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Modern Developments in Biodegradable Conducting Polymers

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INTRODUCTION

Biodegradable polymers are substances that can break down into water and carbon dioxide when they come into contact with certain environmental microbes like bacteria and fungus. The capacity to accurately and precisely determine the composition of a degraded polymer is becoming more and more important due to its biodegradability properties. The development of analytical products has led to the availability of a variety of analytical techniques that are hailed as practical and preferred approaches to bioanalytical techniques that allow for the understanding of the complicated composition of biopolymers such polyhydroxyalkanoates and poly (lactic acid). The definition and examples of biopolymers are covered in the first section of this review. After that, the theory and instrumentation of analytical methods that can be used to analyse biopolymers are covered. These methods include physical methods (SEM, TEM, weighing analytical balance, etc.), chromatographic methods (GC, THM-GC, SEC/GPC), spectroscopic methods (NMR, FTIR, XRD, XRF), respirometric methods, thermal methods (DSC, Chromatographic techniques are given particular attention since they are the standard approach for polymer analysis. In order to analyse the many forms of biopolymers, this study will concentrate on current advancements in the field of biopolymer analysis and instrument application. Biodegradable polymers are substances that may break down into water and carbon dioxide when exposed to certain environmental microbes like bacteria and fungus. The extracellular enzymes of microorganisms act on the polymer surface to start the biodegradation processes or breakdown, producing oligomers. Once within the microorganism cell, these matching oligomers operate as carbon sources and are broken down into carbon dioxide and water. Due to their degradability characteristics and minimal environmental burden upon disposal, biopolymers have attracted a lot of interest as "green" or "environmentally friendly" polymetric materials.

DESCRIPTION

Biopolymers are frequently modified to increase their physical and thermochemical qualities in order to make them more suitable for use in finished products. The improvement is accomplished by adding fillers, binders, or copolymers. On an industrial basis, these modified biopolymers are manufactured and used extensively. Rigidity is one characteristic that makes using a variety of biodegradable polymers for particular applications challenging, as is the case with TPS, various Polyhydroxyalkanoates (PHAs), and Polylactic Acid (PLA) (thermoplastic starch). Because of this, the reduction in rigidity of these three families of biodegradable polymers has been studied using a variety of techniques, such as the use of plasticizers to make the polymers more flexible and make it easier to process them using transformation techniques like extrusion and injection moulding. To avoid preventing the final polymer from degrading, it is desired that these plasticizers are renewable in nature and biodegradable, which is why several vegetable oils, like maize oil, soybean oil, and linseed oil, are employed. Another tactic is to create blends of these polymers with other, more flexible ones, such as PBS or bioPBS, which have low Young's moduli ranging from 320 MPa to 645 MPa. PBS is a biodegradable polymer of petrochemical origin, while bioPBS is the same polymer whose synthetic components are renewable. For these reasons, binary biopolymer blends were created in this work to enhance the ductile characteristics of those that behave more rigidly. In order to lessen the stiffness and brittleness of the three polymers, Polybutylene Succinate (PBS) was mixed with Polylactic Acid (PLA), Polyhydroxyalkanoate (PHA), and Thermoplastic Starch (TPS). The mixes' compatibility and resultant mechanical characteristics were investigated. As a further method of enhancing PLA's flexibility, the usage of mixes of PLA with an additive based on Ethylene-Vinyl Acetate (EVA) was examined. Numerous techniques, including Ring Opening Polymerization (ROP), chemo-enzymatic approaches,

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photo-initiated radical polymerization, enzymatic polymerization, and cationic, anionic, enzymatic, coordinative, and radical ring opening polymerization, can be used to create biodegradable polymers. Biodegradable polymers are defined as "polymers that breakdown or decompose under chemical, physical, and biological interactions with microorganisms from the environment, such as bacteria, fungi, and algae" by the American Society for Testing and Materials (ASTM). Without creating hazardous waste, they decompose into their natural constituents, including CO_2, water, and biomass. Based on their level of biodegradability and renewability, biodegradable polymers may be categorised. Due to its characteristics like degradability, eco-friendliness, sustainability, and non-toxicity, biodegradable polymers are in high demand. Since green/biodegradable polymers are widely utilised in a variety of industries, including medicine, agriculture, transportation, packaging, electronics, health care, and pharmacy, their use has expanded over the past 10 years. Many biodegradable polymers were created during this time period, and these materials found use in novel biomedical approaches such controlled drug delivery, regenerative medicine, biological nanotechnology, treatment, and tissue engineering. In this study, we mainly concentrated on the numerous biodegradable polymer production techniques and their applications in diverse domains. Biodegradable polymers have a plethora of different uses.

CONCLUSION

Each biodegradable polymer will have a unique synthesis process depending on the area in which it is used. The most important attribute of a biodegradable polymer is its ability to degrade; hence it is important to consider its degradation pathways when creating a biodegradable polymer for a particular application. No of the mode of deterioration, there shouldn't be any harmful by products left over after decomposition. Each biodegradable polymer has unique features that may be used in a variety of contexts. The syntheses and their applications have been shown in tabular form. PLA may be used for food packaging because of its qualities of heat resistance, high stability, and visual transparency. Injectable implants employ PCL, polyester that may be broken down by ester hydrolysis under physiological circumstances.

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CONFLICT OF INTEREST

There are no conflicts of interest.