Introduction to Polymers

Historical:

Christopher Columbus (15th Century): South American natives playing a bouncing game. Ball made our of mass collected from a tree called "weeping wood". Joseph Priestley showed that that mass could rub pencil marks from paper – "rubber" was found!

Christian Schonbein, a Swiss Scientist had an accident while mixing Nitric acid and Sulphuric acid. He used his wife's apron to clean the mess and rinsed with water and left to dry near the fire place. The apron caught fire and disappeared without a trace. Schonbein discovered that the cotton was converted to "gun cotton" a nitro derivative of cellulose.

Elephant tusks were used to make billiard balls, which was getting scarce in the late 19th century. John Wesley Hyatt of New York developed a material that resembled ivory and could be moulded into different shapes by applying heat. Hyatt named the material "celluloid" in 1870 and is considered to be the first thermoplastic.

Leo Blakeland in 1909 mixed phenol and formaldehyde to develop a resin (later named Bakelite) that could be moulded into hard infusible articles. Jacques Brandenburger in 1912 introduced the transparent material "cellophane". The decade that followed saw newer polymers with increasingly better properties synthesized in labs the world over.

Most synthetic polymers are of relatively recent origin. In fact they appeared later than the radio but have made a great impact in our lives. Whether we are looking for fancy decoration articles, textiles, building materials or packaging materials, polymers have given us a range of attractive choices.

What are Polymers?

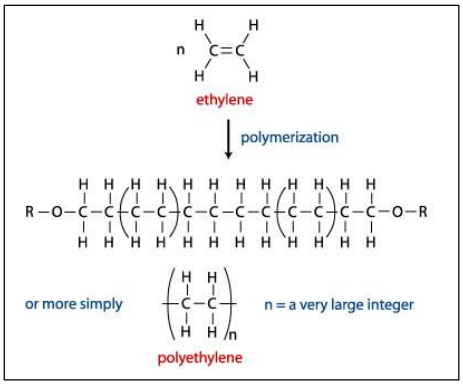
Complex, giant molecules, very different from low molecular weight compounds like common salt. To contrast the difference, the molecular weight of NaCl is 58.5, while that of polymer can be as high as several hundred thousands. These big molecules or "macromolecules" are made up of smaller molecules. The small molecules that combine to form big molecules could be of one or more chemical compounds. The word "polymer" has Greek origin: "poly" meaning "many" and "mer" meaning "parts".

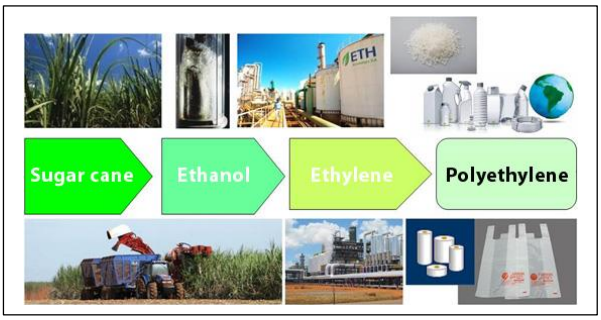
Contrast the behaviour of low molecular weight compound and a polymer to the exposure to heat. How to they melt? Boil?

Contrast the solubility behaviour of a low molecular weight compound (NaCl) and a polymer (Polyvinyl alcohol). How do they dissolve? Supersaturate?

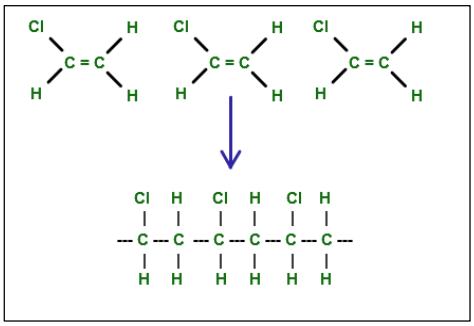
Ten most common Polymeric Materials:

1. Polyethylene (PE)

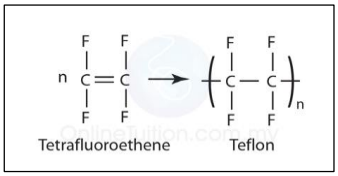




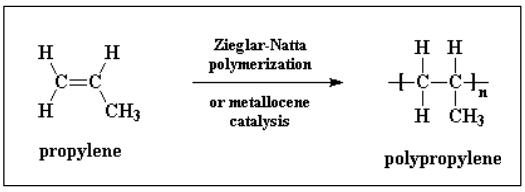
2. Polyvinyl chloride (PVC)



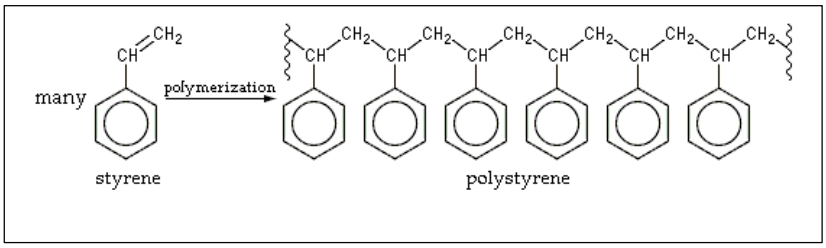
3. Polytetrafluoroethylene (PTFE)



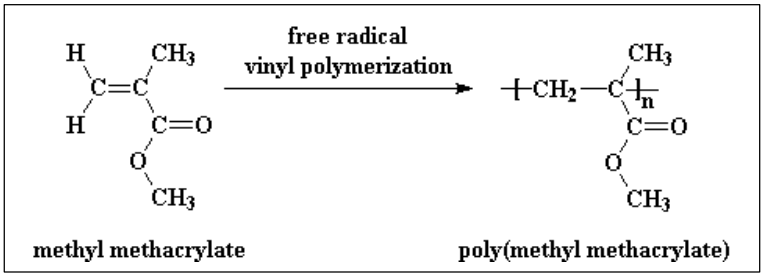
4. Polypropylene (PP)



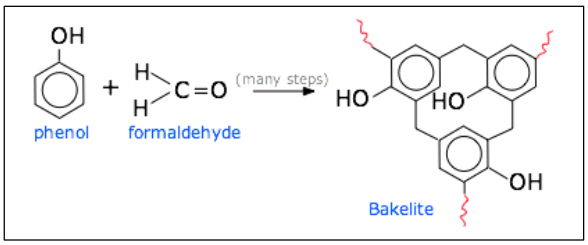
5. Polystyrene (PS)



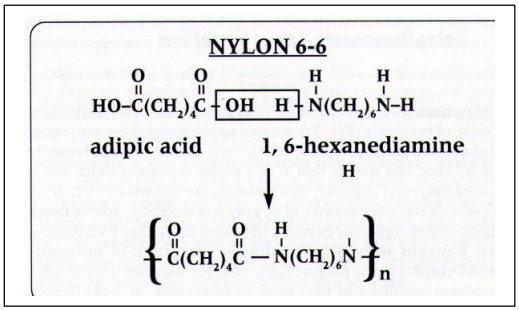
6. Poly-methyl methacrylate (PMMA)



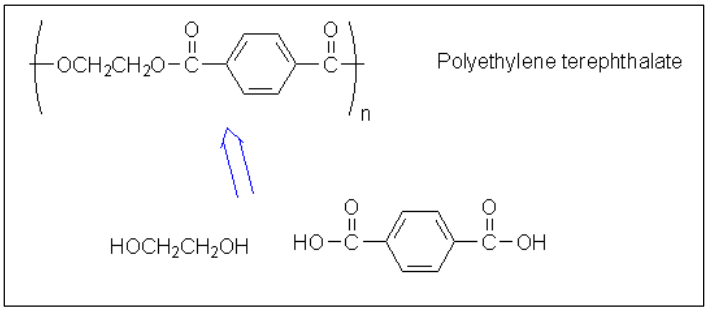
7. Phenol-formaldehyde (Bakelite)



8. Poly-hexamethylene adipamide (nylon 6,6)



9. Poly-ethylene terephthalate (PET)



10. Polycarbonate (PC)