B.Sc. Semester-VI
Organic Chemistry
Paper-XIV

2. Synthetic Polymers

Coverage:

20. **Plasticizers**
21. **Biodegradable Polymers**

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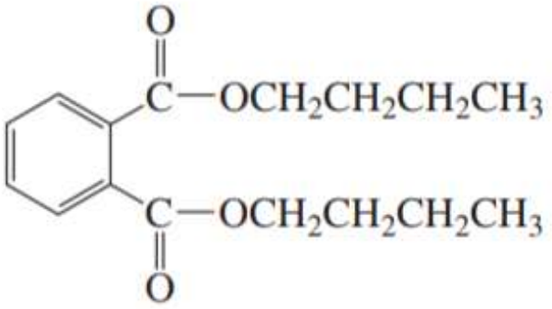
20. Plasticizers

A plasticizer can be added to a polymer to make it more flexible. A **plasticizer** is an organic compound that dissolves in the polymer, lowering the attractions between the polymer chains, which allows them to slide past one another. Dibutyl phthalate is a commonly used plasticizer. It is added to poly(vinyl chloride)—normally a brittle polymer—to make products such as vinyl raincoats, shower curtains, and garden hoses.

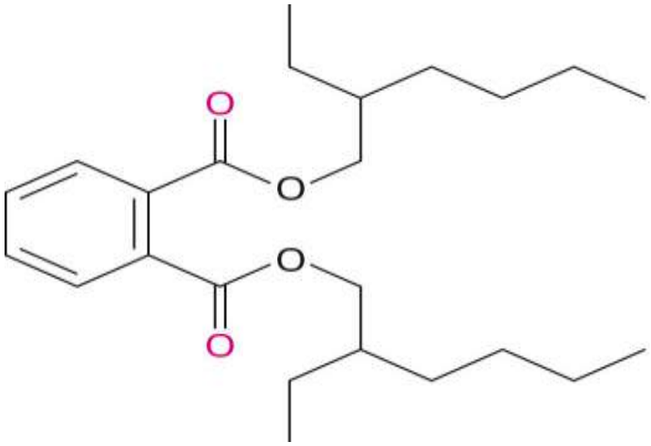


dibutyl phthalate
a plasticizer

An important criterion to consider in choosing a plasticizer is its permanence—how well the plasticizer remains in the polymer. The "new-car smell" appreciated by car owners is the odor of the plasticizer that has vaporized from the vinyl upholstery. When a significant amount of the plasticizer has evaporated, the upholstery becomes brittle and cracks. Phthalates with higher molecular weights and lower vapor pressures than those of dibutyl phthalate are now commonly used for car interiors.

Plasticizers

Small organic molecules that act as lubricants between chains
Added to thermoplastics to keep them from becoming brittle at room temperature
Dialkyl phthalates are commonly used for this purpose



Di(2-ethylhexyl) phthalate (or dioctyl phthalate), a plasticizer

21. Biodegradable Polymers

Biodegradable polymers are polymers that can be broken into small segments by enzyme-catalyzed reactions. The enzymes are produced by microorganisms. The carbon–carbon bonds of chain-growth polymers are inert to enzyme-catalyzed reactions, so they are nonbiodegradable unless bonds that *can* be broken by enzymes are inserted into the polymer. Then, when the polymer is buried as waste, microorganisms present in the ground can degrade the polymer. One method used to make a polymer biodegradable involves inserting hydrolyzable ester groups into it. For example, if the acetal shown below is added to an alkene undergoing radical polymerization, ester groups will be inserted into the polymer, forming "weak links" that are susceptible to enzyme-catalyzed hydrolysis.