# Biopolymers in Drug Delivery

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**Introduction**:

Polymers of natural origin are termed as 'Biopolymers'. These are abundant in nature and are either derived directly from biological systems or chemically synthesized from biological building blocks. The major reason that biopolymers have gained popularity as carriers for drug delivery is that they offer a plethora of advantages over conventional polymers. Biopolymers are non-toxic and biocompatible, thus making them a versatile carrier. They offer the economic advantage as they are relatively cheap. Biopolymers offer environmental advantages as well because they are biodegradable.

**Objectives:**

Polysaccharides are the most frequently used biopolymers e.g. starch, mucilage's, gums, chitosan etc. together with their synthetic and semi-synthetic derivatives. An emerging class of biopolymers is peptides and polypeptides based polymers which have arisen due to the amalgamation of protein engineering and macromolecular self-assembly. Biopolymers find extensive use in formulation of nanoparticles such as liposomes, micelles, dendrimers and hydrogels which mostly have therapeutic or diagnostic applications.

**Results**:

Plant-derived polymers have found specific applications in drug delivery as films, solid monolithic matrix systems, beads, micro particles, implants, nanoparticles, as well as inhalations and injectable systems and viscous liquid formulations. The role of polymeric materials in the above state dosage forms is multifaceted. They function as matrix formers or drug release modifiers, binders, film coating formers, viscosity enhancers, disintegrate, solubilizes, emulsifiers, suspending agents, gelling agents and bio adhesives. Food-grade biopolymers, such as proteins and polysaccharides, are employed to create a diverse range of delivery systems suitable for encapsulating, protecting, and delivering lipophilic functional components, such as ω-3 rich oils, conjugated linoleic acid (CLA), oil-soluble vitamins, flavors, colors, and nutraceuticals

. Use of biopolymers in smart drug delivery is clearly a rapid emerging new technological advancement which depends upon the plethora of therapeutic applications of Nano products to facilitate patient complaints in the healthcare industry. As smart medicine started to garner attention in the pharmaceutical industry the emphasis on advanced and well-characterized bio-Nano technological products grew. The scope of these advanced biopolymers lays in fighting cardiovascular diseases, aging, and diabetes some chronic metabolic syndrome, cancer and several degenerative disorders. Such polymers can be employed to guide the drugs to the target cells and thus reduce the adverse-effects. In addition to being used as carriers for delivery of therapeutic molecules, biopolymers are also being increasingly used in gene therapy and for tissue engineering scaffolds.

**Conclusion:**

Protein-based nanoparticles offer various opportunities for surface modification owing to the presence of functional groups on their surface thereby proving useful in targeting the drug to the site of action. Like proteins, polysaccharides also get digested by a specific enzyme. Circulation time of polysaccharides is more than the synthetic polymers like polyethylene glycol. For tissue engineering silk-based nanoparticles are being exploited. Silk proteins display a huge potential as biomaterials due to the excellent qualities of slow biodegradability, biocompatibility selfassembling property, excellent mechanical property (tensile strength and Young's modulus) and controllable morphology and structure. For gene delivery, the biopolymers can function as not only DNA complexing agents but also as structural scaffolds for tissue engineering application. Combining gene therapy with tissue engineering in one single drug delivery system is a new treatment strategy for regenerative medicine. Another unique approach for drug delivery involves grafting hydrogels onto biomaterials by physical entrapment, physisorption, graft coupling and polymerization. The antibacterial properties of titania nanotubes–titanium (TNT– Ti) samples coated with two biopolymers such as polylactic-co-glycolic acid (PLGA) and chitosan were investigated and compared with bare Ti, bare TNT–Ti, TNT–Ti loaded with gentamicin and d-α-tocopheryl polyethylene glycol 1000 succinate (TPGS)-gentamicin micelles. The combination of gentamicin or TPGS-gentamicin with chitosan packs inside the TNT displayed a significant enhancement of antibacterial activity. Thus it was inferred that they could be used as a potential candidate for biomedical applications, for example, in drug delivery, implant- related infections and osteointegration. For intra-articular delivery was attempted via elastin-like polypeptides (ELPs), which is a biopolymer comprising of repeated unites of pent peptides that undergo phase transition to give rise to aggregates at a temperature above their transition temperature. Chitosan has proven to be a versatile biopolymer for orthopedic engineering. Biopolymers have been extensively investigated for various drug delivery applications and through in-vitro and in-vivo studies have affirmed their potential as drug carriers. However, clinical trials need to be carried out to prove their potential and for these systems to be available commercially.