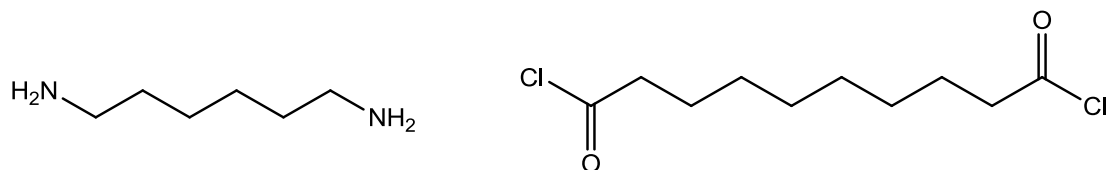


Condensation polymerisation

Introduction

In this experiment you will synthesise Nylon 610. Nylon is a polymer made of two parent monomers, a di-amine and a di-acid chloride



Equipment

- 10 mL hexamethylene diamine solution (0.5 M, in water, with NaOH added)
- 10 mL sebacoyl chloride solution (0.25 M, in hexane)
- 100 mL beaker
- tweezers
- wire winding apparatus
- nylon waste container

Method

Pour the aqueous, hexamethylene diamine and NaOH aqueous solution into the beaker. Very carefully, pour on top of this an equal volume of the sebacoyl chloride solution by tilting the beaker and pouring down the side. Do not stir or mix.

The interface where the nylon forms will be clearly visible between the two phases and this is where the Nylon polymer will form.

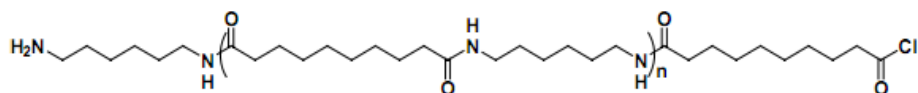
Using tweezers, grasp the polymer film at the interface of the solutions and draw it out, being careful not to let the nylon strand touch the side of the beaker. The strand can now be rapidly wound on the wire apparatus

to give a rather large amount of nylon thread.

The remaining monomers can be mixed using the tweezers to form a nylon blob

What is going on?

The two monomers do not mix because one of the solutions is aqueous and the other is organic. However, a reaction does occur at the interface where they are touching. The amine groups and the acyl chloride groups react and form a long chain polymer with the structure below. The other product of the reaction is HCl as a hydrogen ion is lost from the diamine and a chloride ion is lost from the di-acid chloride when they react. The polymer forms at the interface and is a solid because it is a large molecule.



When some of the nylon is drawn out of the beaker, more monomer molecules come in contact so they can react to form the polymer. This keeps the nylon thread continuous.

Relevance to solar energy

Synthetic polymers are used in polymer solar cells.

**Disposal**

Put all waste from this reaction in the nylon waste container; do not put anything down the drain. Be sure to wash out the beaker well and do not leave any nylon residue on the sides.

Safety

Wear gloves. During the mixing of the two solutions, HCl is generated and is often seen in the beaker as a vapor above the liquids. Rinse the nylon with water very well before letting anyone touch it.

References

<http://web.mit.edu/chemistry/www/outreach/experiments.pdf>