GLOBUS

**Cosmos** Journal of Engineering & Technology
A Refereed Research Journal
Vol 11 / No 2 / Jul-Dec 2021 ISSN: 2231-4210

# A STUDY ON CHEMICAL CONSTITUTION OF POLYMERS

*Soniya
**Dr. Anil Sharma

**Paper Received**: 14.12.2021 / **Paper Accepted**: 12.01.2022 / **Paper Published**: 15.01.2022
**Corresponding Author:** Soniya; doi:10.46360/cosmos.et.620212019

## Abstract

Polymers are lengthy chains of molecules that have qualities that are primarily determined by the chain behavior of the molecules and the nature of their chemical constitution. The distinction between thermoplastics and thermosets is becoming increasingly difficult to make as a result of the development of new materials that can function in settings that are more demanding than those that existed in the past. They include high performance polymers that are more resistant to high temperatures, have greater moduli or strengths, and can be mixed with additives to boost their intrinsic capabilities even further. In addition, high performance polymers can be combined with additives. In the field of molecular engineering, having a grasp of the atomic and molecular construction of polymers provides an insight into how improved materials might be generated. It entails having knowledge of both the molecular arrangement and the conformation of the molecule. The paper deals with the chemical constitution of polymers.

**Keywords:** Chemical, Polymer, Molecules, Complex.

## Introduction

A few number of processes that are carried out in large-scale petrochemical complexes are responsible for the vast majority of the production of polymers from oil and gas feedstocks. Because intermediates and monomers can frequently change into one another, it is possible to balance supply and demand. However, the generation of olefins during the thermal cracking of naphtha varies within rather narrow margins. This means that at medium and high cracking severity, for example, excess quantities of propylene may be created. The most important petrochemical building block for the development of vinyl chain growth polymers is ethylene, and the most important suppliers of aromatic structures inside polymer repeat groups are benzene and para-xylene. The consumption of polymers is continuing to rise, and over the course of the past two decades, there has been a significant expansion in the selection of general-purpose materials as well as specialty polymers. Within each polymer type, the variety of grades that are available to the design engineer has also continued to broaden. This is due to the close control over molecular mass and structure that is available with the most recent polymerization catalysts. Specifically, this control can be found in the latest polymerization catalysts. The process of copolymerization, for instance, is one of the most important ways in which the structure of a material can be altered at the molecular level to generate the end product with the required balance of its physical attributes. It enables $T_g$ and $T_m$ to be changed to match the temperature scale of exposure of the finished product, in addition to altering other attributes like toughness and stiffness. This is possible because it matches the temperature scale of exposure.

When choosing the suitable grade for a certain product, it is frequently necessary to find a middle ground between competing requirements pertaining to the product's properties. However, the effect of processing adds an additional layer of complexity because it has the potential to influence the orientation of the molecules, the crystallization process, and the end properties. In addition, the restrictions of processing can significantly limit the grades that can be properly handled. Therefore, in order to maximize and make the most of the additional design freedom that polymers offer, it is necessary to arrange some sort of balance between designing for function and designing for manufacture.

## Literature Review

Alina (2011) [1] The most recent developments in the field of blending natural and synthetic polymers to create new biomaterials are discussed in this article as a review. Because these materials display advances in qualities that are necessary in the biological area, they have drawn the interest of both the academic community and, for several mixes, the industrial community. In this article, the structure, preparation, and properties of blends of naturally occurring and synthetic polymers are explored in general. Additionally, specific examples are extracted from both published scientific research and practical experience. Collagen, chitosan, elastin, keratin, and silk are some of the most prevalent natural polymers, and they are explored here as potential components of mixes with synthetic polymers. In the realm of biomedicine, olymeric materials are used in a wide variety of applications.

**Research Scholar, Kalinga University, Naya Raipur, Chhattisgarh, India.*
*** Supervisor, Kalinga University, Naya Raipur, Chhattisgarh, India.*

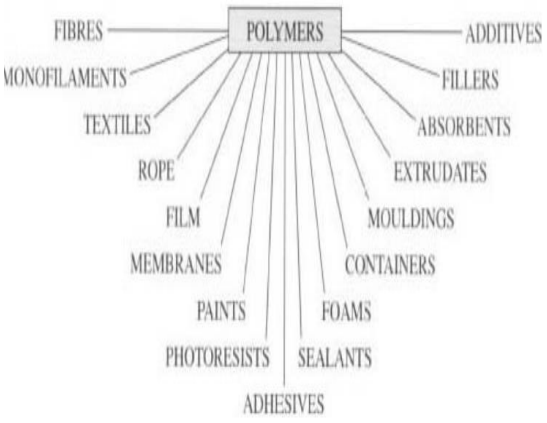
Natural polymers are essential due to their biocompatibility and biodegradability, despite the fact that it is much simpler to employ synthetic polymers in the biomedical area. Combining natural and synthetic polymers is yet another approach to the production of polymeric materials for use in biomedical applications. During the course of the last three decades, there has been a discernible rise in people's interest in newly developed materials that are composed of mixtures of two or more types of polymers. When compared to the properties possessed by single components, the composites that are formed from mixtures of natural and synthetic polymers result in a new category of materials that are more biocompatible and possess superior mechanical qualities. These polymeric substances have also been referred to as bioartificial or biosynthetic materials. The biocompatibility of natural polymers is typically higher than that of synthetic polymers, which might contain a residue of initiators as well as other substances and contaminants that prevent the proliferation of cells. The mechanical qualities and thermal stability of synthetic polymers are much superior to those of numerous naturally occurring polymers. Synthetic polymers can be made in a laboratory. When compared to synthetic polymers, the performance of many naturally occurring polymers is inferior. This is one of the limitations of natural polymers. When compared to natural polymers, synthetic polymers may be processed into a broad variety of shapes, whereas natural polymers can only be formed into a limited number of shapes. This is due to the fact that processing natural polymers at high temperatures can result in the destruction of their original structure. For usage in biomedical applications, newly created polymeric materials that are based on blends of natural polymers and man-made polymers should be biocompatible and, at the same time, offer good thermal and mechanical properties.

Brinson (2008) [10] Polymers can be found in a wide variety of natural substances. In point of fact, the fundamental molecular structure of all plant and animal life is very comparable to that of a man-made polymer. Silk, shellac, bitumen, rubber, and cellulose are examples of natural polymers. Other natural polymers include cellulose. However, the vast majority of polymers and plastics used in engineering design are synthetic, and frequently, chemists or chemical engineers explicitly synthesize or "design" them to fit a particular function. This can be done in a variety of ways. The majority of the time, other types of engineers (mechanical, civil, electrical, etc.) will create engineering components using the materials that are at their disposal; nevertheless, on occasion, they will collaborate directly with chemists or chemical engineers to synthesize a polymer that has specific properties. There are many different engineering polymers, each of which has its own unique set of features. Some of these properties include a high strength or modulus to weight ratio (light weight yet relatively stiff and strong), toughness, resilience, resistance to corrosion, lack of conductivity (heat and electrical), color, transparency, ease of manufacturing, and an affordable price. The long chain molecular structure of polymers is responsible for many of the valuable features that are exclusive to polymers and are a result of this structure. The following chapter will devote considerable attention to addressing these concerns in further detail. In this chapter, we will be focusing on basic characteristics, applications, and providing an introduction to the mechanical behavior, which will include an overview of fundamental principles regarding the time dependent or viscoelastic nature of the material itself. There are a number of different ways to categorize polymers in accordance with their molecular structure. However, there are two primary categories that need to be discussed in this context. The vast majority of polymers can be arranged into one of two basic categories: thermoplastics or thermosets. The bonding between molecular chains is where the two types of materials most fundamentally diverge from one another in terms of their physical properties. Thermoplastics only have secondary connections between chains, whereas thermosets also have primary bonds between chains. Not only are the names related with the chemical structure of each substance, but also with the overall thermal and processing properties of the substances, given that this fundamental change in structure has a significant impact on the material qualities. When compared to thermosetting polymers, thermoplastic polymers are able to be melted and shaped, but thermosetting polymers cannot be melted or shaped in the same way. Sometimes "linear" or "cross-linked" are used to refer to thermoplastic or thermosetting polymers instead of their more common nomenclature. It is important to emphasize that the term "linear" in this context refers to the structure of molecules, not the mechanical (stress-strain) features of the material.

## Study on Behaviour of Polymers

The form or purpose of polymers can also be used to categorize them. For example, certain polymers are used as additives to other bulk materials (like viscosity modifiers in plaster), coatings to products (like paints), film and membranes to fibers (like textiles), and bulk products like pipe, containers, and mouldings. Some of these raw materials are, of course, fabricated into products in their own right, while others are further processed into completed goods. This is not always the case, however, because some polymers used in particular industrial processes serve only as a disposable intermediary. Therefore, photoresists are put to use in the process of creating the circuit patterns on semiconductor

chips by means of controlled degradation; nevertheless, these photoresists do not appear at all in the finished product.




The very earliest polymeric materials to be put to use were from wholly natural sources and required just a minimal amount of alteration before they could be put to productive use. These materials included wood from a wide variety of tree species, fibers that were used to make rope and textile textiles, and amber adhesive that was used to bind stone and metal instruments to wooden handles. Rubber was utilized by the early Americans for a variety of purposes, including the production of containers, shoes, and balls. During the Victorian era, methods were established for processing them to shape and enhancing their characteristics; nevertheless, the first synthetic polymers were not manufactured until the rise of the organic chemical industry. During the Victorian period, methods were developed for processing them to shape and improve their qualities. Hermann Staudinger's discovery in the 1920s that natural rubber and synthetic materials like Bakelite have a chain-like structure was the first step toward understanding the true molecular basis of materials like natural rubber and synthetics like Bakelite. During this time period, the field of polymer chemistry developed, which allowed for the synthesis of monomers and the polymerization of monomers into macromolecular materials in a regulated manner. During this time period, several of the important polymers that are used today were developed, and the 1930s and 1940s saw their commercialization. Materials such as polychloroprene (also known as Neoprene rubber), nylon, polyester (also known as Terylene or Dacron), and polyethylene (also known as Polythene) were among them. Please note that trademarks for polymers are shown as proper names.

## Conclusion

The world of polymers, with its enormous selection of natural and manufactured materials, has an essential role to play in the contemporary fields of research and industry. Polymers, which are big molecules that are formed of repeating subunits known as monomers, may be found practically everywhere in our everyday lives. They are the foundation of a vast number of things, including the plastics that we use to package our food, the materials that are used in medical devices, and the textiles that we use to dress ourselves in. Polymers act as a connection between the natural world, where they are found in abundance in forms such as cellulose, proteins, and DNA, and the industrial world, where they are synthesised and manufactured to satisfy a wide variety of human requirements. In the natural world, polymers are found in abundance in forms such as cellulose, proteins, and DNA. [11]

The field of polymer science is critically important to the process of reducing the environmental impact of industrialization. The investigation of polymers, which are huge molecules that are composed of repeating units, constitutes the central focus of this academic field. These materials provide an important link between the natural world and industrial uses, which paves the way for innovation, sustainability, and forward movement.

Natural polymers, such as cellulose and proteins, have developed in the natural world over the course of millions of years, displaying incredible structural diversity and functional versatility in the process. Not only does an understanding of these natural polymers help us to comprehend the complexity of biological systems, but it also provides inspiration for the design of synthetic polymers with features that may be tuned to specific needs.

Synthetic polymers have brought about a revolution in a number of areas of industry, most notably the packaging and electronics industries. Polymer characteristics can be manipulated by scientists and engineers to satisfy a variety of requirements, including making polymers more durable, increasing their resistance to heat, and making them biocompatible. This resilience has been a driving force behind technological progress, while at the same time increasing environmental concerns due to the permanence of synthetic polymers in ecosystems.

The field of polymer science is currently at the forefront of sustainability efforts, with the goal of closing the gap by inventing polymers that are biodegradable and kind to the environment. These developments have the potential to lessen the negative effects that industrialization has on the environment and to lessen our dependency on plastics made from fossil fuels.

In a nutshell, the field of polymer science fills the role of a conduit by bridging the gap between the inherent qualities of naturally occurring polymers

and the practical applications of synthetic polymers. It is a critical discipline in our effort to bring industry into harmony with nature, since it helps to advance progress while simultaneously supporting practises that are responsible and sustainable. This study endeavour dives into the interesting field of polymer science, with the goal of elucidating the complex qualities and actions that characterise both natural and manmade polymers. It is a voyage that takes us from the organic wonders of nature to the cutting-edge laboratories of industry, where researchers and engineers strive to harness the unique qualities of polymers for a variety of uses. This is a journey that takes us from the organic wonders of nature to the cutting-edge laboratories of industry.

## Conflict of Interest

There is no conflict of interest by the authors in this manuscript.

## References


1. Sionkowska, Alina (2011). Current research on the blends of natural and synthetic polymers as new biomaterials: Review. Progress in Polymer Science, 36(9), 1254-1276.
2. Doyle J.P., Lyons G. & Morris E.R. (2008). New proposals on hyperentanglement of galactomannans: Solution viscosity of fenugreek gum under neutral and alkaline conditions. Food Hydrocol., 23, 1501-1510.
3. Mingyi, Ma & Xie, Ming & Ai, Qing (2021). Numerical simulation on photo-thermal properties of double glazing unit filled with TiN-$Al_2O_3$ binary nanoparticles enhanced phase change material. Sustainable Energy Technologies and Assessments, 48, 101676, 10.1016/j.seta.2021.101676, 2021.
4. Basha, Shaik Shakeer & Dwara, Dr. Sudhir Dawra (2015). Prologue to Second Order Factor Models. Globus An International Journal of Management & IT, 7(1), 61-62, 2015.
5. Singh, Sardar Inderjeet & Singh, Dr. Yashpal (2016). Study of Voltage Mode Technology. Cosmos Journal of Engineering & Technology, 6(2), 1-2.
6. Naruka, Seema and Tomer, Dr. V.K. (2017). A Study on Surge Control and Drainage Management. Cosmos An International Journal of Art & Higher Education, 6(2), 1-4.
7. Tripathi, Praveen Kumar & Kumar, Dr. Sudesh (2017). A Study on Energy-Efficient Aomdv with Fitness Function. Cosmos Journal of Engineering & Technology, 7(1), 1-3,
8. Bhatt, Pran K. and Singh, Dr. R.P. (2018). The Effects of Toxic Agricultural Wastes on the Environment and their Management. Cosmos An International Journal of Art & Higher Education, 7(1), 1-7.
9. Chandramouli B. (2014). Discussion on Static Var Compensator (SVC). Cosmos Journal of Engineering & Technology, 4(2), 1-3.
10. Brinson, Hal F. and Brinson, L.C. (2008). Characteristics, Applications and Properties of Polymers. Polymer Engineering Science and Viscoelasticity, Springer, Boston, MA. https://doi.org/10.1007/978-0-387-73861-1_3
11. Kluge, J.A. and Mauck, R.L. (2011). Synthetic/Biopolymer Nanofibrous Composites as Dynamic Tissue Engineering Scaffolds. Biomedical Applications of Polymeric Nanofibers; Jayakumar, R., Nair, S., Eds.; Advances in Polymer Science; Springer: Berlin/Heidelberg, Germany, 246, 101-130.