Glossary of Polymer Terms

Monomer: a molecule (or a small unit) that can be polymerized to form a polymer.

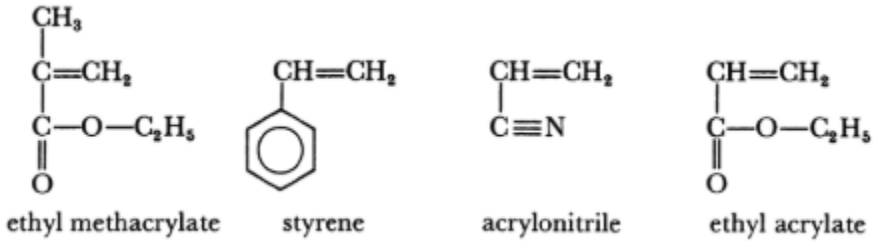


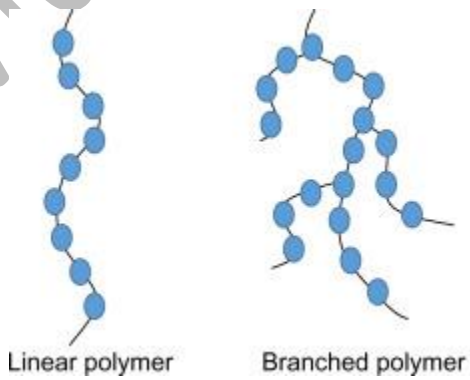
Figure 1. Monomers

Oligomer: a small macromolecule consisting of around 10 to 100 chemically bonded monomer repeat units.

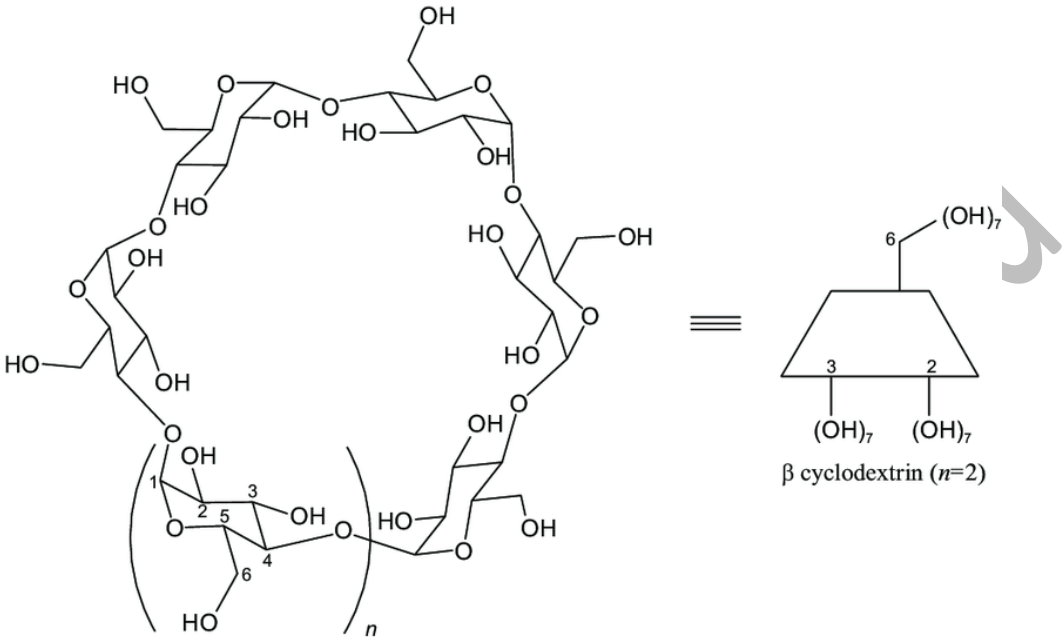
Polymer: a macromolecule consisting of at least around 100 chemically bonded repeat units.

Linear polymer: a polymer that is a single continuous chain of chemically linked monomer repeat units without any branching, e.g., polystyrene.

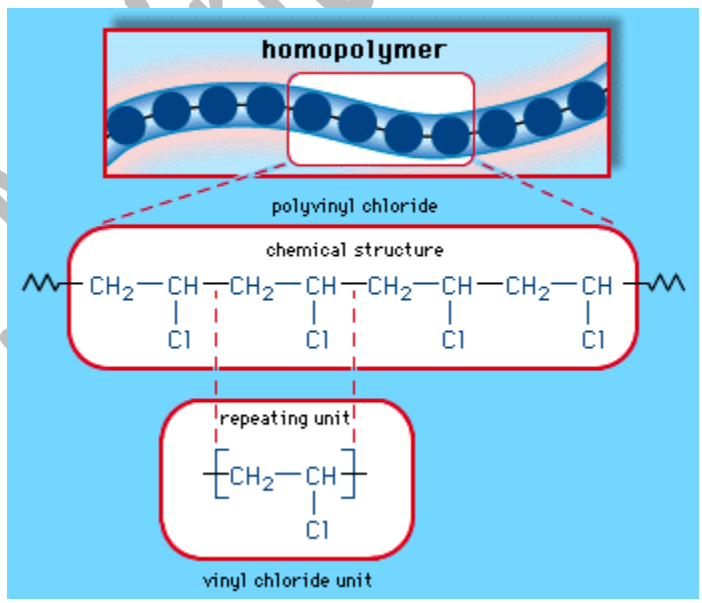
Branched polymer: a polymer molecule comprising a linear polymer backbone with one or more substituent side chains (branches) of similar chemistry, e.g., low density polyethylene



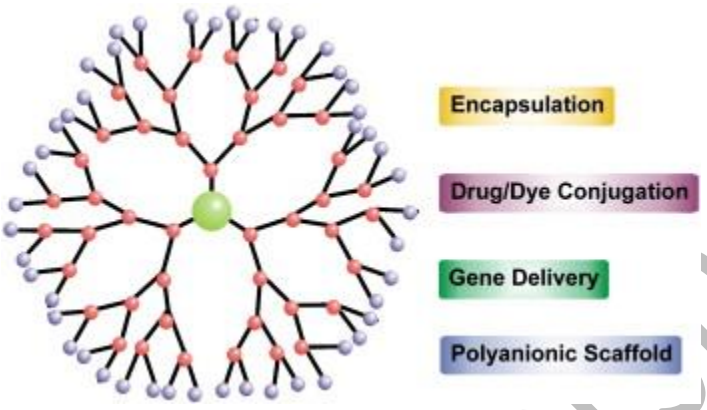
Cyclic polymer (ring polymer): a polymer that is a continuous chain of chemically linked monomer repeat units joined at the ends to form a ring, e.g., **cyclodextrin** (strictly a cyclic oligomer).



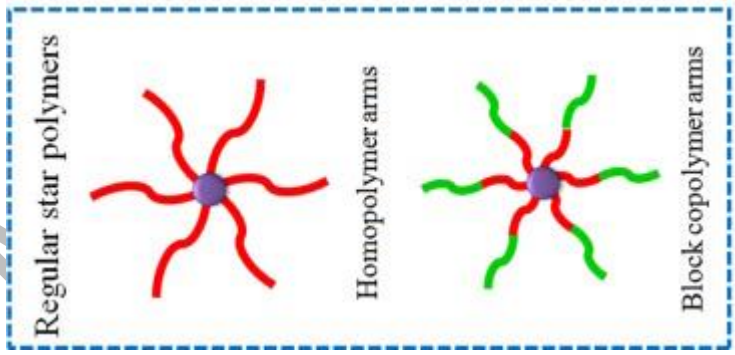
Homopolymer: a polymer made of only one type of monomer repeat unit, e.g., poly(vinyl chloride).



Dendritic polymer: a highly structured **spherical polymer** grown in successive generations from a **central "core" moiety**, in which every monomer in a generation contains **a branch point** and allows the attachment of more than one repeat unit in the next generation, e.g., poly(propylene imine).



Star polymer: a polymer in which three or more linear polymer **chains radiate from a central**, multifunctional moiety to which they are all chemically attached, either by coupling or by being grown from that moiety in the polymerization step.



Copolymer: a polymer comprising more than one type of repeat unit, e.g., poly(ethylene-co-vinyl acetate) (EVA).

Alternating copolymer: a polymer comprising only two types of repeat unit chemically linked in an alternating sequence.

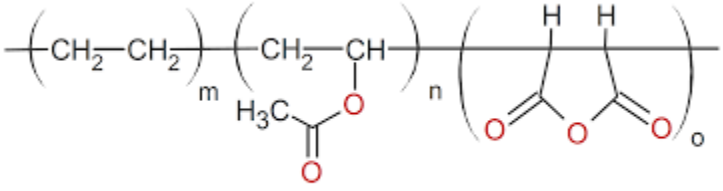
Block copolymer: a polymer comprising more than one type of monomer repeat unit, in which each type of monomer is found in **a homopolymerized "block"** within the polymer chain, e.g., poly(ethyleneoxide-b-propyleneoxide) (PEO-PPO).

Figure 2. Different types of polymers: 1) homopolymer 2) alternating copolymer 3) random copolymer 4) block copolymer 5) graft copolymer.

Graft copolymer: a branched polymer in which the **branches have a different chemistry than the main chain**, e.g., poly(L-lysine)-g-poly(ethyleneoxide).

Random copolymer: a polymer comprising more than one type of repeat unit chemically linked in as random sequence.

Terpolymer: a copolymer comprising **three different monomer repeat units**, e.g., poly(ethylene-co-vinyl-co-acetate).



Ethylene vinyl acetate terpolymers (EVA-MAH)

Types of Polymerization

Living polymerization: Since the propagating chain end maintains its reactivity and is still "living," the resulting polymer and the polymerization system are called as "living polymer" and "living polymerization," respectively.

Chain growth/ Addition polymerization: polymerization occurring by addition of successive monomer units, one at a time, to a reactive growing polymer chain, e.g., free-radical polymerization, ring-opening polymerization, ionic polymerization.

Step growth/ Condensation polymerization: a polymerization that proceeds by linking together multi-functional monomers to first dimers (two monomers) then trimers (three monomers), etc., which themselves link together to form a high molecular weight polymer towards the end of the polymerization, e.g., polyesterification, polyamidation.

Solution polymerization: a polymerization carried out in a **one-phase system** with **monomer, polymer, and initiator dissolved** in a common solvent, in which the final **polymer product is also soluble**.

Dispersion polymerization: a polymerization carried out initially in a **one-phase system** with **monomer, polymer, and initiator dissolved** in a common solvent in which the **polymer is insoluble**. The polymer precipitates during the reaction to yield a dispersion of polymer particles in the liquid.

Emulsion polymerization: a polymerization performed in an **oil-in-water emulsion** using a **water-soluble initiator** where initiation occurs in the aqueous continuous phase. The polymerization occurs mainly in the monomer-swollen surfactant micelles in the continuous phase, fueled by diffusion of monomer from the droplets to the micelles, and not in the monomer droplets themselves.

Suspension polymerization: a polymerization performed in an **oil-in-water emulsion** using an **oil-soluble initiator**. The polymer is formed in the emulsified oil droplets and the resulting size distribution reflects that of the starting emulsion droplet size distribution.