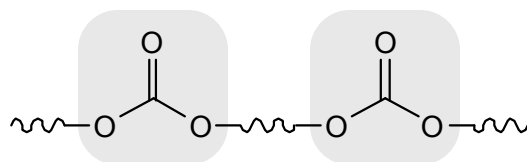
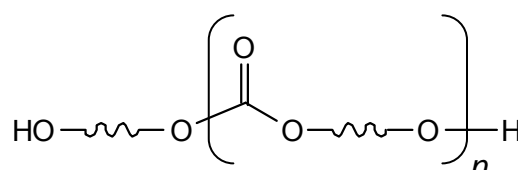


Workshop 27
Bisphenol A Polycarbonate, and the Alternatives

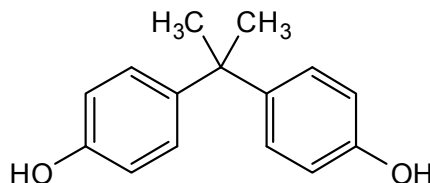
Polycarbonates are condensation (step-growth) polymers that have the generic structure shown on the right. When most people use the term “polycarbonate”, however, they are usually referring specifically to bisphenol A polycarbonate, a condensation polymer synthesized from bisphenol A and phosgene. Bisphenol A has come under scrutiny in a variety of different polymer products because of its potential to act as an endocrine disruptor—a mimic of hormones, and a possible concern in child development. Many nations have now prohibited the use of bisphenol A-containing materials, including bisphenol A polycarbonate, in the packaging of products intended for children.



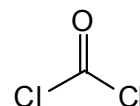
carbonate groups



a generic polycarbonate



bisphenol A



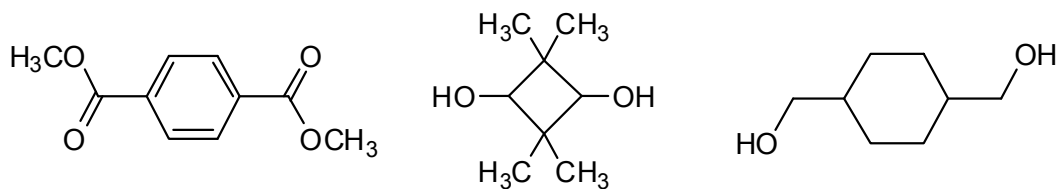
phosgene

1. Draw two structures of bisphenol A polycarbonate—one showing multiple repeat units chained together, and the other using brackets to illustrate the repeat units.

2. In principle, all of the bisphenol A in polycarbonate should be integrated into polymer chains; at the end of condensation polymerization, there should be no monomer left. In practice, however, there may be unreacted monomer that can leach out of the solid polymer material.

Another potential source of bisphenol A is hydrolytic degradation. In the space below, draw a potential mechanism for the hydrolytic degradation of bisphenol A polycarbonate in mild aqueous acid ($\text{H}_3\text{O}^+/\text{H}_2\text{O}$, like you might find in a child's size bottle of apple juice) that illustrates how bisphenol A monomer might be formed.

3. Ever since the action by governments to ban bisphenol A, manufacturers have been trying to invent new materials with the same durability and optical clarity as bisphenol A polycarbonate, but without the potentially toxic side products. On such polymer, marketed by Eastman as Tritan, is a copolymer of dimethyl terephthalate, 2,2,4,4-tetramethyl-1,3-cyclobutanediol, and 1,4-cyclohexanedimethanol (all shown below).



What is the structure of this copolymer? Draw a few monomer units linked together into a polymer chain.