

NS207 Lab 5 – CONDENSATION POLYMERIZATION (NYLON 6,10)

A condensation polymerization occurs when a polymer is formed from a reaction that leaves behind a small molecule, often water. The formation of peptide bonds in proteins is an example of a condensation polymerization. In this case, an amine reacts with a carboxylic acid to form an amide bond. Glycine is the simplest amino acid: the reaction below shows the reaction between two glycine molecules to form a glycine dimer.



the atoms in the red box drop away to form the water molecule on the right. This is the reaction that is used for all amino acids in the formation of proteins and is fundamental to life as we know it.

Polyamides - Nylon:

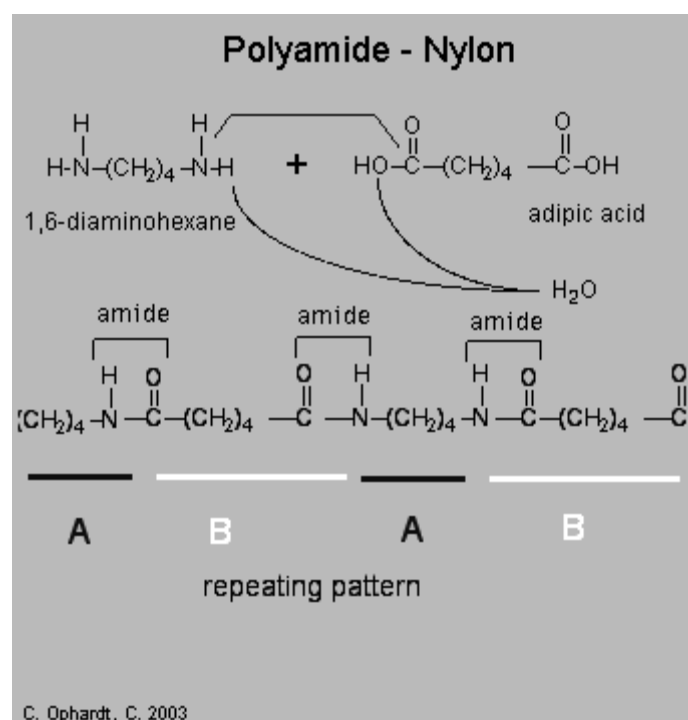
Polyamides such as nylon are also condensation polymers. The formation of a polyamide follows the same procedure as in the synthesis of a simple amide. Again, the only difference is that both the amine and the acid monomer units each have **two** functional groups - one on each end of the molecule. In this polymer, every other repeating unit is identical.

Nylon is made from 1,6-diaminohexane and adipic acid by splitting out water molecules (-H from the amine and -OH from acid as shown in red on the graphic). The units are joined to make the ester group shown in green.

A simple representation is -[A-B-A-B-A-B]-.

Nylon 66, discovered in 1931 by Wallace Cruthers at DuPont was the first completely synthetic fiber produced. It was introduced to women in nylon stockings in 1939 to immediate success. During World War II, nylon production went into making parachutes and other items needed by the military.

Nylon is very similar to the protein polyamides in silk and wool, but is stronger, more durable, more chemically inert, and cheaper to produce than the natural fibers.



Procedure

Interfacial Polycondensation of Hexamethylene diamine and Sebacyl chloride (Synthesis of Nylon 6,10) ; as mentioned in the introduction section, nylon 6,10 is an interfacially formed condensation polymer.

1.1 g of hexamethylene diamine dissolved in 50 mL water and 100 mL of CCl₄. Azobenzene is used for coloring CCl₄ and phenolphthalein is used for water phase. After adding hexamethylene diamine solution into CCl₄ two phases are obtained and 0.5 mL of sebacyl chloride is injected into the organic phase. With the help of needle of the injector Nylon 6,10 taken out and rolled to the needle.

Questions:

1. Write the reactions for Nylon 4,10 and Nylon 6,6
2. What is the difference between condensation polymerization and addition polymerization?