Since a prior volume in this series comprehensively describes gas chromatography as a separate method in combination with various detectors, this review of GC/MS analysis focuses on mass spectrometry as a detection method. In addition to the presentation of the underlying physico-chemical principles and current instrumental technology, special aspects of the coupling and method development are treated.

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C.C. Chien, H.I. Inyang, L.G. Everett (Eds.), Barrier Systems for Environmental Contaminant Containment and Treatment, Taylor & Francis Group, CRC Press, Boca Raton, FL, 2006 (403 pp., Price USD 149.95, ISBN 0-8493-4040-3).

An overview of the contents of this book is found on the back cover.

> "Containment and permeable reactive barriers have come full circle as an acceptable environmental control technology during the past 30 years. As interest shifted back toward containment in the 1990s, the industry found itself relying largely on pre-1980s technology. Fortunately, in the past 10 years important advances have occurred in several areas of containment, most notably in the area of permeable barriers."

Given the editors' interest in the subsurface and the technologies to be employed in investigations thereof, answers are needed for questions regarding predicted and verifiable performance of long-term barriers. To this end, a conference sponsored by the U.S. Department of Energy was held in mid-2002 in Baltimore, Maryland. International experts formed five separate discussion panels. Three panels focused on prediction and two on verification. One of these panels was led by Dr. Charles Shackelford, an editor of this journal. Each panel leader was responsible for writing a chapter in the book.

While avoidance, destruction or treatment of hazardous wastes (both currently generated or disposed of in the past in landfills) is preferable to long-term storage, this desired result is not always possible technically or economically, whereas nature, itself, has been shown to adsorb or degrade certain contaminants. The editors note:

> "This book provides a comprehensive report on the science and technology of waste containment, with a balanced presentation of what is and is not known. Subsurface containment will continue to be a widely used environmental control technology in the years ahead."

Chapter 1, entitled "Damage and system performance prediction", reports how contaminants can get to the subsurface. In this chapter, the authors discuss both the pathways of contaminant transmittance and barrier degradation. Various barrier designs, waste types, management systems, climate and geohydrogeologic environments, site stability, and barrier construction, all of which affect barrier performance, are reviewed.

Chapter 2, "Modeling of fluid transport through barriers", discusses the basis for predicting the transport of water and contaminants through barriers. The chapter focuses on: (1) modeling of the inflow of moisture to the buried wastes and (2) the release of contaminants through a subsurface barrier. Information provided in the chapter includes a discussion of the current state-of-the-art for performance prediction as well as the limitations in modeling specific situations.

Chapter 3, "Material stability and applications", addresses the materials used in barriers, defining the properties of barrier materials and exploring how materials perform in the field. Such materials include natural soil, stones and cobbles, impermeable plastic lining materials, man-made filter fabrics, and chemical agents designed to adsorb or degrade contaminants that might come in contact with the material.

Chapter 4, "Airborne and surface geophysical method verification", describes the utilization of geophysical methods. The discussion goes beyond the conventional use of these methods, moving on to identifying contaminant plumes and other anomalies. When utilized to evaluate subsurface barriers, it is noted that geophysical methods are challenged beyond their traditional role of identifying gross features that might warrant more detailed explanation toward identifying more subtle features, such as a leak in a subsurface barrier. The techniques described in this chapter include both near- and far-field devices, including equipment deployed in aircraft flying above a site as well as devices placed on the ground surface directly with electromagnetic or other sources of energy.

Chapter 5, "subsurface barrier verification", discusses a topic the editors label the most challenging aspect of waste containment technology, i.e. validation of field performance.

> "This chapter provides a comprehensive review of sensors and examples of how sensors can be used to document system performance, addressing the basic questions: where, what, how, and what-if? Ultimately the performance verification scheme should be linked to the performance prediction process. It is perhaps this leakage that is our most important end point and one that requires more work, particularly in terms of assessing reliability and risk associated with the use of waste containment as a technique for managing waste in the subsurface." The chapter ends with two case studies.

This book provides a valuable addition to the scientific literature on the topic of barrier systems. It contains the collective wisdom of the leading U.S. scientists in this field.

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