Biopolymers Research

Luke, Biopolymers Res 2023, 7:2

Mini Review Open Access

Composite Materials Based of Biopolymers are Produced Using Ionic Liquids

Suzanne Luke*

Department of Biological Engineering, South Korea

Abstract

Due to their intrinsic biocompatibility and biodegradability, biopolymer-based composite materials have a wide range of potential applications in the biomedical, pharmaceutical, environmental, bio-catalytic, and bio-electronic domains. Ionic liquids can be used as solvents to construct biopolymers such proteins and polysaccharides into a variety of morphologies, including moulded objects, films, fibres, and beads. The procedures for creating biopolymer-based composite materials by employing ionic liquids are outlined in this article. Ionic liquids are used to dissolve the biopolymer, an anti-solvent is used to regenerate the biopolymer, forms are formed, and the regenerated biopolymer is dried. The fabrication and use of composite materials based on biopolymer blends that contain two or more biopolymers are specifically discussed.

Keywords: Biopolymer; Blend; Composite; Gel; Ionic liquid

Introduction

The phrase “liquid salts” refers to ionic liquids (ILs), which are made completely of ions. The majority of these substances have been extensively used as a potential replacement for poisonous, risky, volatile, and extremely flammable organic solvents since they are liquids at ambient or well below ambient temperature. The remarkable thermal and chemical stability, extremely low vapour pressure, high solvation interactions with inorganic and organic compounds, broad electrochemical window, and sharp ionic conductivity of ILs, among other distinctive and alluring physicochemical characteristics, make ILs promising candidates for the replacement of volatile organic compounds (VOCs) for polysaccharide dissolution and modification. ILs has been recognised as “designer solvents” because the right anions and cations may be used to modify their characteristics. The application of ILs as ecologically friendly dissolving medium for lignocellulose and diverse biopolymers for the creation of various composite products has been sparked by the combination of all these special qualities [1-5].

Plastics made from petroleum have become a common part of daily life because they have the potential to replace many traditional materials in a variety of applications. High-end applications like vehicles, aeroplanes, and medicine are increasingly using fibre-reinforced polymer composites. In addition to this financial area, the majority of petroleum-based materials create an unsustainable environment. Using bio-based materials is a different technique to create environmentally friendly products. Bio-based materials are those whose constituent parts come from substances obtained from living things. “Green composites” are biopolymers reinforced by natural fibres. It is a biopolymer composite that degrades under the influence of the environment, including air, light, heat, and microorganisms. Natural fibres are more appealing than synthetic fibres even if they have lower stiffness and strength. Natural fibres are superior since they are easily accessible, flammable, biodegradable, and non-toxic. However, natural fibres’ high moisture absorption, low processing temperature, and general quality fluctuation have a negative impact on how they are used. Numerous studies have been published on functionalizing natural fibres in order to produce high-performance products from natural fibre-reinforced biopolymer composites. In a biopolymer composite, the reinforcement fibre dictates the stiffness and strength of the composite, while the biopolymer matrix primarily controls its structure, environmental tolerance, and durability. Biopolymer composites’ potential for expansion on global markets is ensured by their innovative, value-added applications. Environmentally friendly composite product development efforts have led to some significant global applications and are still going strong. The manufacture, processing, and use of biodegradable composites made from polymers like cellulose, starch, polylactic acid (PLA), polyhydroxyalkanoate (PHA), etc.

Discussion

Due to their potential use as a dielectric material in various electronic devices such microchips, transformers, and circuit boards, there has been an increase in interest in researching the dielectric behaviour of biopolymer composites in recent years. Additionally, conducting electroactive polymer composites have been researched for a variety of possible uses, including biomedical, flexible electrodes, display technology, biosensors, and tissue engineering cells. This chapter describes the creation of several biopolymer composites as well as their dielectric behaviour. These biopolymer composites typically include carbon-based nanofillers such carbon nanotubes, graphene, and graphene oxide (GO), as well as nanoscale metal nanoparticles.

The properties of individual filaments and their interconnections influence the reaction at a macroscopic level, but the mechanical behaviour of biopolymer networks is mostly determined at a microstructural level. Experimentally, these networks exhibit phenomena like viscoelasticity and strain-hardening followed by strain-softening, which are frequently brought on by microstructural changes (such filament sliding, rupture, and cross-link debonding). Additionally, composite structures with fundamentally differing mechanical characteristics from the individual networks can be created. To capture these effects, we provide a constitutive model in this research that is

***Corresponding author:** Suzanne Luke, Department of Biological Engineering, South Korea, E-mail: lukesuzzane@rediff.com

Received: 03-Apr-2023, Manuscript No: bsh-23-96528; **Editor assigned:** 06-Apr-2023, Pre-QC No: bsh-23-96528 (PQ); **Reviewed:** 20-Apr-2023, QC No: bsh-23-96528; **Revised:** 22-Apr-2023, Manuscript No: bsh-23-96528 (R); **Published:** 28-Apr-2023, DOI: 10.4172/bsh.1000147

Citation: Luke S (2023) Composite Materials Based of Biopolymers are Produced Using Ionic Liquids. Biopolymers Res 7: 147.

Citation: Luke S (2023) Composite Materials Based of Biopolymers are Produced Using Ionic Liquids. Biopolymers Res 7: 147.

presented in a continuum framework. The formulation of evolution laws for dissipative effects that are thermodynamically coherent is done with great care. This model is based on a strain energy function that is divided into an isochoric and a volumetric part and incorporates potential anisotropic network features. Numerical integration over the unit sphere is used to generalise to three dimensions. According to model predictions, the constitutive model does a good job of foretelling the elastic and viscoelastic response of biological networks, as well as, to a certain extent, composite structures [6-10].

The chemical makeup of the native bone extracellular matrix, which is made up of inorganic minerals and organic collagen, can be mimicked by combining biopolymer and bioceramic. However, the incomplete development of a bioceramic/biopolymer composite scaffold for bone regeneration application is hampered by the poor interfacial compatibility between organic biopolymer and inorganic bioceramic. Due to the two distinct functional groups in its structure, coupling agents have been extensively employed to create a "molecular bridge" at the interface between biopolymer and bioceramic. The first are specific functional groups that can adsorb on the surface of bioceramics to produce a strong binding, and the second are organophilic functional groups that can interact with polymer molecules. As a result, the mechanical properties of the composite scaffold can be improved by increasing the efficiency of stress transmission between biopolymer and bioceramic. This work focused on discussing the interfacial reaction mechanisms under the influence of coupling agents, specifically silane coupling agents, as well as the interfacial characteristics between bioceramic and biopolymer and approaches to optimise interface bonding. Additionally, a thorough summary of the bioceramic/biopolymer composite scaffold's mechanical characteristics, in vitro and in vivo biological characteristics, and coupling agent modification was provided.

Conclusion

Large intrinsic forces are generated by contractile muscle fibres during waves of contraction and relaxation. Their cytoplasmic organelles, such as the mitochondria, sarcoplasmic reticulum, and various nuclei, are directly subjected to these forces. An intricate network of organised microtubules (MT) mixed with Spectrin-Repeat-Containing Proteins (SRCPs) is thought to be one of the main structural components that protects muscle organelles and keeps them in their proper positions during muscle contraction, according to data from our study of Drosophila larval somatic muscle fibres. The SRCPs Nesprin and Spectraplakin form semiflexible filamentous biopolymer networks, giving nuclei the elasticity necessary to withstand the contractile cytoplasmic stresses produced by the muscle, in contrast to the perinuclear MT network, which gives the myonucleus structural rigidity. Numerous structural proteins contain spectrin repeats, which can unfold under tension and are susceptible to mechanical forces inside the cell. In order to balance the fluctuating cellular stresses generated during muscular contraction/relaxation waves and safeguard myonuclei, this special composite scaffold combines stiffness and resilience. We propose that nuclear protection and appropriate function in muscle fibres depend on the elastic characteristics of SRCPs.

References

1. Khalidy R, Santos RM (2021) The fate of atmospheric carbon sequestrated through weathering in mine tailings. Miner Eng 163: 106767.
2. Goglio P, Williams AG, Balta-Ozkan N, Harris NR, Williamson P, et al. (2020) Advances and challenges of life cycle assessment (LCA) of greenhouse gas removal technologies to fight climate changes. J Clean Prod 244: 118896.
3. Park YC, Bedouelle H (1998) Dimeric tyrosyl-tRNA synthetase from Bacillus stearothermophilus unfolds through a monomeric intermediate. A quantitative analysis under equilibrium conditions.The J Biol Chem 273:18052-18059.
4. Bustreo C, Giuliani U, Maggio D, Zollino G (2019) How fusion power can contribute to a fully decarbonized European power mix after 2050. Fusion Eng Des 146: 2189-2193.
5. Lezaun J (2021) Hugging the shore: tackling marine carbon dioxide removal as a local governance problem. Front Climate 3: 684063.
6. Bedouelle H (2016) Principles and equations for measuring and interpreting protein stability: From monomer to tetramer. Biochimie 121:29-37.
7. Lockley A, Mi Z, Coffman DM (2019) Geoengineering and the blockchain: coordinating carbon dioxide removal and solar radiation management to tackle future emissions. Front Eng Manag 6: 38-51.
8. Ould-Abeih MB, Petit-Topin I, Zidane N, Baron B, Bedouelle H (2012) Multiple folding states and disorder of ribosomal protein SA, a membrane receptor for laminin, anticarcinogens, and pathogens Biochemistry. 51:4807-4821.
9. Taylor G (2003) The phase problem. Acta Cryst D 59:1881-1890.
10. Monsellier E, Bedouelle H (2005) Quantitative measurement of protein stability from unfolding equilibria monitored with the fluorescence maximum wavelength. Protein Eng Des Sel 18:445-456.