

Preface

First of all, we would like to thank Prof. S.K. Sharma for the chance to write a monograph in his series of books (SpringerBriefs in Green Chemistry for Sustainability). This book is a comprehensive summary of the recent studies on the adsorption of hazardous substances from the water environment onto clay and clay minerals.

In our modern life, clay minerals are one of the most important materials for a number of industrial applications, from the conventional ones to the advanced applications. A substantial number of studies have been carried out to explore the possible usage of clay minerals as “super” adsorbent for removal of hazardous substances from water environment. To increase the adsorption capability of natural clay minerals, several methods have been used to modify the surface and structure of clay minerals. Often, the modification involved hazardous chemicals which ended up as waste after the process. Combination between clay minerals and other materials to form new composite materials has also been explored, and as a result, many new clay composite materials were developed for the environmental remediation purpose.

A number of literatures dedicated to clay science are available, and most of them provide important information about the science of clay minerals or materials. Different aspects of clays including geology, mineralogy, crystallography, geotechnology, and its industrial importance and applications have been given and discussed in these available books. A large number of studies have been devoted to the use of clay minerals for the removal of hazardous substances from water or wastewater; however, only a limited number of monograph books are available in this area. This book attempts to fill the gap between the science of clays and their applications, especially for water remediation.

Brief discussions about the environmental problem, particularly in water system caused by the pollution of hazardous chemicals, are presented in Chap. 1 as the introduction chapter. The subsequent chapter discusses the structure and classification of clay minerals and its role as cleaning agents in water remediation. Due to their hydrophilic nature, natural clay minerals usually are not suitable as adsorbents for some organic compounds; therefore, modification in their structure and

surface chemistry is needed. Various methods are available for this purpose, and some aspects of clay modification and their application for adsorption purpose are given in Chap. 3.

Relevant adsorption equilibria and kinetic data are needed for the design and analysis of the adsorption separation process. Adsorption equilibria and kinetic data are the most important information in understanding the adsorption process. Several adsorption isotherm and kinetic models are currently available to represent the adsorption data of hazardous substances on clay minerals, and usually, more than one model can represent the adsorption equilibria of a certain system. The decision to choose or decide the suitability of the model to represent the experimental data should not only be based on the value of r^2 but also on the rationality of the physical meaning of each parameter. Comprehensive discussions on the validity of the available models to represent adsorption equilibria and kinetic data are given in Chaps. 4 and 6.

Chapter 5 discusses the characterization of clay minerals and its modified forms. Clay minerals are heterogeneous in both composition and pore structure; therefore, the characterization and identification of the mineralogical composition are challenging processes. With the availability of modern instrumentation, the process of characterization of clay minerals becomes much easier. Various aspects of the characterization of clay minerals for environmental application are covered in the last chapter of this book.

Clay Materials for Environmental Remediation

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