CH0204 Organic Chemical Technology

Lecture 11

Chapter 3 Plastics

Balasubramanian S
Assistant Professor (OG)
Department of Chemical Engineering

Overview of topics

Chapter 3 Plastics

1. Resins
2. Production of Phenolic and Epoxy resins
3. Polymers and their Engineering Properties

Resins

Resin is also hydrocarbon secretion of many plants, particularly coniferous trees. It is valued for its chemical properties and associated uses, such as the production of varnishes, adhesives, and food glazing agents; as an important source of raw materials for organic synthesis.

Resins

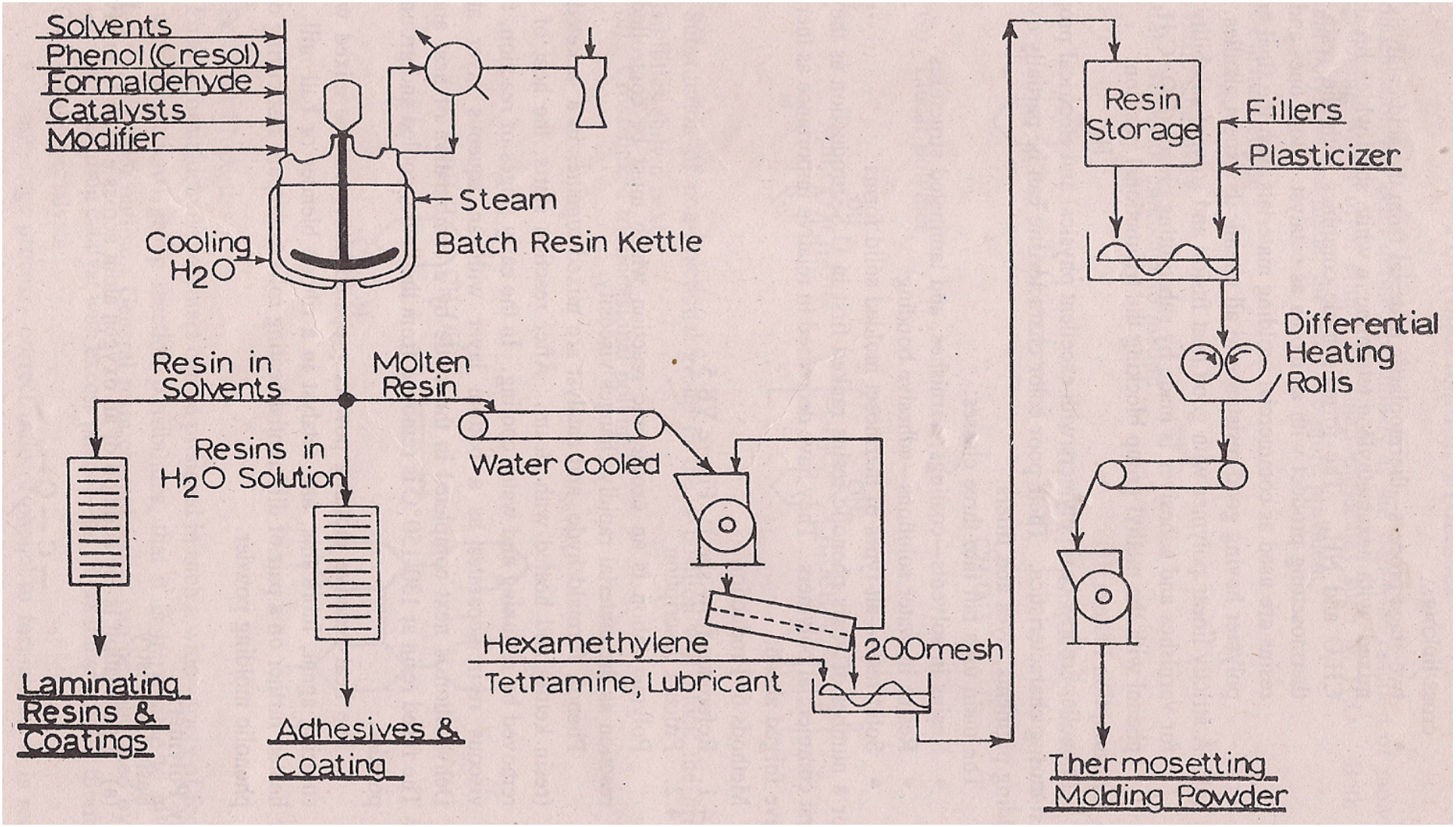
On the basis of derivation, plastics can also be grouped as

1. Natural resins
2. Synthetic resins
3. Cellulose derivatives
4. Protein products

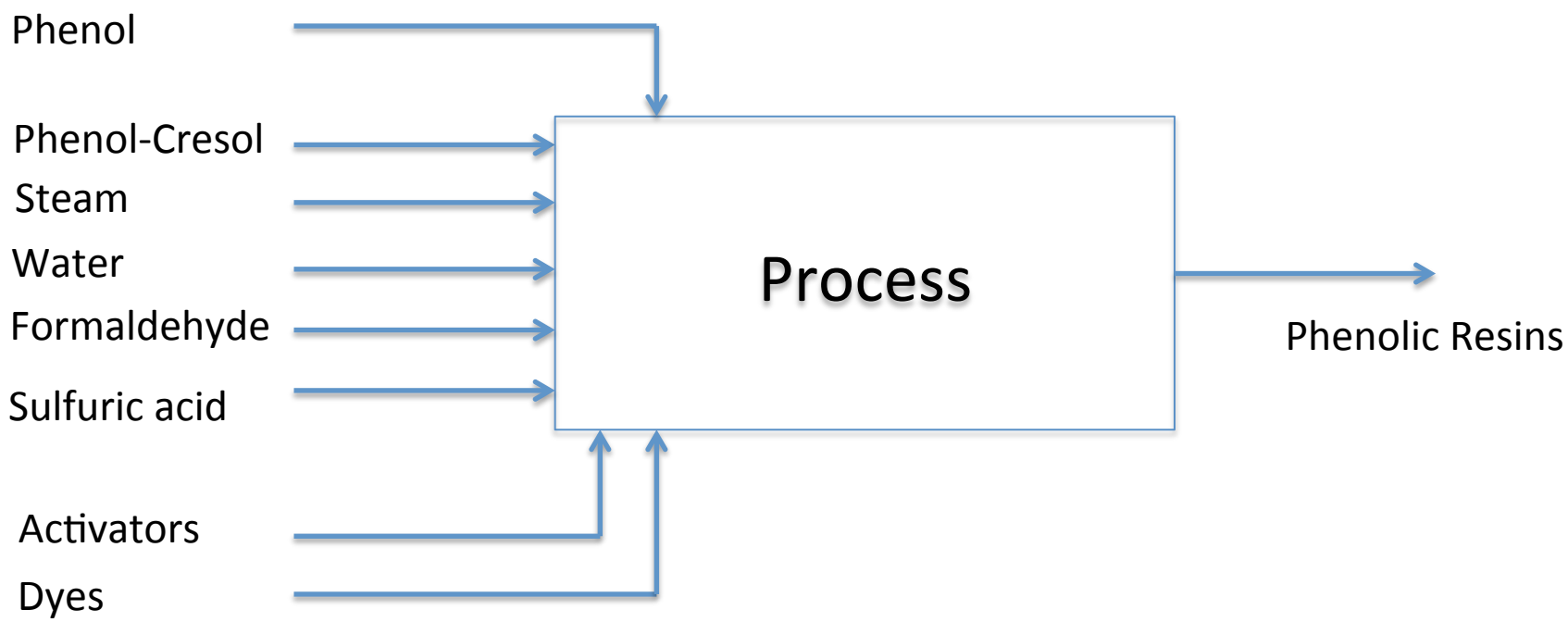
Types of resins and plastics with some common trade name

Thermosetting Resins	Thermoplastic Resins	
	Cellulose derivative	Polymer resin
Phenolic resins	Cellulose nitrate	Vinyl
Amino resins	Cellulose acetate	Polyamides
Alkyd resins	Ethyl cellulose	Polyethylene
Epoxy resins	Cellulose propionates	Polypropylene
Polyester	Cellulose-acetate butyrates	Fluorocarbons
Polyamides	Ethyl cellulose	Polysulfonates

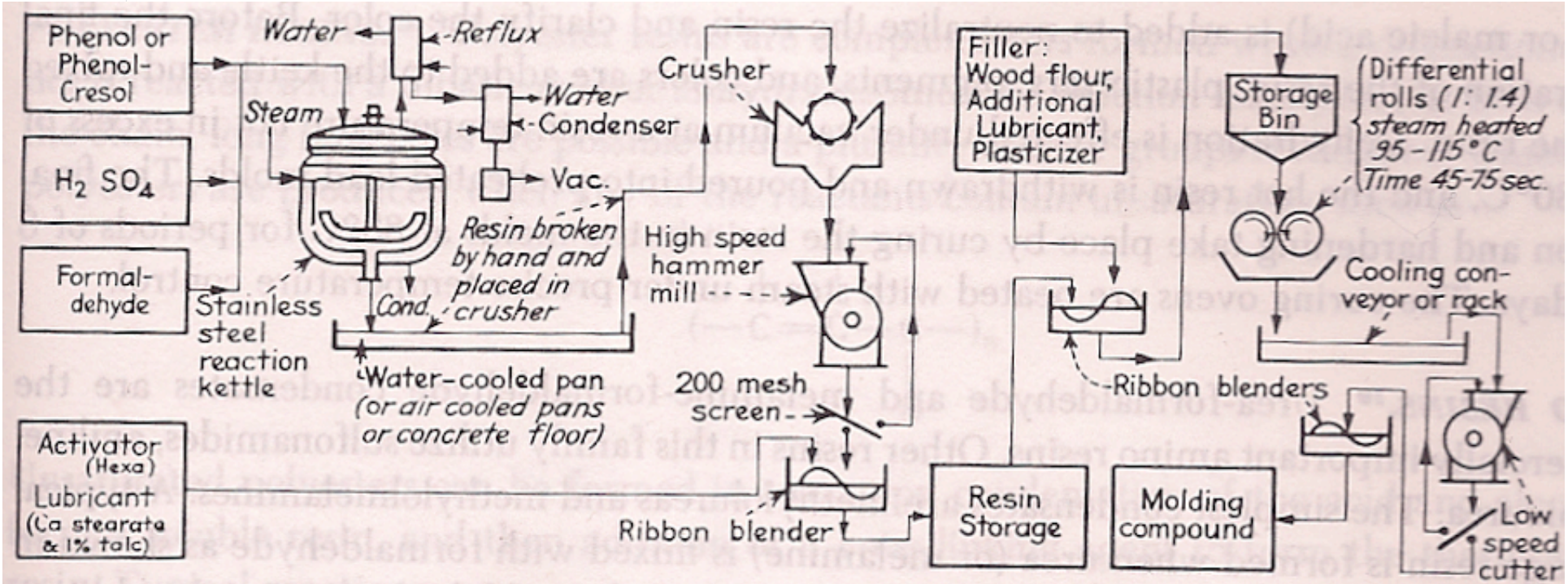
Phenolic Resin



Phenolic Resin



Phenolic Resins Production



In order to produce 100 kg of finished molding compound of a typical kind, the following materials (in kilograms) are required.

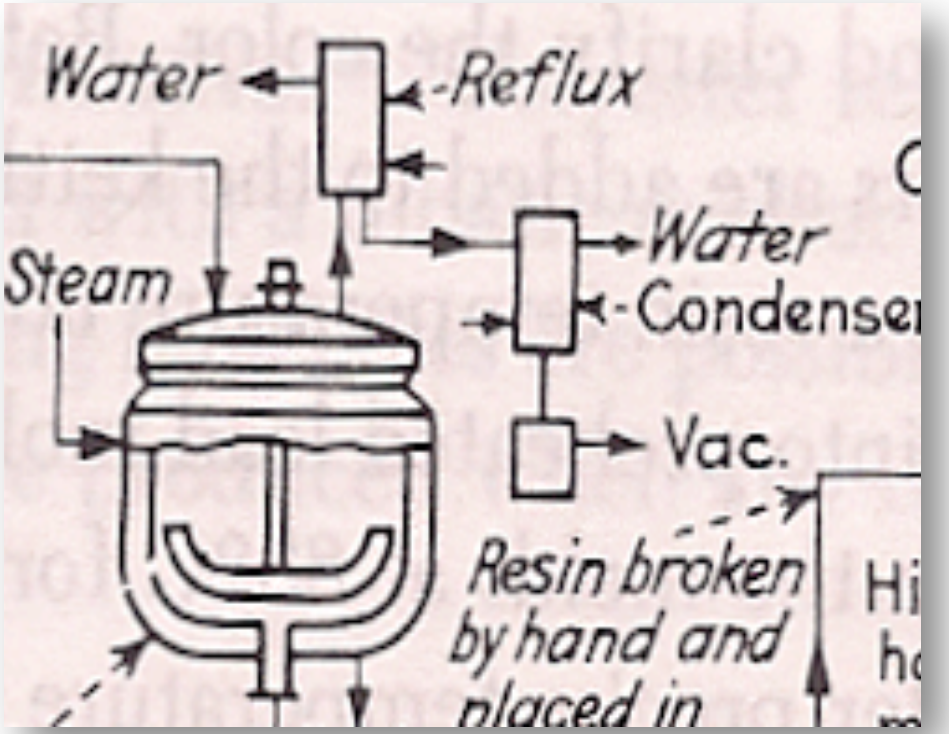
Phenol	42	H_2SO_4	0.1
Formaldehyde	27	Black dye (Nigrosin)	1.3
Wood flour	52	Ca stearate	0.7
Hexa	3.7		

Uses of phenolic resins

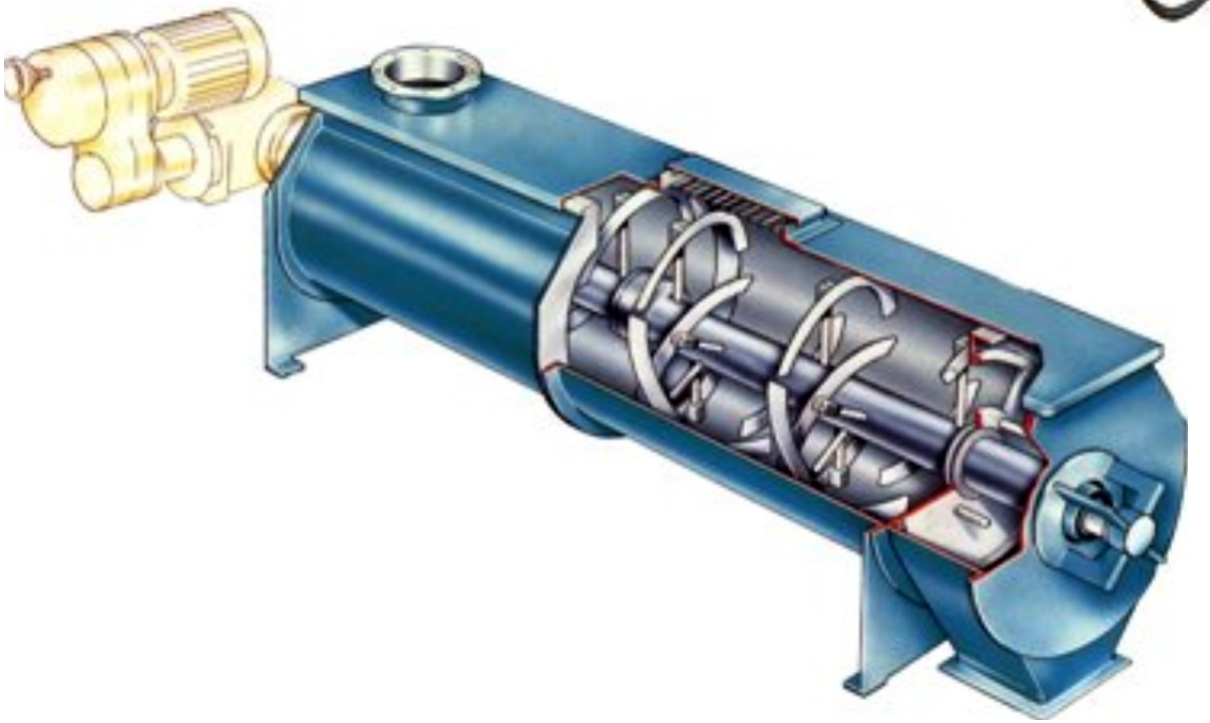
Phenolic resins

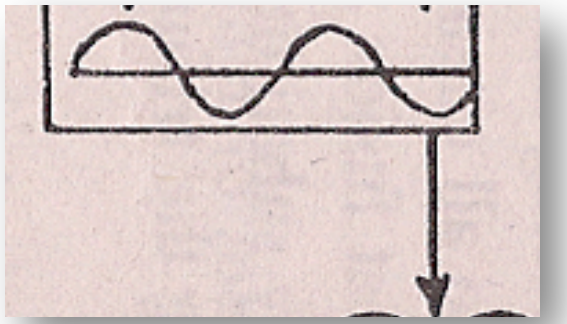
1. Packing films and sheets
2. Containers
3. Wire cable insulation
4. Pipes
5. Coatings, molds, and toys etc.,

Kettle or Auto Clave Reactor

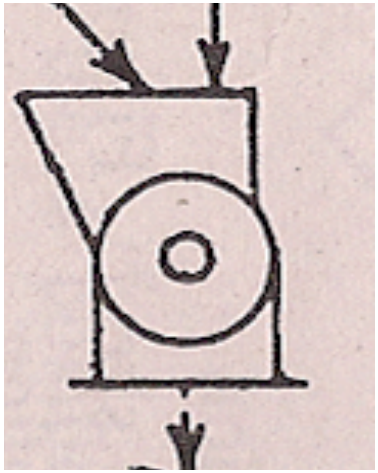


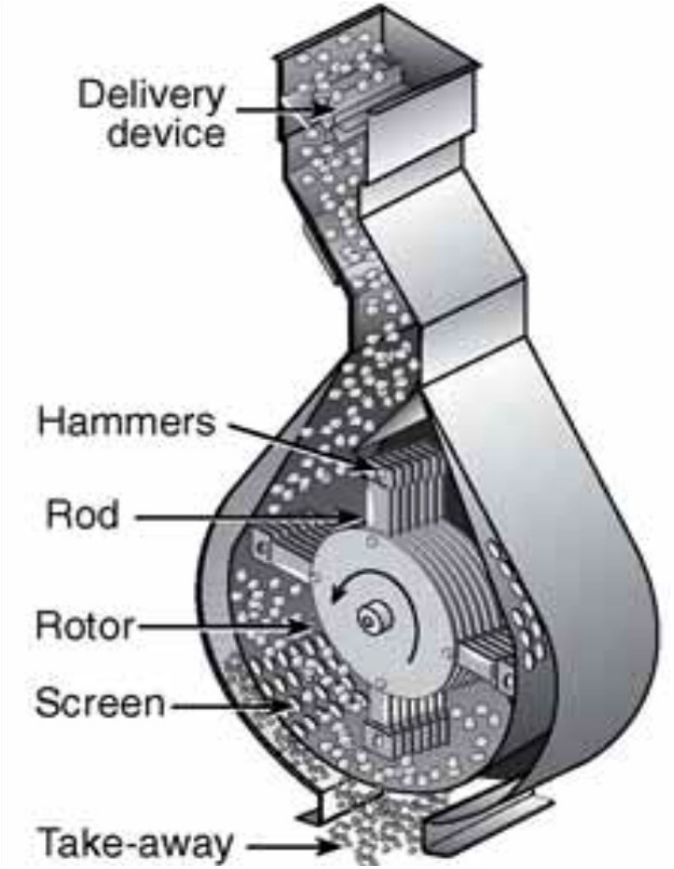
Ribbon Blender



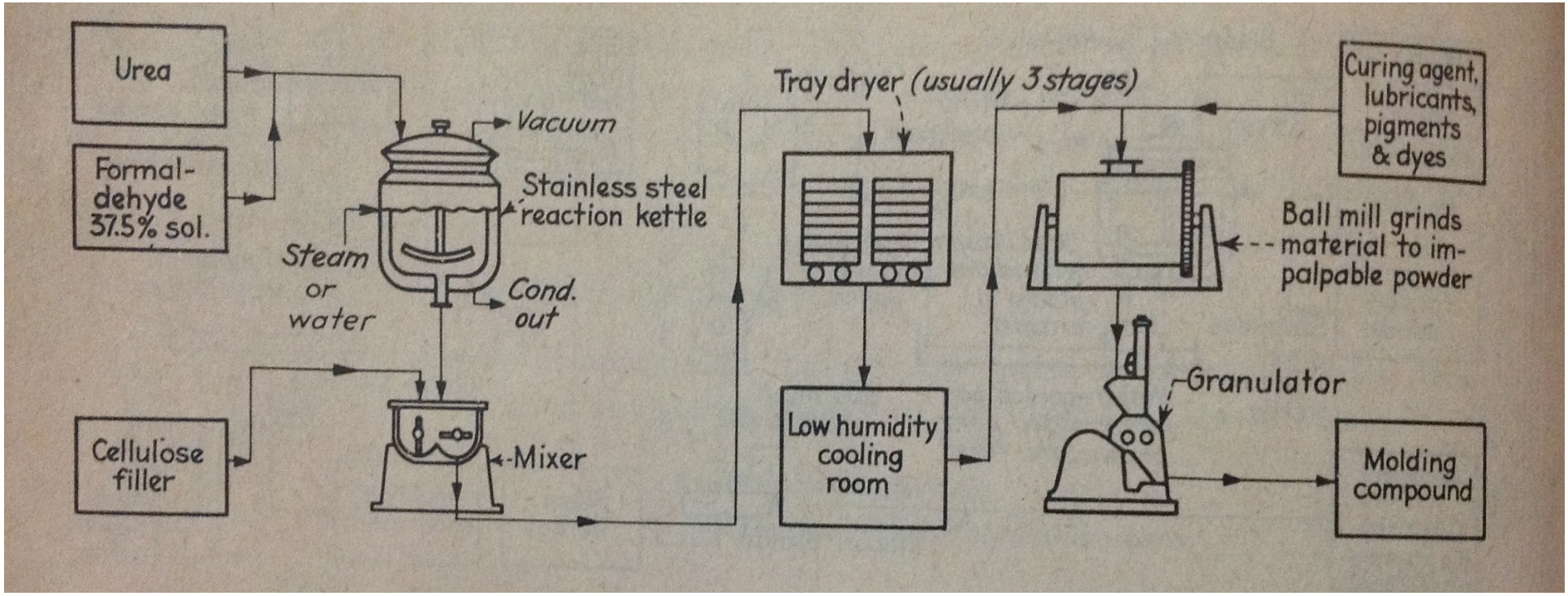


Hammer Mill

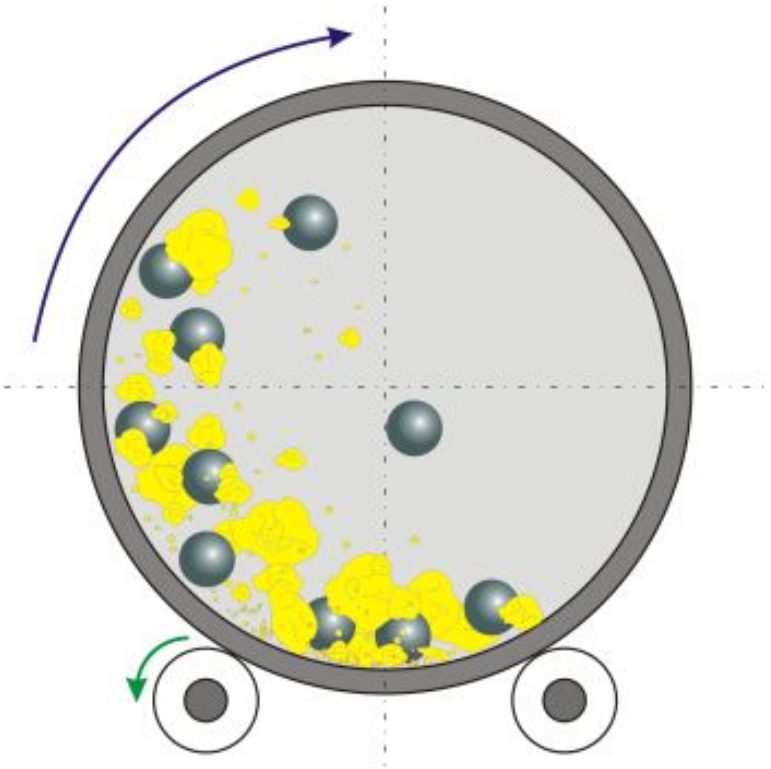




Amino Resins – Urea Formaldehyde

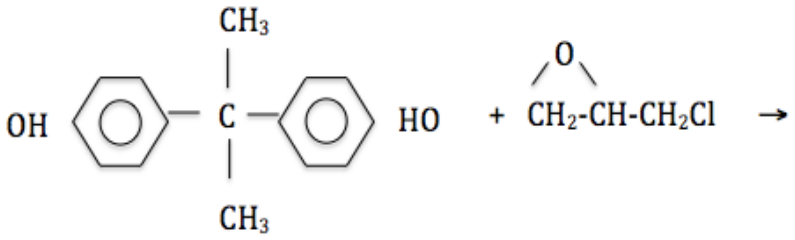


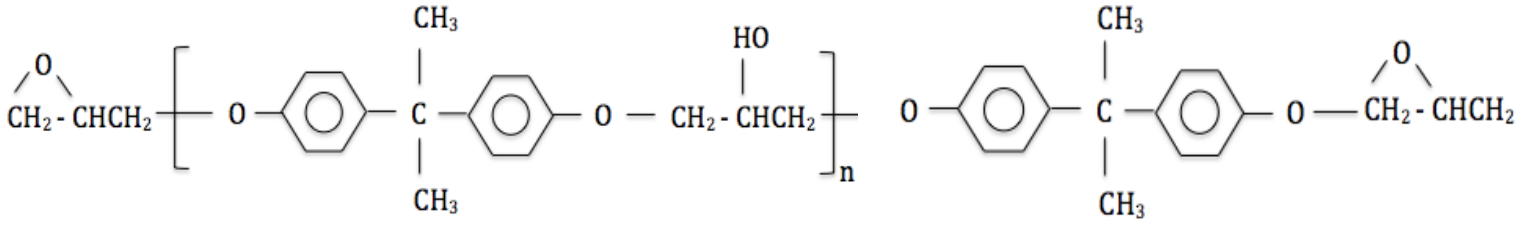
Ball Mill



Epoxy resins

Bisphenol A + Epichlorohydrin ⟶ Epoxide groups or polymer





Resin Properties and its Applications

Resin Types	Properties	Applications
Epoxies	Excellent chemical Resistance, good electrical and thermal properties adhesion properties, strong and tough with low shrinkage	Laminates, Adhesives, Floorings and linings
Phenolics	Good strength, heat stability, and impact resistance, high resistance to moisture penetration and chemical corrosion	Electrical components, structural boards, Laminates, glues, and adhesives
Polystyrene	Low cost, east of processing, excellent resistance to acids, and bases, softened by hydrocarbons, and transparency	Insulation, pipe, foams, thin walled containers, appliances and rubbers.
Polyamides	Tough, strong and easily moldable; light; abrasion resistance; good chemical resistance; low coefficient of friction.	Unlubricated bearings; tires; watch straps; packaging and bottles.

Polymers in engineering applications

Binder: This is usually a resin or cellulose derivative

Fillers: Cellulose, Cotton fibers, Glass fibers or fabrics may be added to increase strength

Plasticizers: Plasticizers are organic chemicals added to synthetic plastics in order to

(I) Improve the workability during fabrication

(II) Reduces the viscosity of the resin and also impart flexibility to finished product

Lubricants: Lubricants such as stearates and other metallic soaps are used particularly in cold-molding compounds to facilitate the molding operation

Polymers in engineering applications

Engineering plastics are high-strength; high performance materials that can be substituted for many metal uses.

There are wide variety of engineering plastics available. Each one has its own special properties, and thus care must be taken in choosing a resin of particular use.

These materials are often the usual plastics but have been carefully manufactured to posses extra quality properties. These materials shows better resistance towards wear impact and corrosive chemicals and have excellent electrical properties.

Some of the uses of engineering plastics are automobile bumpers and dash boards, pumps, valves and gears, drive shafts and transmission in heavy duty equipment.

References

1. Dryden C. E, *Outlines of Chemical technology – for the 21st Century*, 3rd edition, East-West Press (2004)

2. Austin G. T, *Shreve's Chemical Process Industries*, 5th edition, Mc Graw Hill International editions (1984)

Thank you