Biodegradable polymers

Biodegradation is the breakdown of polymer by microbial organism such as bacteria, fungi etc. into smaller compounds. The microbial organisms degrade the polymer through metabolic or enzymatic processes. Synthetic plastics are resistant to degradation, and consequently their disposal is fuelling an international drive for the development of biodegradable polymers. A variety of natural, synthetic, and biosynthetic polymers are bio and environmentally degradable.

A polymer based on a C-C backbone tends to resist degradation, whereas heteroatom-containing polymer backbones confer biodegradability. Biodegradability can, therefore, be engineered into polymers by the judicious addition of chemical linkages such as anhydride, ester, or amide bonds, among others. The usual mechanism for degradation is by hydrolysis or enzymatic cleavage of the labile heteroatom bonds, resulting in a scission of the polymer backbone. Macroorganisms can eat and, sometimes, digest polymers, and also initiate a mechanical, chemical, or enzymatic aging.

Biodegradable polymers with hydrolyzable chemical bonds are researched extensively for biomedical, pharmaceutical, agricultural, and packaging applications. In order to be used in medical devices and controlled-drug-release applications, the biodegradable polymer must be biocompatible and meet other criteria to be qualified as biomaterial-processable, sterilizable, and capable of controlled stability or degradation in response to biological conditions.

The chemical nature of the degradation products, rather than of the polymer itself, often critically influences biocompatibility. Poly(esters) based on

polylactide (PLA), polyglycolide (PGA), polycaprolactone (PCL), and their copolymers have been extensively employed as biomaterials. Degradation of these materials yields the corresponding hydroxy acids, making them safe for in vivo use. Other bio- and environmentally degradable polymers include additional poly(ester)s, and natural polymers, particularly, modified poly(saccharide)s, e. g. , starch, cellulose, and chitosan.