Harmonizing Chemical and Biological Sciences for Sustainable Development

Edited by
Hari Shankar Biswas
Sandeep Poddar
Dilip Kumar Maiti
Amiya Bhaumik

Published by :
Lincoln University College
Malaysia

www.lucp.net

Harmonizing Chemical and Biological Sciences for Sustainable Development

Dr. Hari Shankar Biswas
Assistant Professor (II)
Department of Chemistry, Surendranath College
Kolkata, West Bengal, India

Dr. Sandeep Poddar
Deputy Vice Chancellor (Research & Innovation)
Lincoln University College
Malaysia

Dr. Dilip Kumar Maiti
Vice-Chancellor
Biswa Bangla Biswabidyalay
Bolpur, Shibpur, Birbhum, West Bengal, India

Dr. Amiya Bhaumik
Founder and President
Lincoln University College
Malaysia

Published by :
Lincoln University College, Malaysia

www.lucp.net

Published on: 27th June, 2025

Published by:

Lincoln University College

Wisma Lincoln
No. 12-18, Off Jalan, Perbandaran SS 6/12
47301 Petaling Jaya
Selangor Darul Ehsan
Malaysia
Tel.: +603-7806 3478
Fax: +603-7806 3479
Toll Free: 1-300-880-111
E-mail: lucp@lincoln.edu.my
Web.: www.lucp.net

ISBN: 978-967-2819-46-2

eISBN: 978-967-2819-47-9

doi: 10.31674/book.2025hcbssd

Price: USD 100

Contents _____Pages

Preface

In this new volume entitled, “Harmonizing Chemical and Biological Sciences for Sustainable Development” the authors offer fresh insights and innovative frameworks for reinterpreting sustainable development in the context of global development. The book delves into potential strategies for addressing the complex interplay between energy, environmental sustainability. It explores the intersection of chemistry and biology in addressing the pressing challenges of sustainability bringing together cutting-edge research that delves into the transformative potential of science in creating eco-friendly solutions. By examining various applications, from green solvents and organic synthesis to the role of antioxidants in human health, the contributors provide a comprehensive overview of how harmonizing these fields can lead to innovative, sustainable technologies and practices.

The first article delves into the promising applications of nano-photocatalysis in solving global challenges such as energy scarcity and environmental pollution. By utilizing nanomaterials like TiO_2, ZnO, and various metal nanoparticles, the article explores their use in a wide range of consumer products, including self-cleaning surfaces, UV-protective textiles, and medical devices.

This article entitled “Heterogeneous Catalysts for CO_2 Chemical Transformations in Sustainable Pathways” presents a comprehensive overview of the use of heterogeneous catalysts in the chemical transformation of carbon dioxide (CO_2) into value-added products. The focus is on catalytic cycloaddition reactions that utilize CO_2 to synthesize cyclic carbonates and other chemicals, highlighting their applications in industrial processes.

Moumita Roy in her article explores the significant role of indium-based catalysts in green organic transformations, emphasizing their sustainability and recyclability. The study outlines various techniques for enhancing the catalytic efficiency of indium salts by immobilizing them onto functionalized polymers and metal-organic frameworks (MOFs).

The article “Ornamental Fish diversity of Mridangabhanga River - A distributaries of River Ganga” delves into the rich biodiversity of ornamental fishes in the Mridangabhanga River, a distributary of the River Ganga. Through seasonal assessments, the study identifies 49 species of ornamental fish, shedding light on their distribution, ecological roles, and the environmental pressures they face. This study is vital for understanding how human activities and natural environmental factors interact, and it advocates for the preservation of these valuable resources.

In the article “Thermal Stability and Swelling Behavior in Aqueous Medium of Acrylamide-Based Hydrogels”, the authors examine the thermal stability and swelling behavior of acrylamide-based hydrogels in various aqueous environments. The study highlights the relationship between crosslinking and swelling behavior,

demonstrating that the hydrogels' swelling characteristics are influenced by temperature and network structure.

Sobhana Palit (Paul) in her study investigates the bioaccumulation of heavy metals in the muscle tissues of two commercially important prawn species from the Hooghly estuarine system. By analyzing concentrations of metals such as copper, lead, and cadmium, the research highlights the potential health risks associated with consuming contaminated seafood.

Suman Mandal in his article explores the synthesis of copper nanoparticles (CuNPs) using different non-ionic surfactants, particularly polysorbates, and their morphological changes under varying conditions. Through a combination of techniques like transmission electron microscopy (TEM), dynamic light scattering (DLS), and UV-visible spectroscopy, the study provides insights into how surfactant concentration and type affect the size and shape of CuNPs.

This article “The Future of Zinc Implant: Its Revolutionary Effects in Modern Advancements “discusses the emerging field of zinc-based biodegradable implants as alternatives to traditional non-biodegradable materials used in orthopaedic surgeries. Focusing on zinc alloys such as Zn-Mg and Zn-Mn, the article highlights their mechanical properties, biocompatibility, and potential for reducing post-surgical complications.

This article, authored by Dipasree Roychowdhury, presents a comprehensive review of the pharmacological properties of guava (Psidium guajava L.), focusing on its medicinal benefits. The fruit and various plant parts of guava have been used traditionally to treat a wide range of ailments, including diabetes, diarrhoea, and inflammation. Recent studies support these traditional uses, with evidence of the plant's anti-diabetic, antimicrobial, anti-inflammatory, and antioxidant activities.

This article “Physico-Chemical Parameters for Checking Drinking Water Quality: A Review” provides a critical review of the physico-chemical parameters used to assess the quality of drinking water, emphasizing the importance of these parameters in ensuring public health. The study outlines the various characteristics of water, such as pH, electrical conductivity, total dissolved solids, hardness, and levels of contaminants like chloride and sulphate, which are key indicators of water quality.

Another article uthored by Debarati Dey, investigates the impact of external magnetic fields on electron transfer reactions, with a particular focus on homogeneous mediums. The study delves into the role of spin correlation and the mechanisms underlying photoinduced electron transfer (PET) processes, providing insights into how magnetic fields affect the dynamics of these reactions.

The article “Functional Molecules for Organic Light-Emitting Diodes (OLEDs)” addresses the crucial role of functional organic molecules in the development of organic light-emitting diodes (OLEDs). With a focus on amorphous molecular materials, the study reviews key components such as hole- and electron-

transporting materials, charge-blocking layers, and emissive substances.

The article “Assessment of Total Flavonoid Content and Antioxidant Activity of Mango Pulp Extracts” presents an in-depth assessment of the flavonoid content and antioxidant activity of mango pulp extracts. Utilizing various extraction techniques, including microwave-assisted extraction, the study compares the efficacy of different solvents in extracting bioactive compounds from mango pulp. The findings highlight the potential health benefits of mango pulp due to its high flavonoid content and antioxidant properties, which are essential in combating free radical-related diseases.

In another article, the author explores the growing applications of ionic liquids (ILs) as alternative solvents in organic synthesis. Characterized by low vapor pressure and excellent thermal stability, ILs are considered green solvents and have gained significant attention for their eco-friendly properties. The article provides a detailed examination of the use of ILs in catalysis, nanoparticle synthesis, and other chemical reactions.

The book chapter, “From Fossil Fuels to Blue-Green Energy: A New Era for Sustainability”, delves into the transformative shift from traditional fossil fuels to sustainable energy solutions like green hydrogen and blue ammonia. Through comprehensive analysis, it explores their production, advancements, and environmental benefits. Addressing the technological, economic, and policy challenges, this work provides valuable insights into how these energy carriers can drive the global transition toward a cleaner, more sustainable energy future.

This volume stands as a testament to the transformative power of integrating chemical and biological sciences in pursuit of a more sustainable and equitable future. By aligning with the United Nations Sustainable Development Goals—particularly SDG 12: Responsible Consumption and Production and SDG 3: Good Health and Well-being—the contributions within this book highlight innovative strategies to reduce environmental impact, promote efficient resource use, and enhance public health through science-driven solutions. This work not only advances academic inquiry but also inspires meaningful action toward responsible innovation and improved quality of life for communities around the world. We hope this book will serve not only to enrich scholarly discourse but also to catalyse tangible progress in responsible innovation, ultimately enhancing the well-being of communities worldwide.

Hari Shankar Biswas
Sandeep Poddar
Dilip Kumar Maiti
Amiya Bhaumik

Published by :

LINCOLN UNIVERSITY COLLEGE
DKU016 (B)

2022 SETARA COMPETITIVE UNIVERSITY COLLEGE

ISO 9001:2015 Certified

e ISBN 978-967-2819-47-9

ISBN 978-967-2819-46-2

www.lucp.net