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Enzymatic Polymer Synthesis: A Potential for Green Polymer Chemistry

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Abstract

From synthesis to materials and applications, this thematic issue covers a wide range of current polymer chemistry topics. The use of click photochemistry in the synthesis of polymers and organic molecules, as well as the combination of polymers and supramolecular chemistry for the assembly of polymer fibers and the production of well-defined polysaccharides, are examples of synthetic methods. Cryogels, reinforced hydrogels, and 3D-printed poly(caprolactone) biomaterials are among the materials discussed. This thematic issue also discusses the properties of thermoresponsive and self-healing materials. Finally, the synthesis of drug carriers made possible by polymerization-induced self-assembly is discussed. The issue also demonstrates the multidisciplinary nature of polymer science, as evidenced by the use of supramolecular motifs, organic coupling reactions, and photocatalysis in the creation of new polymer materials for specific applications.

Keywords: Polymers • Green Chemistry • Macromolecules

Introduction

The goal of the Frontiers in Chemistry section on Polymer Chemistry was to document, promote, and document the most recent developments in the field of macromolecular science. The significant impact that this field and the outcomes of its research efforts have had and continue to have on our day-to-day lives justified the opening of a section solely devoted to this topic. "Despite the astonishing achievements we have witnessed along the years, many exciting challenges remain to be faced, including green polymer chemistry, environmental pollution issues, polymers for the storage and delivery of energy, and polymers for the human health," the inaugural article stated. We can say that the section has accomplished the tasks for which it was created seven years after its launch. It was influenced by the journal platform's significant bibliometric figures, the readership's acceptance as measured by the limited number of articles included, and, of course, the Editor's own preferences, for which he is solely responsible. The work presented here demonstrates significant advancements in theory, experiment, and methodology applied to cutting-edge research challenges, as well as the wide range of activities covered in the section [1,2].

Monomer design principles that provide spatiotemporal control over the polymerization of a polymer are discussed in this account, as are the strategies that have made it possible for synthetic polymer chemistry to be carried out within cells (including the membrane). We begin by providing a chemical description of each major cellular compartment because reaction considerations like monomer concentration, polymer growth dynamics, and reactivities are intertwined with the subcellular environment and transport processes. As a result, the kind of polymer chemistry that can be done will be limited by the conditions in each compartment. In the context of scaffold design, the polymerization mechanism, and activation, the concepts of covalent and supramolecular polymerization are examined separately.

Methods

The formation of platinum black is an important process in the catalytic system when platinum complexes are used. Its formation and impact on catalytic activity were explained in. It was demonstrated that this reaction is not catalyzed by colloidal platinum. According to previous research, the hydrosilylation process begins with the formation of platinum colloids. It is now abundantly clear that the reaction's final stage is colloid formation. During hydrosilylation, X-ray absorption fine structure (EXAFS) analysis has revealed the presence of molecular compounds. After solutions from several reactions involving platinum, a Si–H compound, and either poorly coordinating olefins or no olefin are evaporated, transmission electron microscopy (TEM) allows for the observation of colloidal platinum. However, the reaction product between platinum and a Si–H-containing compound did not always result in colloidal platinum species when silicon-vinyl-containing species were present; Additionally, a TEM analysis revealed that the crystalline substance was not metallic platinum crystallites [3].

Numerous factors clearly affect the DESs' physicochemical properties, the most significant of which appear to be the nature of both the HBA and HBD, their molar ratio, temperature, and water content. As a result, deep eutectic solvents are adaptable to specific applications. Due to the necessity of accurately utilizing the data in a variety of industrial applications, extensive research has been conducted on the physicochemical properties of DESs. The freezing point, density, viscosity, surface tension, conductivity, thermal stability, polarity, and acidity of DESs are among their most important characteristics. We attempted to describe some systems and their chemical and physical properties using literary sources. Sadly, these systems are not characterized in terms of all of these properties in the majority of published works.

Discussion

The sharp freezing point for crystalline compounds, or the glass transition temperature in the case of amorphous compounds, is absent from the majority of published papers, and the papers focus on the practical applicability of DESs rather than their in-depth theoretical investigation. In addition, the literature rarely (if ever) discusses the interrelationships of the aforementioned properties, such as viscosity-density dependences, other than the temperature dependences of conductivity, density, and viscosity [4].

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Particles of cellulose with a minimum dimension of less than 100 nanometers make up nanocellulose. This term generally refers to a variety of cellulosic materials, including cellulose nanocrystals (CNC), cellulose nanofibrils (CNF), microfibrillated cellulose (MFC), carboxymethylated cellulose (CMC), microcrystalline cellulose (MCC), cellulose filaments (CF), and cellulose whiskers. Other examples include cellulose nanocrystals (CNF). While bleached pulps, cellulose fibers from cotton, hemp, wheat straw, sisal, and nanocellulose are all sources of lignocellulosic material, wood pulp remains the primary one. There are two main ways to prepare it [5].

Conclusion

Acid hydrolysis, a chemical process that produces nanoparticles that are shorter (102-103 nm) and highly crystalline and rigid, is one of them. The other is a mechanical process like grinding, homogenizing, or micro fluidizing. Even though a lot of papers are looking into nanocellulose, very few of them mention the actual or potential use of DESs in the process of making nanocellulose. This piece attempts to fill the void.

Acknowledgement

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Conflict of Interest

None.

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