

## Preface

Chemical and biological sciences encompass the study of matter, living organisms, their interactions, life processes, adaptability, and environmental relationships. Green chemistry, biotechnology, bioinformatics, nanotechnology, bioremediation, medicinal chemistry, environmental science, sustainable agriculture, and renewable energy are among the rapidly advancing areas discussed in Application of Chemical and Biological Sciences for Sustainable Future.

The first study explores the diversity and foraging behaviour of insect pollinators visiting *pomelo* (*Citrus maxima*) flowers in North 24 Parganas, West Bengal. It highlights the dominant role of honeybees, the influence of environmental conditions on pollinator activity, and the importance of insect-mediated pollination in enhancing fruit production and ecosystem stability.

Moumita Roy explores the potential of sustainable nickel catalysis as an efficient strategy for water remediation in her chapter. The study highlights a polyaniline-supported nickel catalyst for degrading hazardous organic pollutants, emphasizing its catalytic efficiency, structural characteristics, recyclability, and environmental benefits. The work contributes to developing affordable and reusable systems for cleaner water treatment.

The chapter "Study of accumulation of hazardous metals in edible parts of fishes from Kakmara Rive" examines the accumulation of hazardous metals in commonly consumed fish species from the Kakmara River. The study evaluates metal contamination in river water and edible fish tissues, highlighting potential bioaccumulation and associated consumer health risks. It also emphasizes the need for regular monitoring and conservation of contaminated aquatic environments.

Attreyee Mukherjee's chapter reviews recent advances in green and multicomponent strategies for synthesizing pyrano[2,3-c]pyrazoles, an important class of biologically active fused heterocycles. Emphasizing sustainability, atom economy, recyclable catalysts, alternative energy sources, and eco-friendly reaction conditions, it highlights modern approaches that support efficient, cleaner, and more responsible heterocyclic compound development.

Chandan Kumar's chapter explores the role of task-specific ionic liquids (TSILs) as green reaction media and efficient catalysts in synthetic organic chemistry. Highlighting their low volatility, thermal stability, reusability, and tunable structural features, the chapter presents recent developments in TSIL-based catalysis and emphasizes their growing importance in sustainable and environmentally responsible chemical synthesis.

Priyanka Sanphui and Rupam Mandal's chapter examines the current status, threats, conservation strategies, and human perspectives related to the Tibetan gazelle (*Procapra picticaudata*) in the Indian Trans-Himalayan region. Focusing on Ladakh's Changthang landscape, it highlights restricted distribution, population decline, habitat pressures, and the importance of community awareness, scientific monitoring, and integrated conservation efforts.

The chapter titled "A Review of Fluorescence Spectroscopic Studies Inside Confined Systems" explores the role of fluorescence spectroscopy in understanding photophysical processes within organized molecular assemblies. It highlights confined systems such as micelles, reverse micelles, and vesicles, emphasizing their influence on FRET, PET, solvation dynamics, and molecular behavior in biologically relevant microenvironments.

The chapter "Transformation of Plastic Waste into Carbonaceous Materials for Advanced Energy-Storage Applications" explores the sustainable transformation of plastic waste into valuable carbonaceous materials for advanced energy-storage applications. It highlights emerging upcycling strategies for producing graphene, activated carbon, carbon nanotubes, and porous carbon materials, emphasizing their potential use in batteries and supercapacitors while supporting waste reduction, resource recovery, and greener energy technologies.

Sanchayita Adikari explores the emerging field of green-synthesized trimetallic nanoparticles and their diverse biological applications in her book chapter. It highlights sustainable synthesis

approaches, unique physicochemical properties, and their potential roles in agriculture, healthcare, and environmental sustainability. The discussion reveals how these advanced nanomaterials can contribute to innovative and eco-friendly solutions.

Pritha Mondal's chapter examines the effect of climate change on coral mortality, focusing on ocean warming, acidification, bleaching, and coral–algal symbiosis. It highlights the physiological stress mechanisms, ecological consequences, and increasing severity of mass bleaching events, while emphasizing the urgent need for climate mitigation, conservation strategies, and management of resilient reef ecosystems.

Debasmita Sardar, in his chapter, explores sustainable approaches for synthesizing bimetallic nanoparticles and their growing importance in medicinal and catalytic applications. The review highlights eco-friendly physical and biological synthesis methods, distinctive physicochemical properties, enhanced performance, and the potential of bimetallic nanoparticles as efficient, scalable, and environmentally responsible nanomaterials.

Collectively, these chapters present interdisciplinary advances in chemical and biological sciences, emphasizing sustainability, innovation, and environmental responsibility. The diverse research contributions demonstrate the potential of emerging technologies and scientific approaches to address challenges in healthcare, ecology, agriculture, energy, and environmental protection for a sustainable future.

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