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Preface

All-pervading and wide-ranging applications of nanomaterials motivate the present-day scientists and technologists to search for and to develop newer and more useful nanomaterials, through conventional (physical, chemical and physicochemical) as well as biological preparation methods. While the so-called conventional methods involve the use of costly and often hazardous chemicals (leading to the toxicity to the environment, endangering the living beings and the plants), the biological synthesis routes have been proven to be nontoxic and eco-friendly.

The exploitation of biosynthesised and nonbiosynthesized nanomaterials in environmental applications (analysis, monitoring, clean-up and maintenance), in biomedical applications (antioxidant activity, antibacterial property, antimicrobial activity, antiproliferation, bioimaging and drug delivery), in the development of sensors, and very recently, as an integral component in making materials for personal protective equipment (PPE) against the deadly coronavirus pandemic (COVID-19), have led to an unprecedented growth of the nanomaterials, both in terms of uses and their large-scale production, all over the globe.

Since late December 2019, the coronavirus pandemic has been surging rapidly around the world. As of the first week of December 2020, worldwide about 67.6 million people have been infected with the virus and the death toll due to COVID-19 infection is about 1.55 million. The nanotechnologists can actively contribute to the prevention of the spread of pandemic, by designing virus-proof PPE materials that can both trap and destroy viruses [1]. Special antiviral coatings made of nanomaterials are also being developed as effective shields against coronavirus [2]. The emerging antiviral coatings including metal and inorganic nanomaterials, polymeric and organic coatings, should act as omniphobic pathogen-repellent barriers. The viability of coronaviruses on various surfaces ranges from 2h to 9 days. Nanostructured surfaces with randomly aligned ridges on a special aluminium alloy (Al 6063) had been fabricated and was found to kill the coronavirus effectively [3]. The importance of copper oxide nanoparticles loaded onto synthetic nanofiber membranes, in the making of antimicrobial breath masks was already known to the community [4].

Several contributing authors, in their respective chapters of the present book “Biosynthesized Nanomaterials” have dealt with the effective use of nanomaterials for their antimicrobial and antiviral action. This makes the
present book very relevant and timely, during the testing time of the global COVID-19 pandemic. Use of smart nanocarriers for the development of anticoronavirus nanomedicine is also outlined by a group of authors in their chapter in this book.

As such, there is a growing need for the production of nanomaterials using nontoxic and eco-friendly methods. The biosynthesized/green-synthesized nanomaterials may provide novel pathways for developing efficient sensors for low-cost environmental monitoring and remediation. Further, newer biomedical and pharmaceutical applications can be explored by the use of biosynthesized nanomaterials.

The present book discusses critically the recent developments in the synthesis, characterization and applications of various nanomaterials, with a special emphasis on the biosynthesized ones. The newly developed nanomaterials may revolutionize the diagnostics and imaging applications and contribute significantly in environmental monitoring. Currently, production of silver and gold nanoparticles using biosynthetic methods are the more popular ones with the researchers. However, biosynthesized other nanoparticles (metals, metal oxides, quantum dots, etc.) are also catching up slowly.

Although the current literature is abundant with topical review articles on the use of nanomaterials, a serious reader will be happy to find most of the important developments in this field of research, collected in the present book. The chapter contributors have already established themselves as reputed researchers, in their respective fields. All the chapters have undergone extensive review process for ensuring scientific accuracy of the information presented.

The book will serve as an excellent reference material in the academic, industrial, green chemistry, biomedical and environmental sectors. At the universities and research institutes, the book will serve as a source book for the use of biosynthesized nanomaterials in various disciplines. It may also be used to initiate new explorations in microbial, viral, drug delivery and related research. The nanotechnology-based industries will use the book in order to formulate new nanomaterials, their characterization and quality control. In the pharmaceutical sector, the book will serve as a guide to selection of appropriate vehicles for drug delivery and design of nanocarriers.

We express our sincere gratitude to all the authors who have come together on this endeavour and have contributed their excellent works. We are grateful to Prof. Dr. Damia Barcelo (Editor-in-Chief, Elsevier
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