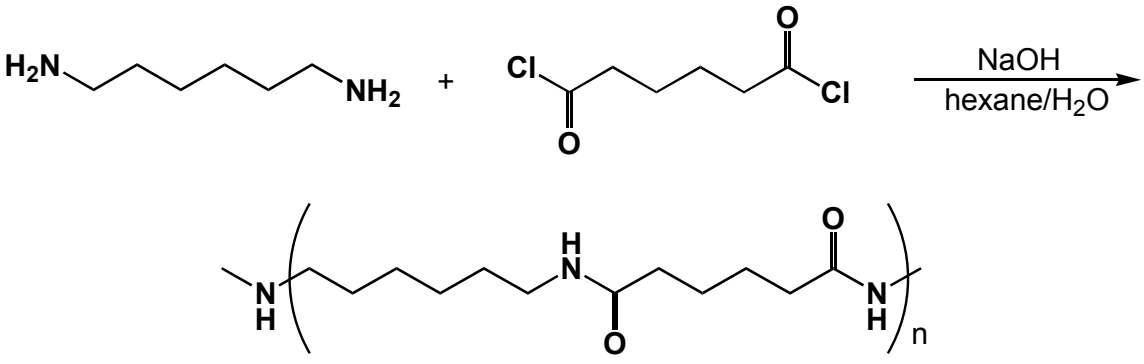
Nylon-6,6

Description: A continuous thread of nylon is generated by continually removing a thin film at the interface of two immiscible liquids.

Reaction Scheme



Materials:

Hexamethylenediamine

hexane

Beaker

0.25 M adipoyl chloride

Glass stir rod with hook

Procedure:

a. To prepare the hexamethylenediamine (HMDA) solution, dissolve 3.0 g of hexamethylenediamine and 1.0 g of NaOH in 50 mL distilled water in a labeled 100-mL beaker. (Caution! The solution of NaOH is highly exothermic. Note: HMDA can be dispensed by placing the reagent bottle in hot water until sufficient solid has melted and can be decanted.)

b. Measure 5 mL of the HMDA solution in a 10-mL graduated cylinder.

c. To prepare adipoyl chloride solution, dissolve 1.5 to 2.0 mL of adipoyl chloride in 50 mL hexane (or ligroin) in a second labeled 100-mL beaker.

d. Measure 5 mL of the adipoyl chloride solution in a second 10-mL graduated cylinder and pour into the third 100-mL beaker.

e. Slowly pour the 5 mL of adipoyl chloride solution through a funnel onto the top of the beaker containing the HMDA. Do not mix or stir. A film will form at the interface between the two solutions.

f. With forceps, grab a hold of the film at the center, pull slowly, and wind the resultant fiber onto a glass rod. Rinse the product with water and dry the nylon fiber by sandwiching between paper towels.

Discussion: Nylon refers to a family of synthetic polymers which are synthesized from the reaction of diamine with diacids (or the acid chloride analog). Specifically, Nylon-6,6 is a polyamide used as a fiber in applications such as carpeting and clothing. The numbering system for acid (in this case “6,6”) refers to the number of carbons in the monomer which came from the diamine and the diacid respectively. In this reaction, Nylon-6,6 is formed from a condensation reaction between hexamethylenediamine and adipoyl chloride.

Safety: Wear proper protective equipment including gloves and safety glasses when preparing and performing this demonstration. Hexanes are volatile and extremely flammable. Do not use near an open flame or expose to a heat source such as an overhead projector. Hexamethylenediamine is corrosive and a strong irritant. Adipoyl chloride is a lachrymator and irritant to the skin and eyes. Perform demonstration in a well-ventilated area as a small amount of HCl gas is given off.

Disposal: Place materials in a fume hood to dry. Dry nylon thread can be disposed of in a normal waste container.