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# Biopolymers and their applications in chemistry

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**Abstract**
Biopolymers have wide applications in all areas of chemistry such as nano-polymers, biopolymers, and polymers as drug carriers. When individual organic molecules are linked together in long chains, polymers that have completely different properties compared to smaller starting materials are formed. The most important biopolymers are DNA, RNA, proteins and sugars. The basic building blocks of these molecules are respectively nucleotides, amino acids and carbohydrates (sugars). These compounds have many well-established industrial applications, but new areas of application such as pharmaceuticals and pharmaceuticals are receiving increasing interest and importance. Understanding the chemical and physical properties of polymers allows us to produce a variety of materials precisely tailored to personal and industrial needs. If we look around we will notice a large number of plastic, rubber and nylon items, made of different types of polymers. Polymers are everywhere.

**Keywords:** polymer, biochemical polymer, drugs

## Introduction

Biopolymers have a variety of structural properties that make them useful for different applications. In many cases, such as medical applications, biocompatibility is required for polymers however, mechanical strength, flexibility, stiffness, structural stability and biodegradability may also be required. Since ancient times, people have used natural raw materials to produce things and materials that have greatly improved their quality of life. But during the nineteenth century important events occurred, the effects of which are well known to us. These events were the starting point for a great revolution. This revolution has transformed us from consumers of natural raw materials to producers of new materials with great qualities. These materials are called polymers. In 1844, the American inventor Charles Goodyear (after whom the famous tire company Goodyear was named) patented the reaction between natural rubber and sulfur in a process called vulcanization. This process greatly changed the properties of natural rubber, resulting in a flexible, strong and stable rubber. Despite the industrial importance of vulcanization, Goodyear did not know what polymers were and did not really understand why the properties of rubber had changed, in fact no one at that time was able to define what a polymer was and what its properties were. The term polymer was first coined by the Swedish chemist Jans Bersilius, who is considered one of the predecessors of modern chemistry, in 1833. German chemist Hermann Staudinger, who won the Nobel Prize in 1953 for his great contribution to understanding the properties of polymers, offered a more precise interpretation of the term. What we know today about the precise definition of polymers, their properties, and how to control them is thanks to the work of Staudinger and his successors in the same field.

## Importance of Biopolymers

Biopolymers were first used as additives to stabilize trench walls during excavation. With the advances made through its use, the add-on application has been developed into a new technology. The procedure shows similar features to conventional trenching, the main difference being that a biopolymer (such as guar gum) is added to the stabilization suspension. The reactive material can then be placed in the trench using tremie tubes. In the construction of an experimental reactive barrier of 7.6 m in length and 10.4 m in depth, a 90-10% iron/sand mixture was placed in the trench using a trench tube . Care was taken to minimize separation and contact between the iron/sand mixture and the biopolymer. After placement, a high pH enzyme breaker was added to the liquid to break up the biopolymer remaining in the trench, and the slurry was placed over the bulkhead to prevent contact with air. For many biopolymers, their importance to the organism lies in the way they interact with other polymers. In a few cases covalent bonds exist between polymers, for example: in the proteoglycans of animal connective tissue, or between lignin and sugars in plant cell walls. However, in many cases the interactions are non-covalent and involve weaker bonds, such as hydrogen, ionic, or hydrophobic bonds. A variety of bio-derived polymers (termed “biopolymers” or “biopolymers”) have been investigated to replace petrochemical-derived polymers in many applications. In general, these polymers have a structural or nutritional role in the organisms that make them. As biopolymers for our use, they have been removed from their biocatalyst organism and purified to evaluate their molecular properties. Biopolymers are polymers produced naturally from living organisms, especially plants. Also called renewable polymers, there are different types of them in nature in all groups of living organisms, that is, they are of renewable origin and are biodegradable in nature. And the expansion of its use will

reduce the negative impacts on the environment compared to other manufactured materials. A polymer consists of long chains of molecules linked together by covalent chemical bonds. This term is applied to plastics or plastics; But it also includes a group of natural or synthetic compounds with multiple and disparate properties, which have a major role in everyday life. Natural polymers such as shellac, amber and natural rubber have been used for centuries, as well as other basic polymers in living organisms such as cellulose, the building block of plants, and products such as wood, paper and natural textiles. While the polymers manufactured include materials such as synthetic rubber, bakelite, a type of hard plastic used in the manufacture of electrical insulators, neoprene (a type of synthetic rubber used in water-resistant products), nylon, polystyrene, polyethylene, polypropylene, and many others. Some of these polymers are produced by bacterial or fungal fermentation of organic substrates and agricultural residues for wide commercial use in many applications, such as food, pharmacy, plastics and agriculture.

**Preparation of Biopolymers**

Biopolymers produced from biomass can be used as an alternative to conventional petroleum-derived plastics. Biopolymers can be extracted from biomass (eg: starch, cellulose, proteins, collagen) produced by fermentation (eg: bacterial cellulose PHA) or produced by polymerization of monomers produced by fermentation (eg: acid (eg: acid ( polylactic) Biopolymers are derived from biological sources such as plants, microbes, animals, agricultural waste and fossils or are chemically synthesized from biological monomer units such as sugars, amino acids, lipids, natural oils and nucleotides These biopolymers include cellulose, starch, chitin, chitosan proteins, peptides, DNA and nucleotides. RNA Compared to synthetic polymers, biopolymers are structurally well defined (lignocelluloses are an exception) and rely on their primary structure of sequential repeating monomer units They are readily available and can be mass-produced and are a sustainable source of non-toxic and biodegradable polymers environmentally friendly and low cost Its vital horizon in agriculture. The people of ancient Mesoamerica began using natural rubber in the form of balls and other objects as early as (1600) BC. Ebonite, or hard rubber, was first discovered in the early 19th century and was the first material to withstand high temperatures. In 1839, Goodyear invented Vulcanized rubber, and the name Goodyear is still popular as the tires we still buy are called after him, and during the first half of the twentieth century, no less than (15) types were made Since then, polymers have become an integral part of commercial products, and the word (plastic) was used for the first time in (1925).

**Polymer Chemistry**

The enormous importance of polymers in our lives cannot be accurately assessed. We all use products made of polymers, and our lives without them would be difficult, uncomfortable and boring. The word "polymer" in Greek means many units (poly = many; mer = unit). In chemistry, the term refers to a long chain, macromolecule, or macromolecule, which is a large molecule made up of repeating units of a particular molecule. This chain, or long molecule, is called a "polymer", and the small molecule that repeats along the chain is called a "monomer" or, as it originally appeared in the Greek language, "monomer" (mono = one). The process of linking monomers to form a polymer is called the "polymerization reaction". We can imagine the polymer as a train consisting of a hundred exactly alike wagons. The single cart is the monomer and the train is the polymer. The wagons must be firmly and firmly attached during the train's travel, to maintain its integrity. Similarly, the polymer can gain stability and strength thanks to the bonding of its monomers with very strong covalent bonds. The name of a polymer is usually determined by the monomer that composes it, with the addition of the prefix "poly". "Polystyrene", for example, is a polymer made of repeating units of the monomer styrene. If the number of monomers is large, the chemical formula of a polymer can be written abbreviated by specifying the number of repeating units.

**Biopolymer properties**

Chemistry is a science of the natural sciences that man has known since ancient times. The applications of chemistry in ancient civilizations were associated with mining, paint industry, medicine, leather tanning, cloth dyeing, and glass industry. The ancient Egyptian, Babylonian and Indian civilizations succeeded in making practical use of chemistry in mining, pottery and dyes, but they did not They develop theoretical knowledge that can be considered science. In this article, we will address one of the most important applications of chemistry in industry, which is polymers, and we will learn about the uses of polymers that play a very important role in many different industries because of their unique properties. In the seventeenth century, with the division of bodies into raw materials as a result of the research of the world “Boyle”, and “Joseph Priestley” learned about oxygen gas, and then the discovery of the formation of the water molecule by “Henry Cavendish”, all the way to “John Dalton” who developed the modern atomic theory Thus began the era of modern chemistry. Chemistry is the science of matter as it is concerned with the study of the properties of matter, its structure, composition, behavior and interactions, and all the variables that occur in it. The science of chemistry is closely related to the rest of the sciences, such as physics, astronomy, geology and biology. In the current era, there are many applications of chemistry in all aspects of life.

**Polymers in the field of industrial chemistry**

Polymers are found in our bodies, in our food and clothing, and in the products we use, and without them, our lives would not be as we know them. Our bodies are made up of important polymers, such as albumins (proteins), sugars and others. But the most important polymer to us, without a doubt, that is in our bodies, is DHA. that. A (DNA) is made of four different monomers called nucleic acids. The four acids make up the codes that are translated into the synovium, which is responsible for triggering the various processes in the body. The qualities of these products are determined by the use of polymers of different types and lengths. Polyethylene is an outstanding example of a synthetic polymer that has changed a lot in our world. This polymer consists of repeating units of an ethylene molecule. This polymer has become one of the central polymers in our lives thanks to its cheap cost, light weight and ability to control its properties by changing the length of its chains. Many products can be prepared from this polymer such as

nylon bags, tubes, plastic toys and bone saplings. The use of polyethylene has opened up a new world of diverse products, both durable and inexpensive, that have changed our lives dramatically. But one of the central problems that has emerged due to its widespread use is the problem of environmental pollution. Natural polymers, and some synthetic polymers, can be completely degraded in nature by bacteria that prevent their accumulation. But the decomposition of polyethylene in nature is a very slow process, due to the strong bonds between its repeating units, which leads to its accumulation and pollution of the environment. Nowadays, awareness of the quality of the environment is increasing. The most effective way to avoid the accumulation of polyethylene is the process of recycling its production. The search for materials with new and diverse qualities, which began in the middle of the nineteenth century, led to a real revolution that began concurrently with the discovery of polymers. Polymers are so popular today that we can find them everywhere, from toys to medicines. Polymers are being studied on a very large scale in academic institutions around the world, in the fields of chemistry, physics and biology. However, the increasing demand for new products led to an increase in the production of polymers from year to year, and this, in turn, led to an exacerbation of environmental pollution. Environmental hazards to organisms that live on land, in seas, in oceans and rivers result from the accumulation of products made of polymers, the use of which greatly contributes to our quality of life. Therefore, we have to think about our future and the future of the wonderful nature around us, and do the recycling of polymer production, in order to continue to benefit from the many advantages that polymers provide us.

**Natural Biopolymers and Synthetic Polymers**

It can be found in their structures. All polymers are made of repeating units called monomers. Biopolymers often have a well-defined structure, although this is not a distinguishing property (eg: lignocellulose): the exact chemical structure and the sequence in which these units are arranged are called basic structures, in the case of proteins. Many biopolymers spontaneously fold into distinct contracting shapes (see also “protein folding”, as well as secondary structure and tertiary structure), which determine biological functions and depend in a complex manner on primary structures. Structural biology is the study of the structural properties of biopolymers. In contrast, most synthetic polymers have simpler and more random (or random) structures. This fact leads to a missing molecular mass distribution in biopolymers. In fact, since their structure is controlled by a template-guided process in most systems in vivo, all biopolymers of a type (eg one specific protein) are all similar: they all contain similar sequences and numbers of monomers and thus all contain the same Bloc. This phenomenon is called mono-diffusion in contrast to the polydispersity encountered in synthetic polymers. Many people know the industrial revolution that began in the nineteenth century, but what many do not know is how polymers affected that revolution until some considered it a revolution in itself. Since the discovery of their applications in the thirties of the last century, these compounds have become representative of the present and the future in the industry with their many applications and uses. They are almost in everything around us. Synthetic polymers are polymers made by man. Polymers are those that consist of repeating structural units known as monomers. Polyethylene is one of the simplest polymers. It contains ethene or ethylene as a monomer unit. While a linear polymer is known as high density polyethylene, many materials contain polymeric on chain-like structures similar to polyethylene, and from earlier we would have realized what a synthetic polymer is. When creating a research on polymers, we find that synthetic polymers are sometimes referred to as plastics, the most famous of which are nylon and polyethylene, the polymers formed by linking monomer units, without any change in the material, are known as additional polymers or also called chain growth polymers. All of these are said to be synthetic polymers. Some of the synthetic polymers that we use in our daily lives include nylon used in fabrics and textiles, Teflon used in non-stick pans, and PVC used in pipes, PET bottles that we use usually consist of a synthetic polymer called PET, plastic caps and kits are made of From synthetic polymers like polyethylene, vehicle tires are made from Buna rubber, but on the other hand, there are also environmental issues that arise from the use of such synthetic polymers as bioplastics and those made from petroleum as they are said to be non-biodegradable.

**Conclusion**

The polymers found naturally in our bodies, or in nature in general, are called "natural polymers". There is another large group of synthetic polymers called "synthetic polymers". This group includes many types of polymers, from which nylon bags, plastic products of all kinds, rubber, kalkar, glues, dyes, paints, coatings and other products are prepared

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