Nature of Invention: Process design

Applicant: ChemiEvolve Industries

Inventors: Akash Kumar Gupta(220095), Manas Dhakad(220610) ,Raj Patel(220860) , Adarsh Pal(220054)

Chemical Formula: $(C_6H_6O.CH_2O)_n$

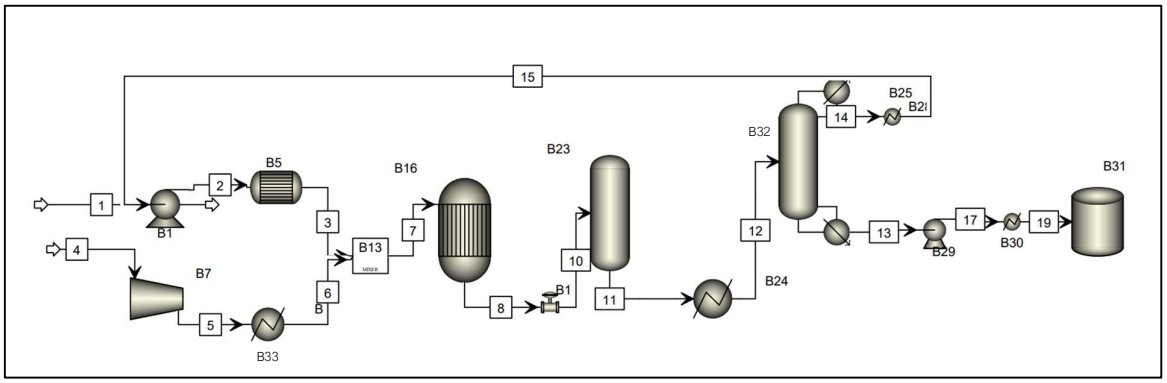
Chemical Name: Polyoxybenzylmethyleneglycolanhydride(Phenol-Formaldehyde Resin)

Process Title: Phenol Formaldehyde Resin Formation

Process Description:

Formaldehyde Formation:

Block Diagram:



Equipment Labelling

Pump: B_1, B_{29}

Mixer: B_{13}

Compressor: B_{17}

Heat Exchangers & Boilers: B_{24}, B_{30}, B_{28}, B_{25}, B_{30} ,B_{33}

Reactors: B_5 ,B_{16}

Distillation Column: B_{23} ,B_{32}

Storage: B_{31}

Process Conditions

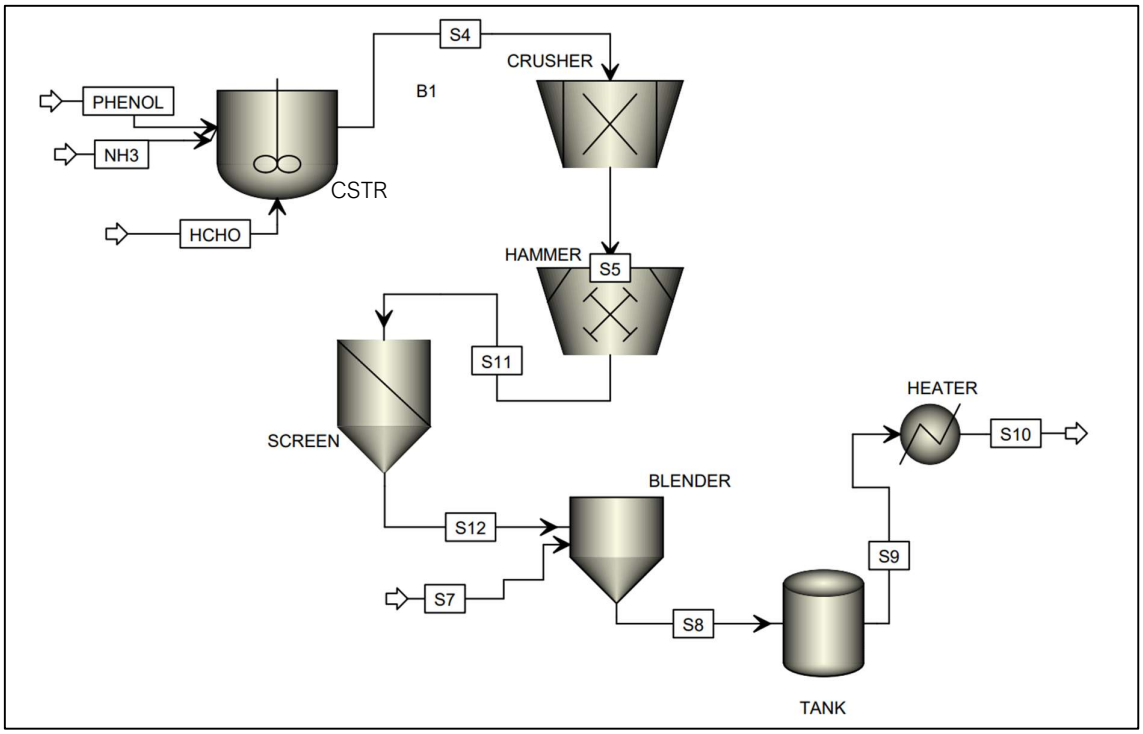
Overall Temperature range should be between 250-400°C.

Mass Balance & Stream Labelling

Stream No.	Component(s) (C)	Flow Rate (R)
1	Methanol	412 kg/day
15	Recycled Methanol	45.68 kg/day
2,3	Methanol	457.68 kg/day
4,5,6	Air	889.33 kg/day
7,8,10,11,12	Methanol + Air	1347.01 kg/day
13,17,19	Formaldehyde	386.88 kg/day
14	Methanol	46.1 kg/day

Bakelite Formation:

Block Diagram:



Process Conditions

Temperature: 60-100 °C and use reduced pressure conditions.

Mass Balance & Stream Labelling

Stream No.	Component(s) (C)	Flow Rate (R)
Phenol stream	Phenol	606.66 kg/day
NH3 stream	NH3	219.23 kg/day
HCHO stream	HCHO	386.88 kg/day
S4,S5,S11,S12	Phenol+NH3+HCHO	1212.77 kg/day
S7	Water	170.87-893.6 kg/day
S8,S9	S7+S12(blended)	1383.64-2106.37 kg/day
S10	Phenol Formaldehyde Resin	1000 kg/day

Capital cost (only for the reactor):

Reactors	Capacity (litre)	Cost ($)
For Formaldehyde	B5 Reactor of 578.32L and B16 of 1347L	26,200
For Bakelite Formation	1300 L	21,300
		Total cost = $47,500

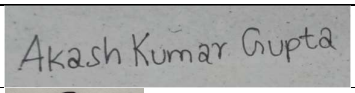
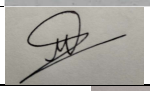
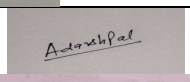
References:

1. http://www.matche.com/equipcost/Reactor.html

List the contributions of each author:

- **AKASH KUMAR GUPTA** and **ADARSH PAL** calculated the respective flow rates in the streams of the diagram and computed the capital cost of the reactors.
- **MANAS DHAKAD** and **RAJ PATEL** converted the lab scale design of the process flow into an industrial design design and performed the scale up process.

Sign the pdf and upload.

Name	Roll No	Signature
Aadityaamlan Panda	220007	
Akash Kumar Gupta	220095	
Manas Dhakad	220610	
Adarsh Pal	220054	
Raj Patel	220860