

Preface

For decades, chemical industry has relied heavily on the fossil oil sector. In recent years, rapidly increasing oil prices, unstable supply, and potential fuel shortages have significantly increased interest in alternative resources. On the other hand, the environmental impact produced by chemical manufacturers led to a critical rethinking of chemical and energy technologies. Replacing fossil fuels, a primary source of synthetic chemicals, with renewable sources to produce polymeric materials is a big challenge.

Worldwide sustainable technologies are gradually introduced to produce “renewable” energy and to replace petrochemical products by resources provided from the renewable biomass. In this sense, the use of this kind of products is in rapid expansion, as it would allow obtaining cheaper and environmentally friendly methodologies.

In this context, biodegradable polymers have become a top research topic nowadays. These materials can be grouped into two large categories, agro-polymers, such as polysaccharides and proteins, which are directly derived from biomass, and biodegradable polyesters, like polyhydroxyalkanoates, which are those derived from microorganisms or synthetically made from either naturally or synthetic monomers. Biodegradable polymers have been proposed for a wide range of applications, from medicinal chemistry to agricultural industry and packaging. On the other hand, the introduction of synthesis alternatives using raw materials from the renewable biomass results in more sustainable routes for the production of chemicals, materials, energy, as well as products with medicinal applications.

Among biomolecules, polysaccharides are the most abundant in nature and are essential elements in a wide range of processes of living systems. These molecules produced by plants are a basic component of human and animal diets and serve as essential ingredients in many manufacturing processes. They are used to recognize proteins and other biological entities, tumor genesis and progression, immune responses, fertilization, apoptosis, and infection. Increasing the total carbohydrate yield is a major goal in biotechnology agriculture.

Starch and cellulose are the most commercially important carbohydrates. They are composed of glucose units with different chemical structures that grant them particular characteristic. Among a large number of applications, we can find the synthesis of polyurethanes with biomedical use, the development of additives to improve polymeric and cement matrix properties, and the fabrication of systems for oil recovery and pollutant removal.

Other polysaccharides include glycosaminoglycans, which are complex molecules ubiquitously present in the extracellular matrix of mammalian tissues and have very important medicinal applications; chitosan, which is made by treating the chitin shells of shrimp and other crustaceans and has a wide range of applications, from tissue engineering to environmental remediation; seaweed polymers, which have been investigated for their strong biological activities (antiviral, antitumor, anticoagulant, etc.); and guar gums, which are obtained from beans and are used in different fields such as oil industry.

On the other hand, proteins such as collagen and silk have been applied in different biomedical applications, from tissue engineering to drug delivery. In particular hydrogels based in proteins have been developed as suitable systems for sustained and targeted drug delivery.

In the field of biodegradable polyesters, the poly(lactic acid) is the one most currently applied in the market. It can be synthesized from fossil resources, but main productions are obtained from renewable resources. Thanks to the ability to process it through a variety of technologies and its excellent compostability, it has been applied to different fields, like sustainable food packaging material or nanofibrous membranes for pollutant removal.

Other important biodegradable polyesters are polyhydroxyalkanoates. These are produced in nature by bacterial fermentation of sugar or lipids and have shown excellent biocompatibility, which makes them perfect candidates for biomedical applications, such as bone tissue engineering.

This book aims to associate the latest scientific advances with current technological applications of polymers from renewable biomass. It features authors' contributions from academic ambit as well as private industry, allowing the reader to find topics that are not developed in related bibliographies and addressed in such diverse areas as, for example, the use in food packaging, medicinal products, energy production, and cosmetics industry as well as in environmental remediation.

Industrial Applications of Renewable Biomass Products

Past, Present and Future

Goyanes, S.N.; D'Accorso, N.B. (Eds.)

2017, VIII, 332 p. 132 illus., 45 illus. in color., Hardcover

ISBN: 978-3-319-61287-4