

# POLYMERS

## Experiment 1

### Adhesive polymers

Laboratory equipment:

- watchglass

Chemicals:

- 2 pieces of plexiglas - poly(methyl methacrylate),
- ethyl acetate

In the top of the cap of mineral water weigh about 0.1 g of plexiglass turnings. Add approximately 4cm<sup>3</sup> of ethyl acetate, stir with stick and cover with a watch glass. The mixture should stand for one hour, stirring every 10 minutes. The resulting adhesive use to glue 2 pieces of plexiglass. Allow it to stand for 10 minutes. Determine the durability of adhesion.

## Experiment 2

### Determination of the density of the polymer

Laboratory equipment:

- analytical balance
- caliper

Chemicals:

- poly (styrene) (PS)
- poly (ethylene) (PE)
- poly (tetrafluoroethylene) (PTFE)

Weigh prepared samples of polymers. Then measure their dimensions (diameter, height) using calipers. Calculate the density of the polymers.

## Experiment 3

### Solubility of polymers

Laboratory equipment:

- test tubes in rack

Chemicals:

- poly (styrene) (PS)
- poly (ethylene) (PE)
- poly (tetrafluoroethylene) (PTFE)
- acetone
- chloroform
- dimethylformamide (DMF)

Place the tubes in a rack, in three rows and pour approximately 1cm<sup>3</sup> of each solvent in sequence: acetone, chloroform, dimethylformamide. Sequentially put in the test tubes the samples of polymers: PS, PE and PTFE. Mix and wait 5 minutes. If the material is not dissolved - heat the tube in a water bath.

## Experiment 4

### Synthesis of urea formaldehyde resin

Laboratory equipment:

- evaporating dish,
- gas burner,

Chemicals:

- formic aldehyde (formaldehyde, formaline)
- urea,
- KMnO<sub>4</sub> saturated solution.

Pour approximately 2 cm<sup>3</sup> of formaline into evaporating dish and add 2g of urea. Heat the solution using gas burner until dissolution of urea. Then add a few droplets (3-6) of saturated KMnO<sub>4</sub> solution. Keep stirring the solution all the time. Pour the liquid mass on the glass. The plastic mass should be stable after cooling.

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**Experiment 1**

**Adhesive polymers**

Observations:.....  
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Reaction of resin formation:

**Experiment 2**

**Determination of the density of the polymer**

Symbol	Polymer	weigh [kg ]	r [dm]	h [dm]	density [kg/dm <sup>3</sup> ]
<b>PE</b>	<b>poly(ethylene)</b>				
<b>PS</b>	<b>poly(styrene)</b>				
<b>PMMA</b>	<b>poly((methyl methacrylate)</b>				
<b>PTFE</b>	<b>poly(tetrafluoroethylene)</b>				

**Experiment 3**

**Solubility of polymers**

Symbol	Polymer	acetone	chloroform	DMF
<b>PE</b>	<b>poly(ethylene)</b>			
<b>PS</b>	<b>poly(styrene)</b>			
<b>PMMA</b>	<b>poly((methyl methacrylate)</b>			
<b>PTFE</b>	<b>poly(tetrafluoroethylene)</b>			

**Experiment 4**

**Synthesis of urea formaldehyde resin**

Observations:.....  
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Reaction of ethyl acetate formation:

Reaction of poly((methyl methacrylate) formation: