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Book reviews

Mycoremediation: Fungal Bioremediation, H. Singh. Wiley/Interscience, Hoboken, NJ (2006). US$ 125.00, 614 pp., ISBN: 3-471-75501-X

The publisher describes this book as a pioneer as it is "... the first encyclopedic examination of the application of fungi in bioremediation, [that] coincides with the rise of a new era in fungal technologies." Indeed, it is, for I have seen no other text on the topic. The coverage in this book is thorough as noted: "All aspects of this multidisciplinary field are covered, including degradative fungi, taxonomy, biochemistry, enzymology, reactor engineering, genetic engineering, and the ecology of biodegradation."

"Fungi are known to degrade, or cause to deteriorate, a wide variety of materials and compounds, through processes known as mycodegradation and mycodeterioration. The degradative activities of fungi have been recognized in various situations where they destroy different types of wood, stored paper, textiles, plastics, leather, and electroinsulating and various wrapping materials."

In the preface, the author notes that:

> "Fungi are one of nature's most versatile organisms in their structure, metabolism, ecology, and genomics. The first step is to understand fungal morphology, analysis and measurement of growth, and processes of fungal biodegradation (Chapter 1). Immunological and molecular assays are defined as novel tools for the detection of degradative fungi. Chapters 2 and 3 cover the treatment of a wide variety of industrial wastewaters and brewery and distillery wastes, fermentations, bioreactors, and modeling concomitant with economic importance. Next, the metabolic pathways and mechanisms of mycotransformation and mycodetoxification of petroleum hydrocarbons (Chapter 4), polychlorinated biphenyls and dioxins (Chapter 5), and pesticides (Chapter 6) are explored. A wide spectrum of bioreactors, mechanisms, and factors affecting mycotransformation, metabolic pathways, and metabolites of phenols (Chapter 7), polycyclic aromatic hydrocarbons (Chapter 8) pulp and paper mill effluents (Chapter 9), and dyes (Chapter 10) are covered next. The role of fungal enzymes in the degradation and transformation of phenols, polycyclic aromatic hydrocarbons, lignin and pulp and paper mill effluents, and dyes is discussed in detail. Chapter 11 focuses on the properties, associated mechanisms, and applications of living and nonliving fungal biomass in metal biosorption. The role of mycorrhizal fungi in the uptake of toxic metals and degradation of xenobiotic organic compounds is also discussed (Chapter 12). Methods to identify, select, and use fungi are discussed holistically associated with mycoremediation applications. The latest advances in genetic engineering and molecular biotechnologies that will be useful for the creation of suitable fungi capable of faster detoxification fo these compounds are also described. However, many problems and limitations still exist and need to be overcome."

Singh begins the book with the following statement: "Fungi are a diverse group of organisms and are ubiquitous in the environment." "Fungi play vital roles in all ecosystems and are capable of regulating the flow of nutrients and energy through their mycelial networks."

Fungi have survived, the author notes, for approximately 5300 years. The fungi group includes molds, yeasts, and filametious fungi. This group of organisms can be utilized to treat wastes and wastewater. In contrast to their beneficial use just noted, "Fungi are known to degrade, or cause to deteriorate, a wide variety of materials and compounds, [in] processes known as mycodegradation and mycodeterioration."

In contrast to their undesirable activities, fungi have been utilized to treat contaminated wastewaters in the following bioreactor types: trickling filter, rotating biological contactor, upflow fixed film, slurry, stirred tank, packed bed, bubble column, fluidized bed, airlift tower loop and immobilized. In addition to their being employed in engineered reactors, fungi (white-rot fungi) have been used in bioremediation.

Chapter 2 is entitled Fungal Treatment of Industrial Wastewaters, that process dates back to the 1960s. Yeasts and fungi have been used extensively to treat food-processing wastewater with a concomitant production of food and fodder yeast and fungi. Separate sections in this chapter discuss the treatment of the following wastewaters: starch, dairy industry, pharmaceutical, protein-containing, oil manufacturing plant, silage, acidogenic and olive mill.

Subsequent chapters are devoted to the fungal treatment of a single wastewater source. They are, by title:

- Fungal treatment of distillery and brewery wastes.
- Fungal metabolisms of petroleum hydrocarbons.
- Fungal degradation of polychlorinated biphenyls and dioxins.
- Fungal degradation of pesticides.

- Fungal metabolism of phenols, chlorophenols, and pentachlorophenol.
- Fungal metabolism of polycyclic aromatic hydrocarbons.
- Fungal lignin degradation and decolorization of pulp and paper mill effluents.
- Fungal decolorization and degradation of dyes.

The final two chapters are:

- Fungal biosorption of heavy metals.
- Mycorrhizal fungi in rhizosphere remediation.

The author cites over 2000 publications from a variety of sources. Many of these citations are from the "waste treatment" literature but most are from the biological literature.

Suffice it to say, this is a well written, extremely well referenced, comprehensive treatment of a formerly (at least in my sphere of reading) undeveloped topic.

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Propellants and Explosives: Thermochemical Aspects of Combustion, 2nd ed., N. Kubota. Wiley–VCG Verlag GmbH & Co. KgaA, Weinheim, Germany (2007). 530 pp., US$ 175.00, ISBN: 978-3-527-31424-9

The Journal of Hazardous Materials has changed over the years, from one which published articles mainly dealing with hazardous chemicals – hazards from chemical spills and hazards from fires and explosions – to a journal mainly publishing environmentally oriented articles. Most book reviews are in the latter area. This review, however, is of a book that returns to Journal's roots.

This book is the second edition of a classic on the thermochemistry of combustion. It ". . . covers the thermochemical and combustion characteristics of all important types of energetic materials, such as explosives, propellants, and the new class of pyrolants, as well as related phenomena. Addressing both experimental as well as theoretical aspects, it presents the fundamental bases of the energetics of materials, deflagration and detonation, thermochemical process of decomposition and combustion, plus combustion wave structures. The book also goes on to discuss the combustion mechanisms of various types of energetic materials, propellants, and explosives, based on the heat transfer process in the combustion waves. The burning rate models are also presented as an aid to understanding the rate-controlling steps of combustion processes, thus demonstrating the relationships of burning rate versus pressure and initial temperature."

This second edition uses the same format as the first edition whose material has been updated. In the preface to the first edition, the author writes:

> "This book is divided into four parts. The first part (Chapters 1–3) provides brief reviews of the fundamental aspects relevant to the conversion from chemical energy to aerothermal energy. References listed in each chapter should prove useful to the reader for better understanding of the physical bases of the energy conversion process; energy formation, supersonic flow, shock wave, detonation, and deflagration. The second part (Chapter 4) deals with the energetics of chemical compounds used as propellants and explosives, such as heat of formation, heat of explosion, adiabatic flame temperature, and specific impulse.
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> The third part (Chapters 5–8) deals with the results of measurements on the burning rate behavior of various types of chemical compounds, propellants, and explosives. The combustion wave structures and the heat feedback processes from the gas phase to the condensed phase are also discussed to aid in the understanding of the relevant combustion mechanisms. The experimental and analytical data described in these chapters are mostly derived from results previously presented by the author. Descriptions of the detailed thermal decomposition mechanisms from solid phase to liquid phase or to gasphase are not included in this book. The fourth part (Chapter 9) describes the combustion phenomena encountered during rocket motor operation, covering such topics as the stability criterion of the rocket motor, temperature sensitivity, ignition transients, erosive burning, and combustion oscillations. The fundamental principle of variable-flow ducted rockets is also presented. The combustion characteristics and energetics of the gas-generating propellants used in ducted rockets are discussed."

". . . new to this edition are five additional chapters providing updated coverage of significant recent developments in the field, as well as the major topic of such propulsion methods as duct rockets, ramjets, pulse motors and thrusters, while appendices on flow field dynamics and shock wave propagation have also been added." The titles of these chapters are as follows:

- Emission from combustion products;
- Transient combustion of propellants and pyrolants;
- Rocket thrust modulation;
- Ducted rocket propulsion.

The book topic, being well out of my area of expertise, does not allow me to make a qualitative assessment of its content. I can say, however, that I was impresses by the elegant thermodynamic analysis.