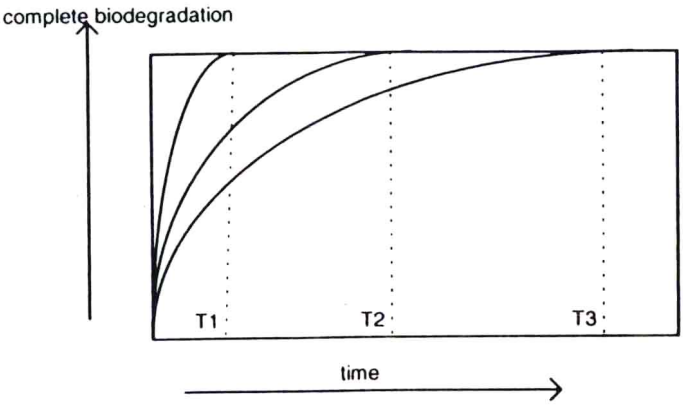
DEGRADABLE POLYMERS, RECYCLING, AND PLASTICS WASTE MANAGEMENT



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PREFACE

As the chairs for the Degradable Polymers working party of the IUPAC commission on functional polymers within the Macromolecular Division Committee, we organized an international workshop in April 1994 in Stockholm, Sweden. The aim of this workshop—Controlled Life-Cycle of Polymeric Materials: Biodegradable Polymers and Recycling—was to bring together scientists with an interest in design, synthesis, characterization, and long-term properties of degradable polymers.

The fate of polymers in nature seems to present a paradoxical problem at times; most polymers are designed and manufactured to resist environmental degradation (photodegradation, hydrolysis, oxidation, biodegradation, etc.) but are used for protective and/or structural purposes. Increasing awareness of solid waste management problems has led to the demand for polymers that do not have a harmful impact on the environment during any part of their life cycles. The complementary recycling of carbon, hydrogen, and nitrogen elements as well as of energy through reprocessing and biological and chemical conversion should be taken advantage of in polymer design. Research efforts in the 1970s by the editors and their colleagues on structure–property correlation and the mechanisms of degradation of polyethylene and step-growth polymers showed that the most important issue is not the type of degradation process, but rather how to develop tailor-made polymers with controllable lifetimes, taking into consideration environmentally acceptable manufacturing, application, recycling, and disposal methods. The ultimate goal is to obtain materials with an economically feasible degradation rate based on principles of the recycling of elements within the biosphere.

The accessibility of a polymer to degradative attack by microorganisms and higher biosystems is not solely related to its biological origin, but rather depends on its chemical architecture, composition, and processing. Both natural and synthetic macromolecules are degraded by microbial systems through hydrolysis and oxidation. Even polyethylene,

which is nonhydrolyzable and in the lowest oxidation state, can be totally mineralized, albeit at a very slow rate.

The present book contains the contributions of 26 world-leading scientists who gave oral and poster presentations at the workshop. The workshop focused on the following topics: polymer waste management, polymers from renewable resources, processing and products, degradation and test methods, environmental aspects, future materials, and governmental policy for degradable polymers. The program was organized in seven sessions and each session was chaired by one university scientist and one person from industry. The 150 conference participants came from all over the world.

The main sponsor of the workshop was the Swedish Waste Research Council (AFR), which made the conference possible, and the chairman of the board of this council, C. Heinegård, director of the National Board of Industrial and Technical Development (NUTEK), also acted as chairperson of the panel discussion. We are very grateful for the strong interest shown by Swedish industry, which helped sponsor the workshop and sent many representatives to Stockholm. Special thanks go to Duni-Bilå, Eka Nobel, Lyckeby Stärkelsen AB, MoDo, Mölnlycke AB, and TetraPak Material AB. Finally, we want to thank all the contributors for their very interesting presentations and subsequent papers.

Ann-Christine Albertsson
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