

# Biopolymers-Applications in Various Fields: A Mini Review

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## Abstract

Biopolymers are polymeric biomolecules that contain monomeric units which are covalently bonded to form a larger molecule. Biopolymers in nature are produced by various microorganisms and plants which require specific nutrients with a controlled environmental conditions. Biopolymers along with nanotechnology have found many applications in various fields which includes water treatment, energy sector, food industry, biomedical, photonic applications etc. Applications of biopolymers in various fields, especially in the field of green nanotechnology, biomedical and pharmaceutical industry etc., and its various characterization techniques were discussed in this review article.

**Keywords:** Biopolymers; Green nanotechnology; Pharmaceutical industry; Biocompatibility; Nanofillers

## Introduction

The biopolymers are natural, and it has produced through various living organisms, which consists of monomeric units that form bigger molecules, polysaccharides (carbohydrates), polypeptides (proteins) and polynucleotides (DNA, RNA). Biopolymers that have included are suberin and lignin (complex polyphenolic polymers), natural rubbers (isoprene), cutan and cutin (fatty acids) and melanin etc. It can be classified as biodetergent, bioplastics, bioadhesive, biosurfactant, bioflocculant [1].

## Biopolymers with Different Characterization Techniques

It is characterized mainly for two purposes viz; processing development parameters, characteristics of end use performance determinations. Fourier Transform Infrared Spectroscopy (FTIR) to examine the interactions of different functional groups present in biopolymers, hydrogen bonding interactions, amide linkage, effortlessly detected through spectral analyzing [2]. Amongst different techniques, attenuated total reflection (ATR) with variety of sample device based upon the Fourier transform infrared (ATR-FTIR) spectroscopy was measured as an impending one. It is the smallest sample preparation that requires and permits regular analysis at mutually in the field environments and laboratories, and it is uncomplicated to the function. Visible and near-infrared (VIS-NIR) spectroscopy is a glowing recognized with different for measuring constituent of biological materials [3]. X-ray diffraction (XRD) techniques were productively used to learn biopolymers crystallinity, NMR spectroscopy for molecular dynamics of water adsorbed on surfaces of biopolymers and biopolymers functional groups straightforwardly are indomitable through NMR technique [4]. The time relaxation, temperature and magnetic field has proved the constructive resource of information in phase change, solubility, molecular structure, conformational exchange, and biopolymers diffusion. Thermal analysis (TA) method, an essential methodical technique is used for polymers characterization which provides an appropriate in sequence concerning of chemical stability, thermal, phase transition kinetics, temperatures, rheology, and polymers molecular relaxation times. Scanning Kelvin Probe Microscopy (SKPM) is used extremely for strong implement in materials science and its surface mapping of the electrostatic potential [5].

## Biopolymers in Green Nanotechnology

Nanosized derivatives of polysaccharides like cellulose and starch synthesized in immensity were used for bio nano composites developments. The polymeric composite materials are packed with the nano-sized inflexible particles, nanomaterials are not solitary comprise with bimetallic, metallic and metal oxides. Biopolymers like chitosan and starch have played a major role of stabilizers for the silver nanoparticles [6]. Starch, for occurrence, in aqueous solution adopts right-handed helical conformation; in widespread number of OH groups can assist the metal ions complexation of molecular matrix [7]. Water soluble starch capped nanoparticles have proved the resourceful for non-cytotoxic bactericidal agents and the nanomolar concentrations. Biopolymers are also talented as biocompatible carrier of nanoparticles for the devastation of cancer/tumor cells.

## Biopolymers in Biomedical and Pharmaceutical Industry

Lively and contemporary covering biomaterials enclose with natural substances were plentifully found in nature [8]. It's mainly based on polysaccharides, among that, alginates applications are in biomedicine, food sector, packaging, and water purification [9], encapsulation, drug release controlled, tissue engineering, scaffolds in ligaments and dentistry preparation of forms release calcium salt (Figure 1).



**Figure 1:** Schematic representation of biopolymers for various applications [10].

## Conclusion

In summary, biopolymers have found in variety of applications, however its application is limited to the constraint of its usage [10]. By incorporating with various nanofillers, these biopolymers can enhance and improve its mechanical and barrier properties for various applications. Various biopolymers were produced using the bacteria under limiting conditions to store their renewable energy resources. The biocompatibility along with the biodegradability of the materials will encourage the use of these biopolymers in our day-to-day applications. Increasing the awareness towards for the sustainable development has caused various researchers to think about natural and biodegradable polymers on replacing with synthetic polymers for various applications.

## References

1. Stupp SI, Braun PV (1997) Role of proteins in microstructural control: Biomaterials, ceramics & semiconductors. *Science* 277: 1242.
2. Theophile T (2015) Infrared spectroscopy-Anharmonicity of biomolecules, crosslinking of biopolymers, food quality and medical applications. *InTech*. pp. 172.
3. Bista RK, Brucha RF, Covington AM (2011) Infrared spectroscopic study of thermotropic phase behavior of newly developed synthetic biopolymers. *Spectrochim Acta Part A* 81(1): 583-589.
4. Blicharska B, Peemoeller H, Witek M (2010) Hydration water dynamics in biopolymers from NMR relaxation in the rotating frame. *J Magn Reson* 207(2): 287-293.
5. Kitamura S, Suzuki K, Iwatsuki M (1998) Observation of silicon surfaces using ultrahigh vacuum noncontact atomic force microscope. *Jpn J Appl Phys* 37(6S): 765-3768.
6. Merga G, Wilson R, Lynn G, Milosavljevic BH, Meisel DJ (2007) Redox catalysis on naked silver nanoparticles. *Phys Chem C* 111(33): 12220-12226.
7. Raveendran P, Fu J, Wallen SLJ (2003) Completely green synthesis and stabilization of metal nanoparticles. *Am Chem Soc* 125(46): 13940-13941.
8. Thakur S, Chaudhary J, Sharma B, Verma A, Tamulevicius S, et al. (2018) Sustainability of bioplastics: Opportunities and challenges. *Curr Opin Green Sustain Chem* 13: 68-75.
9. Song W, Su X, Gregory DA, Li W, Cai Z, et al. (2018) Magnetic alginate/chitosan nanoparticles for targeted delivery of curcumin into human breast cancer cells. *Nanomaterials* 8(11): 907.
10. Rui X, Jingyi L, Saewon K, Ye C, Singamaneni S, et al. (2020) Biopolymeric photonic structures: Design, fabrication, and emerging applications. *Chem Soc Rev* 49(3): 983-1031.

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