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Perspective

A Note on Biomedical Biopolymers

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PERSPECTIVE

Biopolymers offer many uses in pharmaceutical and medical applications. Materials that can be used in biomedical applications such as wound healing, drug delivery, and tissue engineering are complex with biocompatibility, biodegradation into non-toxic products, low antigenicity, high bioactivity, appropriate porosity, and capacity. It must have certain properties, such as processability into a good shape, to support cell growth and proliferation, proper mechanical properties, and retention of mechanical strength. This paper provides an overview of biodegradable biopolymers, focusing on their potential in biomedical applications. The most commonly used and most abundantly available biopolymers are described with a focus on properties related to biomedical importance.

Biopolymers are a type of macromolecule produced by living organisms. Therefore, they are macromolecular biomolecules. This includes many species of plants such as corn and soybeans, but can also occur from different species of trees and some bacteria. Biopolymers can be classified as follows. Classified by the monomer unit used and the structure of the biopolymer formed. Polynucleotide, i.e., DNA and RNA are long polymers consisting of 13 or more nucleotide monomers. A polypeptide that is a short polymer of amino acids. Polysaccharides are linearly linked, high molecular weight carbohydrate structures. According to its origin, it can be classified as follows. Polyester: Polyhydroxy alkanoate, polylactic acid. Proteins: silk, collagen/gelatin, elastin, resilin, adhesives, polyamino acids, soybeans, zein, wheat gluten, casein, serum albumin. Polysaccharides (bacteria): xanthan, dextran, gellan, levan, curdlan, polygalactosamine, cellulose. Polysaccharides (mushrooms): pullulan, ercinan, yeast glucan. Polysaccharides: starch, cellulose, agar, alginate, carrageenan, pectin, conjang, various gums. Polysaccharides (animals): chitin, hyaluronic acid. Lipids/surfactants: acetoglycerides, waxes, emulsions. Polyphenols: lignin, tannins, humic acid. Special Polymers: Synthetic polymers from shellac, poly-gamma-glutamic acid, natural rubber, natural fats and oils.

Collagen Discovered by Payen in 1838, collagen is the major structural material in vertebrates, the most abundant mammalian protein, and accounts for about 20-30% of systemic protein. Collagen is usually synthesized by fibroblasts derived from pluripotent adventitial cells or reticular cells. The basic collagen molecule is rod-shaped, about 3000 Å long, 15 Å wide and weighs about 300 kDa. Gelatin is a water-soluble proteinaceous substance produced by the partial hydrolysis of collagen from animal skin, white connective tissue, and bone, resulting in the destruction of the tertiary, secondary, and to some extent primary structure of natural collagen. Gelatin, unlike other hydrophilic colloids, is mostly polysaccharides, but gelatin is a digestible protein that contains all the essential amino acids except tryptophan. Gelatin can be made from a variety of collagen sources. Beef bones, skins, pig skins and fish are the main commercial sources. Due to its surface-active properties, gelatin is used as a foaming agent, emulsifier, and wetting agent in food, pharmaceutical, medical, and technical applications.

Chitosan is a derivative of the natural polysaccharide chitin. Chitin was first isolated and characterized from the fungus by the French chemist Henri Braconault in 1811. It is the second most common biopolymer in the world. With the exception of cellulose, chitin is the main component of the exoskeleton of crustaceans and insects, and is also found in the cell walls of nematodes, yeasts and fungi, making it the most abundant polysaccharide in nature. Chitosan has excellent biocompatibility. High bioactivity; biodegradability; targeted permeability; polyelectrolyte effect; antibacterial activity; ability to form gels and films; ability to chelate and absorb.

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