Monomer Encyclopedia Article

Monomer

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Monomer

A monomer (meaning "single member") is any molecule capable of bonding with others of the same kind to form a long chain. Monomers are the single repeating units of any polymer (which means "many members.") For example, styrene is the monomer from which polystyrene polymers are produced and vinyl chloride is the monomer of polyvinyl chloride (or PVC). Other common monomers include methyl methacrylate, adipic acid, and hexamethylenediamine.

Monomers are usually molecules of relatively low molecular weight and simple structure. For a monomer to form a polymer, it must be di-functional in other words it must have at least two reactive sites. Under the proper conditions monomers are highly reactive and they can chemically bond together through a variety of chemical reactions. When reacted in this fashion, monomers form polymers which are used in such products as rubber, finishes, synthetic fibers, and plastics.

One of the most common applications of monomer chemistry is found in plastics. Here the monomers, which are microscopic chemical units in liquid form, combine with one another in a "head to tail" fashion to form long fibers. These long chains of connected monomers are called polymers. Polymers link together in a processes known as "crosslinking" to form rigid networks. To picture this network of polymers, think of a piece of rope which is like a single polymer strand. Two polymer strands which are crosslinked are similar to two parallel strands of rope that are connected with smaller pieces of rope to make a ladder. When several rope ladders are joined together they form a net. The net is stronger and holds it shape better than individual ropes. The same is true when multiple polymer strands interconnect. The average number of polymer chains, in other words the lengths of the resulting polymers, determines the average molecular weight of the polymer. These factors can be controlled by determining the reaction kinetics. This fact is important, because large variations in chain lengths can result in variations in properties. For example, in the case of polyethylene, longer polymer chains result in plastics that are harder and stronger but more difficult to shape. Although polymer chains are typically linear, they may also include side chains which may significantly modify their properties.

Monomers which are occur naturally in biological systems can create biopolymers. For example, plants use monomer based on sugar molecules to create the polymer known as cellulose.