

# Lab Report

## **Polymerization-Nylon/Polystyrene**

Student Name

University

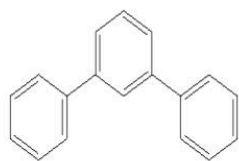
Course

Professor's Name

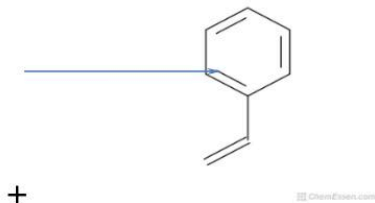
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## Preparation of Polystyrene

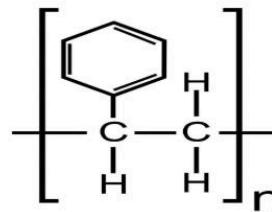
### Reaction



Diphenylbenzene



styrene



Polystyrene

### Material/reagents

- 10 ml of styrene
- 1ml diphenylbenzene
- 100 mg benzyl peroxide
- Conical flask
- 10 ml measuring cylinder for accurate measurement of 10 ml of styrene and 1ml diphenylbenzene
- Aluminium foil
- Electric heater
- Conical flask
- Fume hood
- Gloves
- Face mask
- Safety glasses

### Procedure

- Set an electric heater to 100 °C
- Insert a thin aluminium foil into the beaker to form a mold that will hold the chemicals during the reaction.
- Set the electric heater to 1000 c.
- Measure 10ml of styrene and place it in the conical flask.

- Measure 1ml of diphenylbenzene and add it to the styrene in the conical flask.
- Add all the 100 mg benzyl peroxide into the mixture in the conical flask and swirl until all the benzyl peroxide dissolves
- Pour the mixture into the beaker containing the thin foil mold, place the beaker with its contents on the heater (hot plate), and heat the mix for over 45 minutes.
- After 55 minutes, remove the beaker from the plate and separate the polymer from the foil by tearing it off the foil.

## Results

Quantity of each reagent used	Molecular weights	Reacting time/temperature	Physical properties of the product
<ul style="list-style-type: none"> <li>• 10 ml of styrene</li> <li>• 1ml diphenylbenzene</li> <li>• 100 mg benzyl peroxide</li> </ul>	Diphenylbenzene $C_{18}H_{14}$ M.W. =230 Styrene $C_6H_5CHCH_2$ M.W. = 104 Polystyrene $C_8H_8$ M.W. = 104	<ul style="list-style-type: none"> <li>• 55 minutes</li> <li>• 100oC</li> </ul>	<ul style="list-style-type: none"> <li>• Melts at 2400C and boils at4300C (Vedantu, n.d.)</li> <li>• A hard, solid polymer formed out of the 2 liquids.</li> <li>• A clear, transparent solid.</li> <li>• Thin and brittle</li> <li>• Cracks and breaks easily</li> <li>• Has a strong odor.</li> </ul>

## Discussion

In the reaction, benzyl peroxide acted as a radical initiator/catalyst for the reaction. Under the conditions, diphenylbenzene reacted with styrene to form polystyrene. If the mass/ moles of each of the reactants is known, the mass of the polymer that would form can be calculated. This is the theoretical mass. The actual mass formed can be obtained through measurement. The % yield can be calculated using the formula:

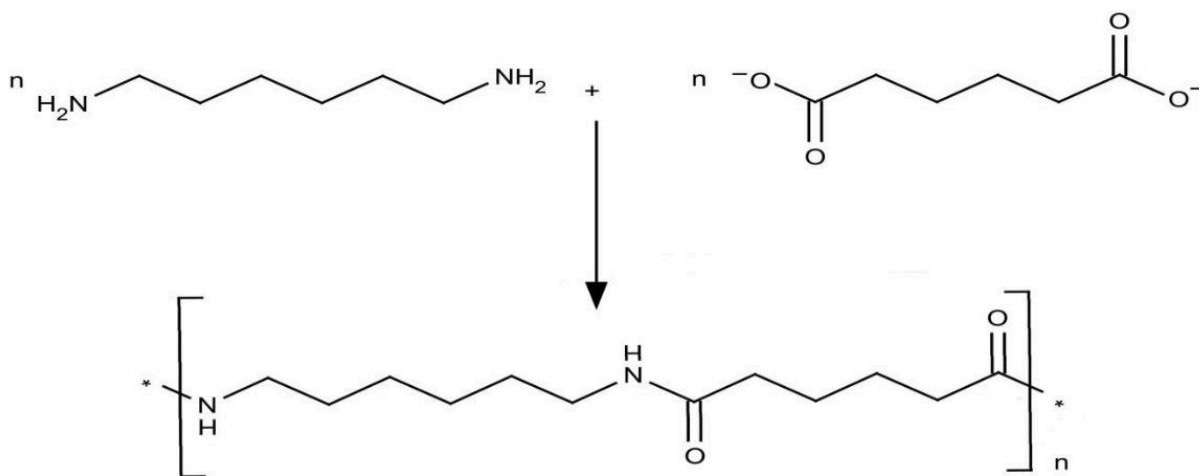
$$\% \text{ yield} = \frac{\text{actual mass}}{\text{theoretical mass}} \times 100$$

## Conclusion

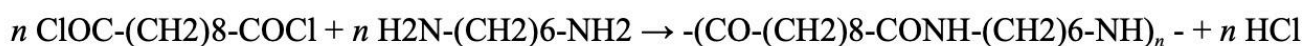
Polystyrene can be synthesized in the laboratory by the reaction between styrene and diphenylbenzene in the presence of benzyl peroxide, which catalyzes the reaction.

## Procedure 2: Synthesis of nylon 6-10

### Reaction



or



### Reagents/materials

- 2% sebacoyl chloride in hexane
- 10% 1,6-diaminohexane in sodium hydroxide
- Beaker

### Procedure

Measure 20 ml of the 2% sebacoyl chloride/hexane mixture and 20 ml of the 10% 1,6-diaminohexane/sodium hydroxide mixture.

- Place all the 1,6-diaminohexane/sodium hydroxide mixture into the beaker.
- With the help of the stirring rod, carefully add the 2% sebacoyl chloride into the 1,6-diaminohexane in the beaker so that 2 layers will be formed. The Sebacoyl chloride mixture will float on the 1,6-diaminohexane mixture. A white film will be formed at the interface of the 2 layers. This is nylon 16. The nylon fibers can be drawn using twin scissors and rolled around the test tube. As the nylon thread is rolled onto the test tube, the total volume of the mixture decreases.
- Rinse the nylon using tap water to remove residual chemicals. Remove the test tube and rinse the inside of the nylon roll with tap water.

## Results

Initial volume of 2% sebacoyl chloride/hexane mixture = 20 ml

Initial mixture of 1,6-diaminohexane/ sodium hydroxide mixture = 20 ml

Initial volume of the mixture = 40 ml

Time taken for nylon film to be visible = 1 minute

## Discussion

The volume of the mixture decreased as nylon 6,10 was drawn out because the liquid molecules had reacted, forming nylon.

### *Description of nylon 6-10 tensile strength*

- Single structures are relatively weak, but grouped structures have significant tensile strength, and are resistant to breakage
- White and opaque polymer
- Fairly brittle

### *Description of nylon 6-10 appearance and texture*

It is an amorphous, opaque white polymer with a slimy texture.

## Odor

- No noticeable odor

The percentage yield can be calculated by determining the actual yield and comparing it with the theoretical yield calculated using the mole concept and stoichiometry of chemical reactions. The % yield shall similarly be calculated by the formula:

$$\% \text{ yield} = \frac{\text{actual mass}}{\text{theoretical mass}} \times 100$$

## Conclusion

Nylon 6,10 can easily be prepared in the laboratory by reacting a 2% sebacoyl chloride/hexane mixture with a 10% 1,6-diaminohexane/sodium hydroxide mixture. Nearly all the liquid mixture formed a nylon solid. The percentage yield for the reaction must be among the best.

## References

Hubbard (2020, October 25). CHEM 2100L Experiment 7 - Polymer Synthesis[video].

[https://www.youtube.com/watch?v=qAwoRmaMZ0o&ab\\_channel=Dr.HubbardUGAChemistry](https://www.youtube.com/watch?v=qAwoRmaMZ0o&ab_channel=Dr.HubbardUGAChemistry)

Vedantu (n.d.). Polystyrene. <https://www.vedantu.com/chemistry/polystyrene>



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