Biodegradation and Bioremediation


As stated in the preface of this book, active interest in the biodegradation of organic contaminants in the environment spans over at least the past 40 years, as the vast and ever-expanding literature in this field attests. In this book, the author draws from research conducted in his and in others' laboratories on the fates of agricultural, petroleum-related, munitions, and other organic chemicals in soils and natural waters to illustrate some fundamental concepts relevant to biodegradation. Chapters dealing with cometabolism, acclimation, activation, degradation kinetics, and bioavailability attempt to synthesize the knowledge of these subjects while acknowledging that different environments and the different organisms within them vary in their biodegradative activities. These and additional chapters dealing with the environmental chemistry of contaminants and the influences of abiotic factors on biodegradation emphasize the complexities of predicting or intervening in the fate of contaminants in the environment. The book introduces some of the important considerations necessary when devising or implementing bioremediation plans such as the C/N/P ratio in the affected environment, the influence of sorption on biodegradation, the use of surfactants to solubilize hydrophobic contaminants, and the associations of contaminants with NAPLs.

Many of the examples used to illustrate principles in the book come from studies of agricultural chemicals done in the author's lab over the past decades. Tables and figures are used to good effect throughout the book and serve to illustrate many of the points made. The chapters are well referenced with many recent citations for readers wishing to pursue topics in more depth. The majority of the book deals with the microbiological aspects of bioremediation and would provide a good introduction to this subject to undergraduate or beginning graduate students, and possibly to practicing environmental engineers who know little about the microbiological nuances of biodegradation. To researchers and advanced students in environmental sciences, most of the material will look familiar. Chapters dealing with the physiochemical aspects of contaminant behavior place the practical problems confronting bioremediation in the proper context and highlight the need for multidisciplinary approaches. This is not, however, an environmental chemistry book and readers will need to look elsewhere for information on sorption mechanisms, desorption kinetics, intraparticle diffusion, and other concepts relevant to bioremediation.

The book concludes with chapters on the successes and failures of inoculation as a means of enhancing biodegradation in contaminated environments, and a survey of bioremediation technologies. As a fairly new approach to environmental cleanup, and one that is difficult to study in the field, the case history of bioremediation is scant. Much of what is known about the efficacy and approaches to bioremediation exists as proprietary information in the private sector. The author cautions readers about unsubstantiated claims for bioremediation miracles and suggests that much needs to be learned before the promise of this technology is realized.—WILLIAM F. GUERIN, Department of Crop and Soil Sciences, Michigan State University, East Lansing, MI 48824-1325.

Clay Mineralogy: Spectroscopic and Chemical Determinative Methods


Clay mineralogy is a topic that crosses the boundaries of many disciplines. Consequently, research in this subject area has traditionally benefited from the application of a wide variety of analytical techniques. Several classic attempts have been made to summarize useful methods of analysis and to demonstrate their applications to clay science. This hardcover text has a similar mission. Following a brief introductory chapter outlining the fundamentals of molecular spectroscopy, a series of eight chapters are devoted to specific spectroscopic and chemical techniques. The former (a total of six chapters) include infrared, Mössbauer, nuclear magnetic resonance, electron paramagnetic resonance, x-ray photoelectron, and x-ray fluorescence spectroscopy. The authors of these chapters follow the often-used approach of (i) defining basic principles specific to the spectroscopic technique of interest, (ii) describing required instrumentation and sample limitations, (iii) presenting data from standard mineral systems, and (iv) discussing possible applications to the broader field of clay science. The remaining two chapters emphasize traditional chemical and selective dissolution methods. In both cases, there is some general discussion of concepts and analytical issues after which preferred methods of analysis are presented using a recipe format that outlines required reagents and procedures.

The combination of both advanced and traditional spectroscopic techniques together with wet chemical methods of analysis makes for a rather curious blend of material. The two wet chemistry chapters have, in fact, largely been adapted from a previous book prepared by the same editor (A Handbook of Determinative Methods in Clay Mineralogy, 1987, Blackie, Glasgow) that is now out of print. While these chapters certainly contain useful information, one cannot help but feel that they have been included mostly as filler material. The spectroscopy chapters are also reminiscent of an earlier effort (Advanced Chemical Methods for Soil and Clay Minerals Research, 1979, edited by J.W. Stucki and W.L. Banwart, D. Reidel Publ. Co., Dordrecht) that included sections on Mössbauer, nuclear magnetic resonance, and x-ray photoelectron spectroscopy. There is, in fact, some overlap among the authors. In a few instances, chapters in the present book must also compete with entire texts dedicated to a given spectroscopic technique and its application to mineralogy. The Infrared Spectra of Minerals (Farmer, 1974, Mineralogical Society, London) is a good example.

A strength of the current book is that it strikes a reasonable balance between spectroscopic concepts and analytical practice while providing a compendium of research findings specific to clay mineralogy. The book should therefore be useful to veteran scientists as well as those seeking an introduction to certain aspects of clay science. The chapter authors are well qualified and have done a mostly admirable job of writing. The text is well illustrated and indexed, and the publisher has contributed an attractive cover and quality printing. The only question is to what degree the substantial cost of this book will prohibit its placement onto shelves already packed with related texts of comparable quality.—J.M. BIGHAM, School of Natural Resources, The Ohio State University, Columbus, OH 43210.