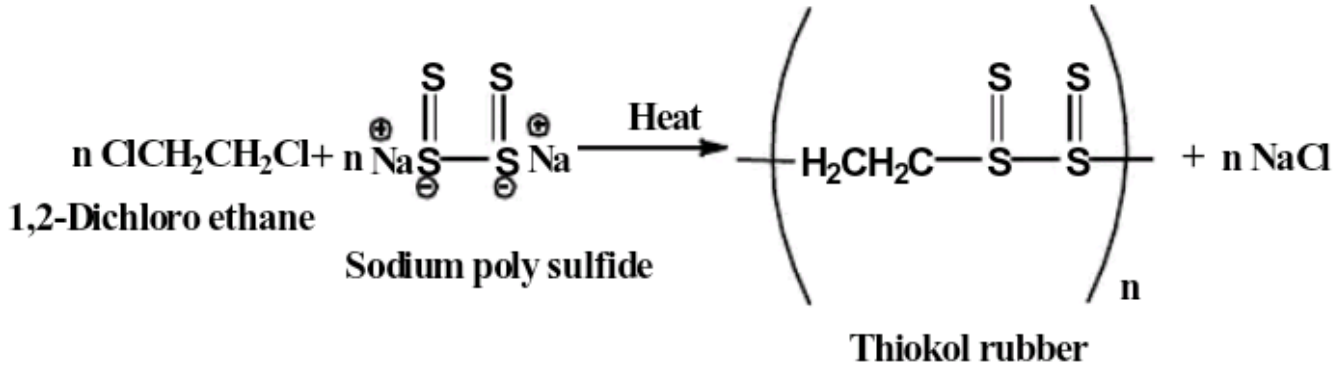
Synthesis of Thiokol Rubber

- Thiokol owes its origins to two chemists, Joseph C. Patrick and Nathan Mnookin, who were trying to invent an inexpensive antifreeze. In 1926, in the course of an experiment involving ethylene dichloride and sodium polysulfide, they created a gum whose outstanding characteristic was a terrible odor. The substance clogged a sink in the laboratory, and none of the solvents used to remove it were successful. Then the frustrated chemists realized that the resistance of the material to any kind of solvent was a useful property. They had invented synthetic rubber, which they christened "Thiokol," from the Greek words for sulfur (theion) and glue (kolla). Thiokol Chemical Corporation was subsequently founded on December 5, 1929.
- - Thiokol is a trademark used for any of various polysulfide polymers in the form of liquids, water dispersions, and rubbers used in seals and sealants.



Procedures:

1- In a beaker containing 100 ml. of dist. water, dissolve 5 g. of sodium hydroxide and heat to boiling.
2- Add 10 g. of sulfur in small lots with constant stirring until a deep red solution is obtained due to the formation of sodium polysulphide.
3- Allow the solution to cool to below 83°C, the boiling point of 1, 2-dichloroethane, and add 20 ml. of 1, 2-dichloroethane with stirring.
4- Continue to stir for a 20 min. while a rubber polymer separates out as a lump.
5- Decant the supernatant liquid and wash the product several times with water and leave in the fume cupboard for a few minutes to allow excess 1, 2-dichloroethane to evaporate.

Uses:

1. It is used for making gaskets, seals and hard rubber products to be exposed to oil and pressure.
2. Thiokol rubber mixed with oxygen releasing chemicals is used as a solid fuel in rocket engines.
3. It is used for making hoses and linings of vessels used in the manufacture of chemicals.

Experiment No. 4

Aim: To prepare Urea formaldehyde (U-F) resin.

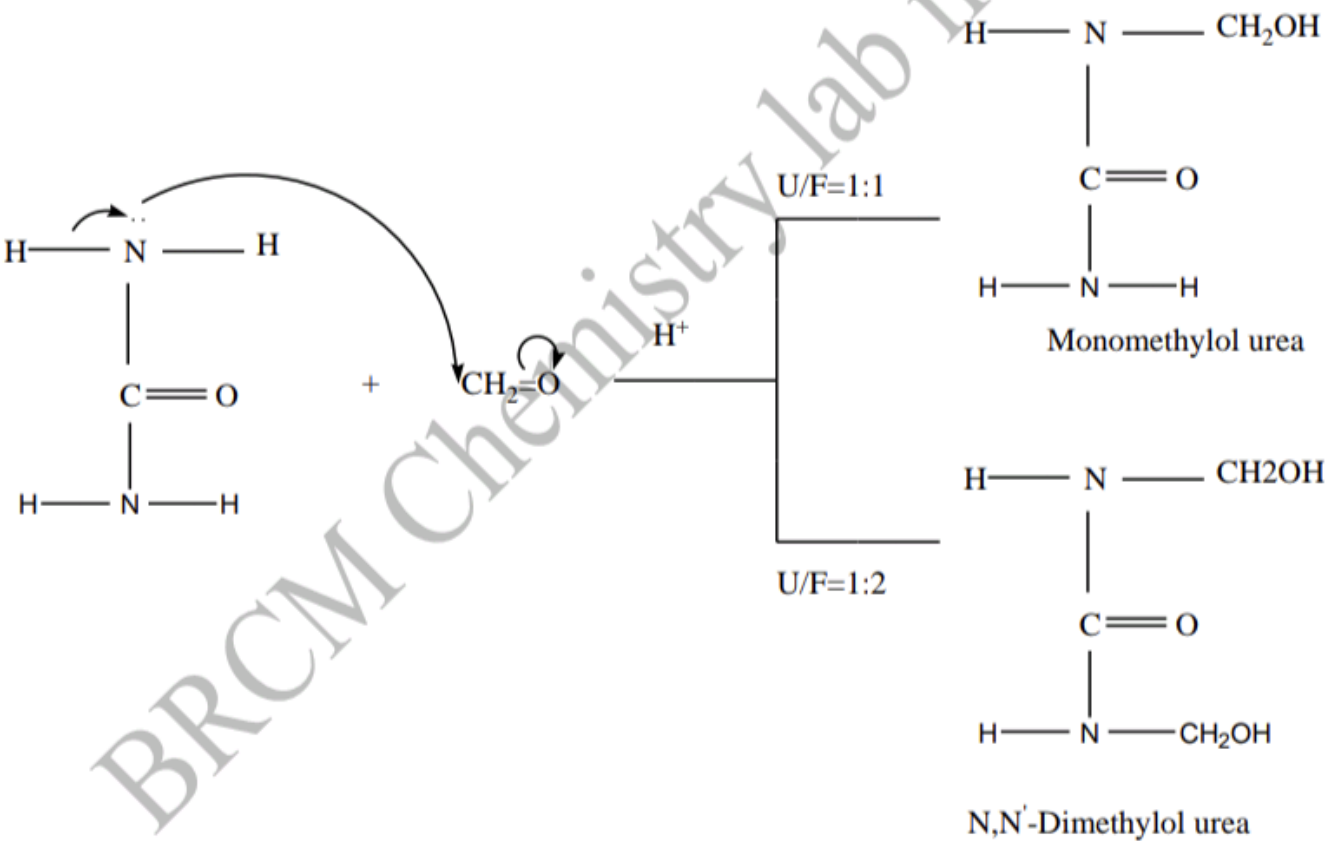
Chemical required: Urea (2g), 40% aq formaldehyde solution or formalin (5 mL), conc. H_2SO_4 (3-4 drops).

Theory

Urea formaldehyde resins are formed by condensation of urea and formaldehyde in acidic medium in following steps:

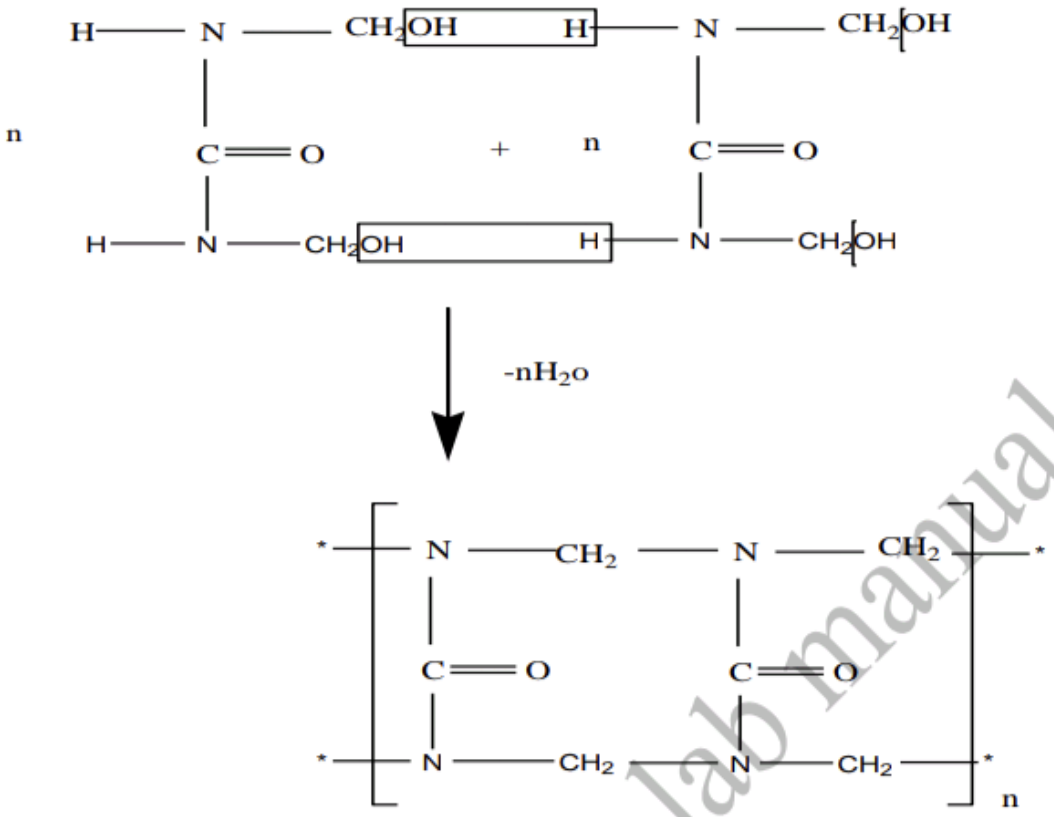
Step 1. Formation of methylol urea derivative

Initially urea and formaldehyde react to form methylol urea derivatives depending upon forsmaldehyde (U/F ratio).



Step 2: Polymerization of methylol urea

Several molecules of methylol urea derivatives condense with loss of water molecules to form a highly cross linked urea formaldehyde resin.



Procedure

Take a 5 mL of 40% aqueous formaldehyde solution in a 100 mL beaker. To this add 2 g urea powder. Stir with a glass rod to make a saturated solution. Add a few drops of conc. H_2SO_4 and stir vigorously till a white solid mass is formed. Filter the residue and wash it several times with distilled water to remove any acid. Dry the residue in folds of filter paper or in an oven and weigh. Report the yield of urea formaldehyde polymer formed.

Observation

Weight of empty watch glass = W_1 g

Weight of watch glass + poymer formed = W_2 g

Weight of polymer formed = $W_2 - W_1$ g

Result

Weight of urea formaldehyde resin = W g

EXPERIMENT No.

AIM: To preparation of glyptal resin.

APPARATUS: R.B. flask, water condenser, conical flask, test tube.

REQUIREMENTS: Phthalic anhydride, glycerol, R.B. flask, beaker, water condenser.

PROCESS:

1. In 250 ml R.B. flask, take 15 gm of phthalic anhydride and 11 ml glycerol.
2. Attach a water condenser to the neck of flask; reflux the content of flask on stand bath at 130^0-170^0 c for 15 min.
3. After this period transfer the brown yellow resin in to a previously weighted test tube.
4. Note down the weighty of glyptal resin formed glyptal is resin soluble in acetone.

OBSERVATION:

Weight of the glass capsule =
Weight of polymer + glass capsule =
Weight of polymer =

CHEMICALS:

1. Burette :
2. Conical flask :
3. Indicator :
4. Co lour change :

CALCULATIONS:

Acid value of polymer = $\frac{\text{molecular weight of KOH} * \text{normality of KOH} * \text{b.r.}}{\text{Weight of the sample}}$

RESULT:

Weight of glyptal resin formed =