

Green Chemistry For Dyes Removal From Waste Water Research Trends And Applications

The use of synthetic chemical dyes in various industrial processes, including paper and pulp manufacturing, plastics, dyeing of cloth, leather treatment and printing, has increased considerably over the last few years, resulting in the release of dye-containing industrial effluents into the soil and aquatic ecosystems. The textile industry generates high-polluting wastewaters and their treatment is a very serious problem due to high total dissolved solids (TDS), presence of toxic heavy metals, and the non-biodegradable nature of the dyestuffs in the effluent. The chapters in this book provide an overview of the problem and its solution from different angles. These problems and solutions are presented in a genuinely holistic way by world-renowned researchers. Discussed are various promising techniques to remove dyes, including the use of nanotechnology, ultrasound, microwave, catalysts, biosorption, enzymatic treatments, advanced oxidation processes, etc., all of which are "green." Green Chemistry for Dyes Removal from Wastewater comprehensively discusses: Different types of dyes, their working and methodologies and various physical, chemical and biological treatment methods employed. Application of advanced oxidation processes (AOPs) in dye removal whereby highly reactive hydroxyl radicals are generated chemically, photochemically and/or by radiolytic/sonolytic means. The potential of ultrasound as an AOP is discussed as well. Nanotechnology in the treatment of dye removal types of adsorbents for removal of toxic pollutants from aquatic systems. Photocatalytic oxidation process for dye degradation under both UV and visible light, application of solar light and solar photoreactor in dye degradation.

This book reviews recent research and applications of chitin and chitosan, as natural alternatives of fossil fuel products, in medicine and pharmacy, agriculture, food science and water treatment. Chitin and chitosan products are polysaccharides derived from food waste of crustaceans and fungi, and thus are cheap, abundant, sustainable, non-toxic, recyclable and biocompatible. Remarkable applications include food additives and preservation, packaging materials, biopesticides and fertilisers, drug delivery, tissue engineering, bioflocculation and dye removal.

In the last two decades the EPA and other national and international agencies have placed increasingly strict regulations on the manufacture and use of synthetic colorants. The pigment and dye industry has had to develop the technology necessary to analyze and remediate pollutants in wastewater. Although these efforts have produced a considerable volume of information, until now, no single book has provided an organized, comprehensive treatment of the environmental chemistry of synthetic colorants. Environmental Chemistry of Dyes and Pigments is the first comprehensive reference to address the environmental problems posed by synthetic colorants, and to provide a forum for the solutions proposed by industry, government, and academia. Focusing on developments in the field over the past two decades, it deals with all aspects of colored wastewater treatment, the disposal of dyes, analytical methods, toxicity, and regulatory questions. In its coverage of wastewater treatment, this book addresses both the most commonly used methods and those specifically designed to address pollution problems at the source by analyzing for and removing dyes and pollutants from wastewater effluent. Throughout, real-world data on a wide variety of dyes and dye intermediates is provided, as well as cost-effective strategies for dealing with wastewater treatment. In addition, several chapters are devoted to the perspectives of national and international experts on regulations governing the manufacture, handling, use, and disposal of synthetic dyes and pigments. The impact these regulations have had on both U.S. and foreign industry is also discussed. A complete, comprehensive, and up-to-date guide to pollution prevention in the dyestuff and textile industries. Environmental Chemistry of Dyes and Pigments is the only self-contained volume that focuses on the environmental impact of synthetic dyes and pigments. Contributions by international experts from industry, academia, and government make this an indispensable book for anyone dealing with the environmental problems posed by synthetic colorants. It covers the entire range of environmental issues, from waste treatment and analysis to pollution prevention and government regulations. Covers the latest wastewater treatment methods Shows how to use recycling and reusing methods effectively, while cutting production costs Describes state-of-the-art technology, including the PACT(r) system Explains analysis techniques, including spectrometry and ionization Covers legislative issues and the regulatory status of various compounds in both the United States and abroad Examines the various pollution prevention programs instituted by government and industry Bridging the gap between industrial interests and environmental concerns, Environmental Chemistry of Dyes and Pigments stands as an invaluable resource for scientists, researchers, and engineers in the textile and dyestuff industries, and in the environmental sciences. It is also an extremely useful text for environmental science students.

Green Chemistry for Dyes Removal from Waste Water Research Trends and Applications John Wiley & Sons

This is the second volume on adsorption using green adsorbents and is written by international contributors who are the leading experts in the adsorption field. Together with the first volume they show a typical selection of green materials used in wastewater treatment, with emphasis on industrial effluents. This second volume focuses on innovative materials. It presents hemp-based materials for metal removal, and the use of leaves for metal removal. It describes the biosorption of metals and metalloids on various materials and discusses the recent advances in cellulose-based adsorbents used in environmental purposes. Furthermore, activated carbons from food wastes, aerogels and bones, and municipal solid waste biochar as efficient materials for pollutant removal, respectively are reviewed as well as biosorption of dyes onto microbial biosorbents and the use of mushroom biomass to remove pollutants are looked at. The volume also includes detailed review of green adsorbents for removal of antibiotics, pesticides and endocrine disruptors and the use of pillared interlayered clays as innovative materials for pollutant removal. Finally, the use of green adsorbents for radioactive pollutant removal from natural water is discussed. The audience for this book includes students, environmentalists, engineers, water scientists, civil and industrial personnel who wish to specialize in adsorption technology. Academically, this book will be of use to students in chemical and environmental engineering who wish to learn about adsorption and its fundamentals. It has also been compiled for practicing engineers who wish to know about recent developments on adsorbent materials in order to promote further research toward improving and developing newer adsorbents and processes for the efficient removal of pollutants from industrial effluents. It is hoped that the book will serve as a readable and useful presentation not only for undergraduate and postgraduate students but also for the water scientists and engineers and as a convenient reference handbook in the form of numerous recent examples and appended information.

This book reviews health hazards associated with wastewater use and water pollutants. Chapters present applications of green materials made of agricultural waste, activated carbon and magnetic materials for wastewater treatment. The removal of toxic metals using algal biomass and the removal of toxic dyes using chitosan composite materials are also discussed. The book includes reviews on the removal of phenols, pesticides, and on the use of ionic liquid-modified activated carbon for the treatment of textile wastewater.

The compliance of this book is helpful for academicians, researchers, students, as well as other people seeking the relevant material in current trends of studies on the topic of environmental degradation. Green chemistry is a work tool that can be applied in different areas such as medicine, materials, polymers, food, organic chemistry, etc., since it was propounded in the early 2000s. It has become a viable alternative for care, remediation and protection of the environment and has been implemented worldwide. In this book the twelve principles of green chemistry are presented in a simple way, with examples of the applications of green chemistry in numerous areas showcasing it as an ideal alternative for environmental care. It also provides information on current research being implemented at the pilot plant and industrial level. The book demonstrates the importance of the use of renewable raw materials, the use of catalysis and the implementation of alternative energy sources such as the use of microwaves and

ultrasound in different separation and chemical processes.

This book describes advances in this new, fast developing science, which seeks to decipher fundamental mechanisms ruling the behaviour in water, soils, atmosphere, food and living organisms of toxic metals, fossil fuels, pesticides and other organic pollutants. Sections on eco-toxicology, green chemistry, and analytical chemistry round out this thorough survey of conditions and analytical techniques in an emerging specialty.

Urbanization, industrialization, and unethical agricultural practices have considerably negative effects on the environment, flora, fauna, and the health and safety of humanity. Over the last decade, green chemistry research has focused on discovering and utilizing safer, more environmentally friendly processes to synthesize products like organic compounds, inorganic compounds, medicines, proteins, enzymes, and food supplements. These green processes exist in other interdisciplinary fields of science and technology, like chemistry, physics, biology, and biotechnology. Still the majority of processes in these fields use and generate toxic raw materials, resulting in techniques and byproducts which damage the environment. Green chemistry principles, alternatively, consider preventing waste generation altogether, the atom economy, using less toxic raw materials and solvents, and opting for reducing environmentally damaging byproducts through energy efficiency. Green chemistry is, therefore, the most important field relating to the sustainable development of resources without harmfully impacting the environment. This book provides in-depth research on the use of green chemistry principles for a number of applications.

This book highlights the potential and scope of green chemistry for clean and sustainable development. Covering the basics, the book introduces readers to the need and the many applications and benefits and advantages of environmentally friendly chemical practice and application in industry. The book addresses such topics as ecologically safe products, catalysts and solvents, conditions needed to produce such products, types of chemical processes that are conducive to green chemistry, and much more.

This is the first volume on adsorption using green adsorbents and is written by international contributors who are the leading experts in the adsorption field. The first volume provides an overview of fundamentals and design of adsorption processes. For people who are new to the field, the book starts by two overview chapters presenting the principles and properties of wastewater treatment and adsorption processes. The book also provides a comprehensive source of knowledge on acid-base properties of biosorbents. It discusses fractal-like kinetic models for fluid-solid adsorption, reports on the chemical characterization of oxidized activated carbons for metal removal, and the use of magnetic biosorbents in water treatment. Furthermore, the thermodynamic properties of metals adsorption by green adsorbents, and biosorption of polycyclic aromatic hydrocarbons and organic pollutants are reviewed, and finally the recent trends and impact of nanomaterials as green adsorbent and potential catalysts for environmental applications are summarized. The audience for this book includes students, environmentalists, engineers, water scientists, civil and industrial personnel who wish to specialize in adsorption technology. Academically, this book will be of use to students in chemical and environmental engineering who wish to learn about adsorption and its fundamentals. It has also been compiled for practicing engineers who wish to know about recent developments on adsorbent materials in order to promote further research toward improving and developing newer adsorbents and processes for the efficient removal of pollutants from industrial effluents. It is hoped that the book will serve as a readable and useful presentation not only for undergraduate and postgraduate students but also for the water scientists and engineers and as a convenient reference handbook in the form of numerous recent examples and appended information.

This book reviews adsorption techniques to clean wastewater, with focus on pollution by dyes and heavy metals. Advanced adsorbents include carbon nanomaterials, biomass, cellulose, polymers, clay, composites and chelating materials.

Green Chemistry for Sustainable Textiles: Modern Design and Approaches provides a comprehensive survey of the latest methods in green chemistry for the reduction of the textile industry's environmental impact. In recent years industrial R&D has been exploring more sustainable chemicals as well as eco-friendly technologies in the textile wet processing chain, leading to a range of new techniques for sustainable textile manufacture. This book discusses and explores basic principles of green chemistry and their implementation along with other aspects of cleaner production strategies, as well as new and emerging textile technologies, providing a comprehensive reference for readers at all levels. Potential benefits to industry from the techniques covered in this book include: Savings in water, energy and chemical consumption, waste minimization as well as disposal cost reduction, and production of high added value sustainable textile products to satisfy consumer demands for comfort, safety, aesthetic, and multi-functional performance properties. Innovative emerging methods are covered as well as popular current technologies, creating a comprehensive reference that facilitates comparisons between methods. Evaluates the fundamental green chemistry principles as drivers for textile sustainability. Explains how and why to use renewable green chemicals in the textile wet processing chain.

The Impact and Prospects of Green Chemistry for Textile Technology provides a review and summary of the role of green chemistry in textiles, including the use of green agents and sustainable technologies in different textile applications. The book systematically covers the history and chemistry of eco-friendly colorants, chitin, chitosan, cyclodextrin, biomordants, antimicrobial, UV protective, flame retardant, insect repellent textiles, and advanced pre- and post- treatment technologies, such as the sonochemistry and plasma methods currently employed in functional modifications. The book also pays attention to the remediation of textile effluents using novel, sustainable and inexpensive adsorbents. Written by high profile contributors with many years of experience in textile technology, the book gives engineers and materials scientists in the textile industry the information

they need to effectively deploy these green technologies and processes. Introduces green chemistry and sustainable technologies, and explores their role in different textile applications Examines the use of renewable materials, such as biopolymers, dyes and pigments, biomordants, polyphenols and plant extracts in functional finishing applications Deals the functional modification of textiles using state-of-the-art biotechnology and nanotechnology

In this book the authors go back to basics to describe the structural differences between dyes and pigments, their mechanisms of action, properties and applications. They set the scene by explaining the reasons behind these differences and show how dyes are predominately organic compounds that dissolve or react with substrates, whereas pigments are (predominantly) finely ground inorganic substances that are insoluble and therefore have a different mode of coloring. They also describe the role of functional groups and their effect on dyeing ability, contrasting this with the way in which pigments cause surface reflection (or light absorption) depending on their chemical and crystalline structure and relative particle size. The book explores the environmental impact of dyes in a section that covers the physical, chemical, toxicological, and ecological properties of dyes and how these are used to assess their effect on the environment and to estimate whether a given product presents a potential hazard. Lastly, it assesses how, in addition to their traditional uses in the textile, leather, paper, paint and varnish industries, dyes and pigments are indispensable in other fields such as microelectronics, medical diagnostics, and in information recording techniques.

Wastewater pollution is a major issue in the context of the future circular economy because all matter should be ultimately reused, calling for efficient depollution techniques. This book present timely reviews on the treatment of wastewater contaminated by organic pollutants, with focus on aerobic granulation and degradation. Organic pollutants include microplastics, phthalates, humic acids, polycyclic aromatic hydrocarbons, pharmaceutical drugs and metabolites, plastics, oil spills, petroleum hydrocarbons, personal care products, tannery waste, dyes and pigments.

Environmental chemistry is a fast developing science aimed at deciphering fundamental mechanisms ruling the behaviour of pollutants in ecosystems. Applying this knowledge to current environmental issues leads to the remediation of environmental media, and to new, low energy, low emission, sustainable processes. Chapters review analysis and remediation of pollutants such as greenhouse gases, chiral pharmaceuticals, dyes, chlorinated organics, arsenic, toxic metals and pathogen in air, water, plant and soil. Several highlights include the overlooked impact of air pollutants from buildings for health risk, innovative remediation techniques such as bioreactors for gas treatment, electrochemical cleaning of pharmaceuticals, sequestration on Fe-Mn nodules, phytoremediation and photocatalytical inactivation of microbial pathogens. This book will be a valuable source of information for engineers and students developing novel applied techniques to monitor and clean pollutants in air, wastewater, soils and sediments.

Green Chemistry and Water Remediation: Research and Applications explores how integrating the principles of green chemistry into remediation research and practice can have a great impact from multiple directions. This volume reviews both common sources of chemical pollution and how using green chemistry as the basis for new or improved remediation techniques can ensure that remediation itself is conducted in a sustainable way. By outlining the main types of chemical pollutants in water and sustainable ways to address them, the authors hope to help chemists identify key areas and encourage them to integrate green chemistry into the design of new processes and products. In addition, the books highlights and encourages the use of the growing range of green remediation approaches available to experts, helping researchers, planners and managers make informed decisions in their selection of remediation techniques. Puts the naturally-aligned fields of green chemistry and environmental remediation in context, providing key background to both Highlights the use of both established and cutting-edge techniques for sustainable water remediation, including nanotechnology, biofiltration and phytoremediation Explores the potential impact sustainability goals in chemical waste production and water remediation

The recent explosion of interdisciplinary research has fragmented the knowledge base surrounding renewable polymers. The Chemistry of Bio-based Polymers 2nd edition brings together, in one volume, the research and work of Professor Johannes Fink, focusing on biopolymers that can be synthesized from renewable polymers. After introducing general aspects of the field, the book's subsequent chapters examine the chemistry of biodegradable polymeric types sorted by their chemical compounds, including the synthesis of low molecular compounds. Various categories of biopolymers are detailed including vinyl-based polymers, acid and lactone polymers, ester and amide polymers, carbohydrate-related polymers and others. Procedures for the preparation of biopolymers and biodegradable nanocomposites are arranged by chemical methods and in vitro biological methods, with discussion of the issue of "plastics from bacteria." The factors influencing the degradation and biodegradation of polymers used in food packaging, exposed to various environments, are detailed at length. The book covers the medical applications of bio-based polymers, concentrating on controlled drug delivery, temporary prostheses, and scaffolds for tissue engineering. Professor Fink also addresses renewable resources for fabricating biofuels and argues for localized biorefineries, as biomass feedstocks are more efficiently handled locally.

This book reviews recent research and applications of chitin and chitosan, as natural alternatives of fossil fuel products, in green chemistry, energy, biotechnology, bioprinting, medicine, water treatment, agriculture and food science. Chitin and chitosan products are polysaccharides derived from food waste of crustaceans and fungi, and thus are cheap, abundant, sustainable, non-toxic, recyclable and biocompatible.

Chemistry is considered to be one of the prime causes of environmental pollution and degradation. The United Nations General Assembly also addressed the environmental challenges in its Sustainable Development Goals (SDGs), which have been adopted in 2015. A closer look shows that to meet these goals chemistry will play an important role.

Green chemistry encompasses design and synthesis of environmentally benign chemical processes, green approaches to minimize and/or remediate environmental pollution, the development of biomaterials, biofuel, and bioenergy production, biocatalysis, and policies and ethics in green chemistry. When products in use today become waste, we need to treat that waste so that hazardous substances are not re-circulated into new products. In this context, circular economy is also an important point of discussion, which focuses on recycling, reuse and use of renewable sources. The theme of the International Conference on "Green Chemistry in Environmental Sustainability & Chemical Education (ICGC-2016) held in Delhi from 17-18 November 2016 was to discuss the emerging green trends in the direction of sustainability and environmental safety. ICGC-2016 consisted of keynote, plenary and invited lectures, panel discussion, contributed oral papers and poster presentations. The conference provided a platform for high school students, undergraduate and postgraduate students, teaching fraternity and young researchers to interact with eminent scientists and academicians from all over the world who shared their valuable views, experience and research on the harmonious methods in chemistry for a sustainable environment. This volume of proceedings from the conference provides an opportunity for readers to engage with a selection of refereed papers that were presented during the ICGC-2016 conference. The overarching goal of this book is to discuss most recent innovations and concerns in green chemistry as well as practical challenges encountered and solutions adopted to remediate a scathed environment into a pristine one. It includes an extensive variety of contributions from participants of ICGC-2016 that demonstrate the importance of multidisciplinary and interdisciplinary approach to problem solving within green chemistry and environmental management. The proceedings is thus a green chemistry monograph resulting from the fruitful deliberations in the conference, which will deeply enhance awareness about our responsibility towards the environment.

Bioremediation: A Sustainable Approach to Preserving Earth's Water discusses the latest research in green chemistry practices and principles that are involved in water remediation and the quality improvement of water. The presence of heavy metals, dyes, fluoride, dissolved solids and many other pollutants are responsible for water pollution and poor water quality. The removal of these pollutants in water resources is necessary, yet challenging. Water preservation is of great importance globally and researchers are making significant progress in ensuring this precious commodity is safe and potable. This volume illustrates how bioremediation in particular is a promising green technique globally. Features: Addresses bioremediation of all the major water pollutants Approaches the chemistry of water and the concept of water as a renewable resource from a green chemistry aspect Discusses environmental chemistry and the practice of industrial ecology Explains the global concern of adequate high quality water supplies, and how bioremediation can resolve this Explores sustainable development through green engineering

As society has become increasingly concerned with the protection and preservation of the environment, many industries have been pushed to comply with new policies and social demands for more environmentally-friendly and sustainable practices and products. However, the textile dyeing industry remains a significant source of complex environmental issues with legislative requirements that often vary in detail and severity concerning the exposure and hazards of potentially harmful chemicals and other associated materials. It is vital that the industry sector involved in the application of dyes continues to be sensitive to potential adverse effects on the environment in its widest sense and respond accordingly. **Impact of Textile Dyes on Public Health and the Environment** is an essential reference source that focuses on the environmental impact and social responsibility of the dyeing industry. While highlighting topics such as toxicology, bleaching, and greenhouse gases, this publication is ideally designed for chemists, industrialists, non-governmental organization members, environmentalists, fashion designers, clothes manufacturers, scientists, academicians, researchers, students, and practitioners seeking current research on dyeing's potentially adverse effects on the environment and strategic, effective responses.

The high rate of industrialization around the world has led to an increase in the rate of anthropogenic activities which involves the release of different types of contaminants into the aquatic environment generating high environmental risks, which could affect health and socio-economic activities if not treated properly. There is no doubt that the rapid progress in improving the water quality and management has been motivated by the latest developments in green chemistry. Over the past decade, sources of water pollutants and the conventional methods used for the treatment of industrial wastewater treatment has flourished. Water quality and its adequate availability have been a matter of concern worldwide particularly in developing countries. According to a World Health Organization (WHO) report, more than 80% of diseases are owing to the consumption of contaminated water. Heavy metals are highly toxic that are a potential threat for water, soil, and air, their consumption in higher concentrations provided hazardous outcomes. The water quality is usually measured keeping in mind chemical, physical, biological, and radiological standards. The discharge of the effluent by industries contains heavy metals, hazardous chemicals, and a high amount of organic and inorganic impurities those can contaminate the water environment, and hence, human health. Therefore, it is our primary responsibility to maintain the water quality in our respective countries. This book provides understanding, occurrence, identification, toxic effects and control of water pollutants in aquatic environment using green chemistry protocols. It focuses on water remediation properties and processes including industry-scale water remediation technologies. This book covers recent literature on remediation technologies in preventing water contamination and its treatment. Chapters in this book discuss remediation of emerging pollutants using nanomaterials, polymers, advanced oxidation processes, membranes, and microalgae bioremediation, etc. It also includes photochemical, electrochemical, piezoacoustic, and ultrasound techniques. It is a unique reference guide for graduate students, faculties, researchers and industrialists working in the area of water science, environmental science, analytical chemistry, and chemical engineering.

This book presents emerging economical and environmentally friendly polymer composites that are free of the side effects observed in traditional composites. It focuses on eco-friendly composite materials using granulated cork, a by-product of the cork industry; cellulose pulp from the recycling of paper residues; hemp fibers; and a range of other environmentally friendly materials procured from various sources. The book presents the manufacturing methods, properties and characterization techniques of these eco-friendly composites. The respective chapters

address classical and recent aspects of eco-friendly polymer composites and their chemistry, along with practical applications in the biomedical, pharmaceutical, automotive and other sectors. Topics addressed include the fundamentals, processing, properties, practicality, drawbacks and advantages of eco-friendly polymer composites. Featuring contributions by experts in the field with a variety of backgrounds and specialties, the book will appeal to researchers and students in the fields of materials science and environmental science. Moreover, it fills the gap between research work in the laboratory and practical applications in related industries.

The book is devoted to the highly versatile and potential ingredient Cyclodextrin, a family of cyclic oligosaccharides composed of α -(1,4)-linked glucopyranose subunits. Its molecular complexation phenomena and negligible cytotoxic effects attribute toward its application such as in pharmaceuticals, cosmetics, food, agriculture, textile, separation process, analytical methods, catalysis, environment protection, and diagnostics. Efforts have also been made to concentrate on recent research outcomes along with future prospects of cyclodextrins to attract the interest of scientists from the industry and academia. The contributions of the authors are greatly acknowledged, without which this compilation would not have been possible.

This book highlights the challenges in sustainable wet processing of textiles, natural dyes, enzymatic textiles and sustainable textile finishes. Textile industry is known for its chemical processing issues and many NGO's are behind the textile sector to streamline its chemical processing, which is the black face of clothing and fashion sector. Sustainable textile chemical processes are crucial for attaining sustainability in the clothing sector. Seven comprehensive chapters are aimed to highlight these issues in the book.

In recent years, there have been significant advances in the techniques of sampling and analysis, which has allowed the more accurate recording of environmental levels of many substances present in the environment. At the same time, processes for the remediation of contaminated matrices have evolved, through the application and/or combination of biological, physical, and chemical procedures. The purpose of this book is to present new studies aimed at determining levels of environmental pollution in various parts of the world. It also shows new alternatives for the remediation of contaminated matrices.

Biopolymer Membranes and Films: Health, Food, Environment, and Energy Applications presents the latest techniques for the design and preparation of biopolymer-based membranes and films, leading to a range of cutting-edge applications. The first part of the book introduces the fundamentals of biopolymers, two-dimensional systems, and the characterization of biopolymer membranes and films, considering physicochemical, mechanical and barrier properties. Subsequent sections are organized by application area, with each chapter explaining how biopolymer-based membranes or films can be developed for specific innovative uses across the health, food, environmental and energy sectors. This book is a valuable resource for researchers, scientists and advanced students involved in biopolymer science, polymer membranes and films, polymer chemistry and materials science, as well as for those in industry and academia who are looking to develop materials for advanced applications in the health, food science, environment or energy industries. Presents detailed coverage of a range of novel applications in key strategic areas across health, food, environment and energy Considers the difficulties associated with two-dimensional materials Assists the reader in selecting the best materials and properties for specific applications Helps researchers, scientists and engineers combine the enhanced properties of membranes and films with the sustainable characteristics of biopolymer-based materials

Emerging contaminants are chemical and biological agents for which there is growing concern about their potential health and environmental effects. The threat lies in the fact that the sources, fate and toxicology of most of these compounds have not yet been studied. Emerging contaminants, therefore, include a large number of both recently discovered and well-known compounds such as rare earth elements, viruses, bacteria, nanomaterials, microplastics, pharmaceuticals, endocrine disruptors, hormones, personal care products, cosmetics, pesticides, surfactants and industrial chemicals. Emerging contaminants have been found in many daily products, and some of them accumulate in the food chain. Correlations have been observed between aquatic pollution by emerging contaminants and discharges from wastewater treatment plants. Most actual remediation methods are not effective at removing emerging contaminants. This second volume presents comprehensive knowledge on emerging contaminants with a focus on remediation.

The series Topics in Current Chemistry Collections presents critical reviews from the journal Topics in Current Chemistry organized in topical volumes. The scope of coverage is all areas of chemical science including the interfaces with related disciplines such as biology, medicine and materials science. The goal of each thematic volume is to give the non-specialist reader, whether in academia or industry, a comprehensive insight into an area where new research is emerging which is of interest to a larger scientific audience. Each review within the volume critically surveys one aspect of that topic and places it within the context of the volume as a whole. The most significant developments of the last 5 to 10 years are presented using selected examples to illustrate the principles discussed. The coverage is not intended to be an exhaustive summary of the field or include large quantities of data, but should rather be conceptual, concentrating on the methodological thinking that will allow the non-specialist reader to understand the information presented. Contributions also offer an outlook on potential future developments in the field./div Chapters "Sonocatalysis: A Potential Sustainable Pathway for the Valorization of Lignocellulosic Biomass and Derivatives", "Valorisation of Biowastes for the Production of Green Materials Using Chemical Methods" and "Green and Sustainable Separation of Natural Products from Agro-Industrial Waste: Challenges, Potentialities, and Perspectives on Emerging Approaches" are available open access under a Creative Commons Attribution 4.0 International License via link.springer.com.

While chemical products are useful in their own right—they address the demands and needs of the masses—they also drain our natural resources and generate unwanted pollution. Green Chemical Engineering: An Introduction to Catalysis, Kinetics, and Chemical Processes encourages minimized use of non-renewable natural resources and fosters maximized pollution prevention. This text stresses the importance of developing processes that are environmentally friendly and incorporate the role of green chemistry and reaction engineering in designing these processes. Focused on practical application rather than theory, the book integrates chemical reaction engineering and green chemical engineering, and is divided into two sections. The first half of the book covers the basic principles of chemical reaction engineering and reactor design, while the second half of the book explores topics on green reactors, green catalysis, and green processes. The authors mix in elaborate illustrations along with important developments, practical applications, and recent case studies. They also include numerous exercises, examples, and problems covering the various concepts of reaction engineering addressed in this

book, and provide MATLAB® software used for developing computer codes and solving a number of reaction engineering problems. Consisting of six chapters organized into two sections, this text: Covers the basic principles of chemical kinetics and catalysis Gives a brief introduction to classification and the various types of chemical reactors Discusses in detail the differential and integral methods of analysis of rate equations for different types of reactions Presents the development of rate equations for solid catalyzed reactions and enzyme catalyzed biochemical reactions Explains methods for estimation of kinetic parameters from batch reactor data Details topics on homogeneous reactors Includes graphical procedures for the design of multiple reactors Contains topics on heterogeneous reactors including catalytic and non-catalytic reactors Reviews various models for non-catalytic gas–solid and gas–liquid reactions Introduces global rate equations and explicit design equations for a variety of non-catalytic reactors Gives an overview of novel green reactors and the application of CFD technique in the modeling of green reactors Offers detailed discussions of a number of novel reactors Provides a brief introduction to CFD and the application of CFD Highlights the development of a green catalytic process and the application of a green catalyst in the treatment of industrial effluent Comprehensive and thorough in its coverage, *Green Chemical Engineering: An Introduction to Catalysis, Kinetics, and Chemical Processes* explains the basic concepts of green engineering and reactor design fundamentals, and provides key knowledge for students at technical universities and professionals already working in the industry.

This book provides researchers and graduate students with an overview of the latest developments in and applications of adsorption processes for water treatment and purification. In particular, it covers current topics in connection with the modeling and design of adsorption processes, and the synthesis and application of cost-effective adsorbents for the removal of relevant aquatic pollutants. The book describes recent advances and alternatives to improve the performance and efficacy of this water purification technique. In addition, selected chapters are devoted to discussing the reliable modeling and analysis of adsorption data, which are relevant for real-life applications to industrial effluents and groundwater. Overall, the book equips readers with a general perspective of the potential that adsorption processes hold for the removal of emerging water pollutants. It can readily be adopted as part of special courses on environmental engineering, adsorption and water treatment for upper undergraduate and graduate students. Furthermore, the book offers a valuable resource for researchers in water production control, as well as for practitioners interested in applying adsorption processes to real-world problems in water treatment and related areas.

Over the past decade, the population explosion, rise in global warming, depletion of fossil fuel resources and environmental pollution has been the major driving force for promoting and implementing the principles of green chemistry and sustainable engineering in all sectors ranging from chemical to environmental sciences. It is noteworthy to mention that production of biofuels, exploitation of renewable energy sources and use of ecologically safer products in applied sectors are becoming increasingly important for the development of alternative sustainable technologies. *Integrating Green Chemistry and Sustainable Engineering* focusses on latest sustainable technologies and developments and describes how sustainable chemistry and engineering practices are being applied and integrated in various industrial sectors. The book addresses emerging topics including biofuel production, CO₂ conversion to green fuels, advanced green polymers in coating applications, biological macromolecules in medical sector, biofertilizers for agricultural sector, bioadsorption and much more.

The present monograph presents 17 in-depths reviews from eminent professors, scientists, chemists and engineers from educational institutions, research organizations and chemical industries introducing a new emerging green face of multidimensional chemistry. It addresses different topics under the domain of 'Green Chemistry' like Introductory aspects, alternate approaches to solvent chemistry, Environment friendly Green techniques, Alternative wastewater treatment technologies and Step change technologies for exploiting Green Chemistry.

Years of human ignorance has diminished our natural resources and aged our planet. Now, people are making an effort to change the way they are treating the planet. Being more environmentally conscious about the impact materials used for fashion have on our planet is one-way designers can reduce waste and help enable a better world. By going eco-friendly can be less harmful to our natural resources. Not all fashion is following this eco-friendly trend, but more designers are embracing the trend toward eco-fashion than ever before. If the entire fashion industry became eco-friendly, it would make a huge difference for future generations because the fashion industry employs over a billion people globally. There is need for eco-friendly wet processing that is sustainable and beneficial methods. Number of sustainable practices has been implemented by various textile processing industries such as Eco- friendly bleaching; Peroxide bleaching; Eco-friendly dyeing and Printing; Low impact dyes; Natural dyes; Azo Free dyes; Phthalates Free Printing. There are a variety of materials considered "environmentally-friendly" for a variety of reasons. The industry is desperately in the need of newer and very efficient dyeing/finishing and functional treatments of textiles. There is growing awareness and readiness to adapt new perspective on industrial upgradation of Cleaner Production Programme, such new technologies help enterprises achieve green production and cost reduction at the same time. Green Production has become necessary for enterprises under the upgrade and transformation policy. The book *Eco-Friendly Textile Dyeing and Finishing* covers topics in the area of sustainable practices in textile dyeing and finishing. In this book, we have summarized recent progresses due to novel nanomaterials for sustainable water resources. Book provides a summary of the state of the art knowledge to scientists, engineers and policy makers, about recent developments due to nanotechnology for sustainable water resources arena. The advances in sustainable water resources technologies in the context of modern society's interests will be considered preferably which allow to identify grand challenges and directions for future research. The book contributors have been selected from all over the world and the essential functions of the nanotechnologies have presented rather than their anticipated applications. Moreover,

up to date knowledge on economy, toxicity and regulation related to nanotechnology are presented in detail. In the end, role of nanotechnology for green and sustainable future has also been briefly debated.

This book describes the various advanced treatment methods for removal of multiple types of dyes from effluent stream. It pays particular attention to the economic aspects of treatment of textile waste-water. The different technologies illustrated in the book include adsorption, nanofiltration, advanced oxidation, micellar enhanced ultrafiltration, cloud-point extraction, and electrocoagulation. The book presents in-depth analyses of the removal mechanisms and performance optimization of the processes involved therein. This book will be useful to chemists, chemical engineers, environmental engineers, and health and pollution control professionals. The contents have been presented in a manner that they can be easily understood and applied by a wide variety of readers including researchers, students, and practicing engineers.

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