HANSER

Engineering Biopolymers: Homopolymers, Blends, and Composites

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Vorwort

Preface

Since Backeland created the very first entirely synthetic polymer about a century ago, the commercial production of such materials has increased enormously. From 1940 to 1980, the rate of polymer production grew by a factor of 100. This trend was still apparent in the year 2000 when the production of polymers increased by a factor of 4 in stark contrast to that of traditional materials; steel production grew by a factor of 2 while that of aluminum did not grow at all. Initially, synthetic polymers were thought of as a cheep replacement of common natural materials. Yet, in a few decades their unique properties were established and they were no longer considered interchangeable with natural materials.

The singularity of synthetic polymers stems from the practically unlimited possibilities of manipulating their chemical composition and physical structure in order to obtain a product with specific properties. Nevertheless, under certain circumstances, the unique features of synthetic macromolecules can be a disadvantage. PET bottles for pressurized soft drinks are a pertinent example. The extreme resistance of PET to chemicals and solvents makes it a very attractive material for food packaging purposes, one to which there is no existing alternative so far. Once PET becomes a waste product, however, its chemical stability leads to very serious environmental problems. This disadvantage is a common feature of synthetic polymers. In the last few decades, steadily increasing efforts have been devoted to managing the problem of synthetic polymer wastes. Having observed that natural cellulose- and protein-based materials are biodegradable, polymer chemists have succeeded in producing synthetic biodegradable polymers. Unfortunately, for many reasons these products are still not widely used and the environmental impact of synthetic petroleum-based polymers remains very acute.

One possible solution is using natural biopolymers and developing techniques for processing them with existing effective plastic processing equipment. Another option is blending synthetic polymers and natural biopolymers; yet another is using natural biopolymers as reinforcement in polymer composites, *e.g.*, replacing glass fiber reinforcements of polymer composites with natural fibers. Such studies are primarily driven by the fact that according to EU legislation, plastics used in car manufacturing (resulting in more than 5% ash residue after incineration) will be banned very soon.

The aim of this project is to collect the results of studies around the world, focusing on the implementation of natural polymers as engineering plastics and the use of their inherent properties, namely biodegradability and harmless burning in combination with synthetic polymers. This book discusses the processing and, more extensively, the application of natural materials (cellulose- and protein-based) as reinforcements of polymer composites. The structural, morphological, and thermal characteristics, as well as the mechanical behavior of the obtained materials are also pointed out. In addition, the book includes studies and results of commercial relevance. Furthermore, we discuss all natural polymers used in the blending or reinforcement of synthetic polymers in an attempt to cover the isolation, pretreatment, blending, and manufacturing of the respective materials. The preparation of biodegradable homopolymers, blends and composites involving chemical reactions (regardless of whether the starting material is petrochemical or natural organic), as well as microbial synthesis are beyond the scope of this book.

We expect this book to be a step ahead in the direction set by the excellent work of E. S. Stevens "Green Plastics".

As the Editors of this volume, we have enjoyed working with the individual contributors and greatly appreciate their support, prompt response, and patience.

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