

An introduction to polymers; a twentieth century scientific wonder.

The scientific understanding of polymers developed throughout the 20th century and that understanding has now fundamentally changed our lives. Synthetic polymers such as nylon and polyethylene were discovered in the 1930s and their discovery and subsequent understanding has resulted in the appreciation that many biological molecules are also polymers. Some of these biological polymers such as collagen within the skin have a structural role, whilst others, DNA for example are literally the stuff of life.

Long chain polymer molecules are made up from many repeat units of a specific chemical species. The polyethylene repeat unit $[-\text{CH}_2-\text{CH}_2-]$ is one of the chemically most simple polymer repeat units and in order to form a polymer chain there are at least about 100 repeat units and possibly many 1000s of repeat units that go to make a long, thin, generally flexible, reptating (wriggling) polymer chain. The fact that the final molecule is a long chain gives polymers unique characteristics which over the past millions of years, nature has evolved to utilise and in the last century humans have mastered to manufacture and exploit.

Natural polymers such as natural rubber, (polyisoprene) and cellulose, (Polysaccharide) can play a structural role and it is their mechanical properties that make them so important. Polyethylene and many other synthetic polymers also have unique mechanical properties that have resulted in their widespread application. Synthetic polymers can be highly crystalline and ordered or also completely chaotically arranged in random coils. This diversity results in a whole range of properties from the rubber in car tyres to the worlds strongest fibres.

In biology the chemical function of long polymeric chains can play a crucial role to life itself. Genetic information is contained within DNA polymer chains where the chemical sequencing of different chemical repeat units holds the code of human life. Protein polymers can also chemically bond in specific ways in order to perform human and animal life sustaining functions.

The 20th century saw a steady growth in understanding relating to polymers and this has resulted in the discovery of new materials, new technologies and an ever increasing lifespan for humans. This trend is continuing into the 21st century and can be anticipated to have further major impact on our current and future life.