spp.*: Chemistry, Bioactivity and Industrial Applications" (Figure 1)[1] is a meticulously researched and comprehensive book that delves into the vast potential of the *Opuntia* genus, a group of cacti that has historically been utilized for various purposes across different industries. The book is divided into 50 chapters, each focusing on a distinct application of *Opuntia spp*., ranging from food and nutrition, pharmaceuticals, cosmetics, textiles, solar cells, and even natural colorants. As the world grapples with increasing concerns about sustainability and climate change, the book presents *Opuntia spp*. as a versatile, eco-friendly resource with untapped potential, and it effectively explores the numerous possibilities for innovation in various industries.

The authors expertly navigate the complexity of the subject matter and provide a thorough understanding of the chemistry, bioactivity, and potential applications of *Opuntia spp*. Each chapter is an independent exploration of a specific application, allowing readers to focus on their areas of interest. The chapters are written with clarity, and the authors do an excellent job of breaking down complex concepts into accessible language without compromising on the depth of information. The book is rich in detail, with each chapter offering a wealth of information backed by extensive research and practical examples. This approach not only makes the book a valuable resource for researchers, students, and professionals in the field but also stimulates further research and innovation in this promising area.

For instance, Chapter 45 discusses the use of *Opuntia spp*. in dye-sensitized solar cells (DSSCs), highlighting the unique pigment betalain found in the fruit of the *Opuntia* species. The authors delve into the structural features and potential applications of betalain pigments in the photosensitization process of solar cells, offering an innovative approach to harnessing solar energy in a sustainable manner. The chapter not only provides a strong foundation for understanding the significance of betalain in DSSCs but also emphasizes the need for further

research in this area, thereby inspiring readers to explore novel applications of this natural dye.

Another standout chapter, Chapter 49, explores the potential of *Opuntia spp.* in the textile industry. The authors discuss how the use of eco-friendly dyes derived from Opuntia fruits can help reduce environmental pollution caused by the textile industry, which is known to be one of the most significant consumers of drinking water and a major contributor to water pollution. By detailing the properties of betalain pigments and their effectiveness in dyeing various textiles, the authors successfully demonstrate how the use of Opuntia-derived dyes can lead to more sustainable and environmentally friendly practices in the textile industry.

Throughout the book, the authors effectively showcase the versatility and adaptability of *Opuntia spp*. across different industries. They also highlight the potential for *Opuntia* to address various global challenges, such as food security, resource scarcity, and environmental degradation. For example, in Chapter 46, the authors discuss how incorporating *Opuntia spp*. into food systems can improve nutritional quality and help combat desertification and declining water resources. By integrating *Opuntia* into various food products, the authors argue that we can better address global food security issues and promote sustainable agricultural practices.

Despite its many strengths, the book could have benefited from a more balanced discussion of potential negative aspects and limitations of *Opuntia spp*. cultivation and use. For example, addressing concerns about the invasive nature of some *Opuntia* species or the potential for overexploitation of natural resources could have provided a more well-rounded perspective on the subject. However, this minor shortcoming does not detract from the overall quality and value of the book, as it remains a comprehensive and informative resource on the potential of *Opuntia* spp.

Another area where the book excels is in demonstrating the potential of *Opuntia* spp. in the cosmetics and pharmaceutical industries. Chapter 47 offers a detailed examination of the bioactive compounds found in *Opuntia spp*. and their therapeutic potential for various diseases. The authors emphasize the role of these compounds in traditional medicine and their potential applications in modern pharmaceutical and cosmetic industries. By discussing recent research and innovations in this area, the authors inspire further exploration and development of Opuntia-derived products in these industries.

In Chapter 50, the authors discuss the use of cactus pear as colorants and coloring foods in different food matrices. The growing consumer preference for natural and healthy food colorants has driven the global market for natural colorants, and the authors showcase how *Opuntia spp*. can be a valuable resource in this regard. By examining the betalain content in various Opuntia species and their potential use in different food matrices, the authors provide valuable insights into the opportunities for innovation in this area.

Throughout the book, the authors successfully intertwine academic research with practical examples, creating a well-rounded and engaging read. This approach allows readers to not only gain a deep understanding of the subject matter but also see its real-world implications and potential for innovation. Furthermore, the book is an excellent resource for professionals in the fields of food science, agriculture, pharmaceuticals, textiles, and environmental sciences, among others. It offers valuable insights and guidance for those looking to harness the potential of *Opuntia spp*. in their respective industries.

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In conclusion, "*Opuntia spp*.: Chemistry, Bioactivity and Industrial Applications" is an exceptional book that offers a comprehensive and detailed exploration of the vast potential of the *Opuntia* genus. The authors expertly navigate the complexity of the subject matter, providing a wealth of information backed by extensive research and practical examples. The book serves as an invaluable resource for researchers, students, and professionals interested in the versatile applications of *Opuntia spp*. and serves as a catalyst for further research and innovation in this promising area. By showcasing the numerous possibilities for *Opuntia spp*. across various industries, the book not only contributes to our understanding of this versatile plant but also provides inspiration for addressing global challenges such as sustainability, food security, and environmental degradation. Overall, the book is an essential read for anyone interested in exploring the multifaceted potential of *Opuntia spp*. and its potential to shape the future of various industries.

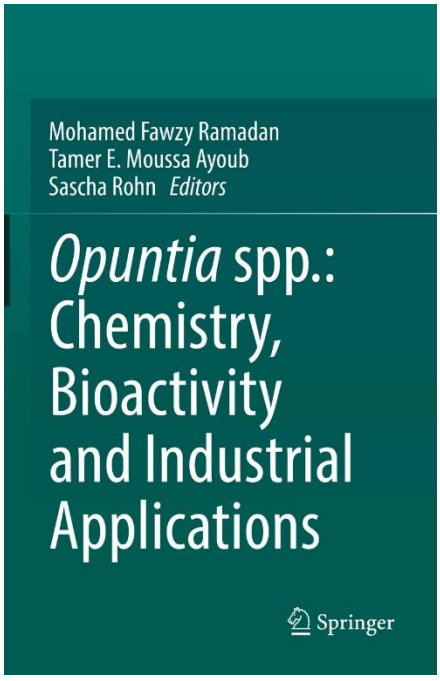

Figure 1. Cover of *Opuntia spp.*: Chemistry, Bioactivity and Industrial Application

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CONSENT FOR PUBLICATION

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AVAILABILITY OF SUPPORTING DATA

Data sharing is not applicable to this article as no datasets were generated or analyzed during the current study.

COMPETING INTERESTS

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