PREFACE

THE PRESENCE OF ORGANIC CHEMICALS in drinking and natural waters and their associated health hazards have long been a concern to the scientific and engineering community. The public shares this concern as shown by the passage of safe drinking water legislation in the United States and other countries. Safe drinking water legislation in the United States has led to the development of maximum contaminant levels (MCLs) for volatile organic chemicals such as trihalomethanes and several pesticides. In 1985, MCLs for more than 80 other chemicals were proposed. Alternative or supplementary approaches being debated are tiered toxicological screening tests on aqueous extracts (e.g., Ames mutagenicity tests). Both approaches are dependent on quantitative methods to properly sample, isolate, concentrate, and sometimes fractionate trace organic chemicals from water.

This book will begin to answer some of the most important questions concerning the sampling, isolation, and analysis methods used to determine the chemicals of health concern that are in our drinking waters, waste waters, and natural waters. The book presents several schemes for isolating and concentrating trace contaminants. Viewpoints on which analytical scheme is best are presented. Is it a broad spectrum approach that attempts to determine everything that is present on the basis of many different isolation methods? Is it an approach that determines everything in a sample as the master analytical scheme proposes? Is it an approach that selects specific chemicals such as priority pollutants for quantitative isolation and analysis? Is it a combination of these approaches that is best? Other questions about sampling are presented. Should composite or grab sampling be the choice? Which approach will best describe the extent of the problem, temporally or spatially selected samples? What are the artifacts produced while sampling?

In general, this book deals with developing analytical protocols for concentrating organics for toxicity testing; isolating nonpolar and polar organics from water; and using reverse osmosis, synthetic polymers, and other methods for composite samples. The book is a modest effort to explore the expanding amount of data from research on sampling, isolating, concentrating, and fractionating organic chemicals from natural and treated water for mutagenic, carcinogenic, and toxicity testing. All of the analytical methods discussed are based on phase-

In Organic Pollutants in Water; Suffet, I. H. (Mel), et al.;
Advances in Chemistry; American Chemical Society: Washington, DC, 1986.

transfer processes in which the compound is isolated by a second phase (e.g., solvent or resin) or separated by a membrane phase.

Regulatory aspects of using biological testing are also presented. Although the U.S. Environmental Protection Agency (USEPA) is proposing MCLs for specific chemicals in drinking water (*Federal Register*), the agency is still interested in seeing if a surrogate toxicity measure can be used to replace specific chemical analysis for chemicals of health concern. Also, the Denver Water Board is currently developing a reuse water treatment system and is planning to isolate organics from the drinking water for the purpose of biological testing. Denver projects that it will use 10% direct drinking water reuse of reclaimed waste water if the reuse water can be proved to be as healthy as its present water supply.

A panel discussion at the end of the book describes the potential biological hazards of drinking water and the needs and applications of the analytical methods presented in the book. This panel discussion is essential to the reader's understanding of the often complex chemistry-toxicology-water treatment-regulators interface. We hope that the reader will enjoy the panel discussion, not only for the technical content, but also for insight into the personal philosophies of the participants.

Acknowledgments

A project such as this one requires the expertise and help of many people. Unfortunately, there is not sufficient space to thank everyone. We know and appreciate how important their contributions were. The support of David B. Preston, Retired Executive Director, American Water Works Association (AWWA) and Michael J. McGuire, AWWA Liaison, is gratefully acknowledged. The USEPA provided financial support for this project (Cooperative Agreement No. CR 811168), making it possible to record the entire symposium, have court stenographers record the panel discussion, and plan the meeting. We are grateful for the guidance of Paul Ringhand, Project Officer, and Fred Kopfler, Chief, Chemical and Statistical Support Branch, Toxicology and Microbiology Division, USEPA, Office of Research and Development, Health Effects Research Laboratory, Cincinnati, Ohio. Although many of the chapters in this book describe research that was fully or partially funded by U.S. federal agencies, the individual chapters do not reflect the views of the agencies and no endorsement should be inferred.

The ACS Division of Environmental Chemistry also provided financial assistance for travel funds and guest registrations of scientists coming from other countries. We gratefully acknowledge the division support. Students from Drexel University, Environmental Chemistry

Group—Ronald Baker, Brian Brady, Gail Caron, Chuck Hertz, Eva Ibrahim, Kathy Hunchak, Lee Lippincott, and Areta Wowk—operated the tape recorders, microphones, and audio-visual system during the symposium from which this book was developed.

We are indebted to the reviewers who worked many hours to ensure that a high-quality book was produced. We are deeply indebted to the speakers and session chairpersons of the symposium for their contributions and efforts before, during, and after the symposium. We thank the discussion participants for their open and frank opinions; we feel that their contributions and the ideas exchanged will generate a better understanding of the subject for the readers.

The task of managing the review process, as well as all production phases of this book, was expertly handled by Janet S. Dodd of the ACS Books Department. We enjoyed working with Janet Dodd, Robin Giroux, Karen McCeney, and the entire ACS staff. We appreciate their patience and professionalism.

At both institutions where we are associated, several people must be acknowledged for their editing, typing, and clerical help. Suffet expresses his gratitude for the work of Beverly Henderson, Evelyn Soto, and Ronald Brown at Drexel University, who handled the correspondence and typing chores with professional dedication, and the work of Susan Sorace, who helped edit the panel discussion. Malaiyandi expresses his gratitude for the support and encouragement of P. Toft, Chief, Division of Monitoring and Criteria, Health and Welfare Canada, and Jean Ireland and Irmgard Schierfeld for handling correspondence.

We both gratefully acknowledge the understanding, support, and encouragement of our wives, Eileen Suffet and Pathali Malaiyandi. They remain a source of perspective as professionals in their own right, and without their concern and help, this book would not have been possible.

I. H. SUFFET
Drexel University
Philadelphia, PA 19104

MURUGAN MALAIYANDI
Health and Welfare Canada
Ottawa, K1A OL2, Canada

May 1986

To Our Wives and Families
Eileen Suffet, Alison, and Jeffrey
and
Pathali Malaiyandi