

Nature of Invention: Process design

Applicant: SynthoChem

Inventors: Vipin Kumar, Himanshu patel

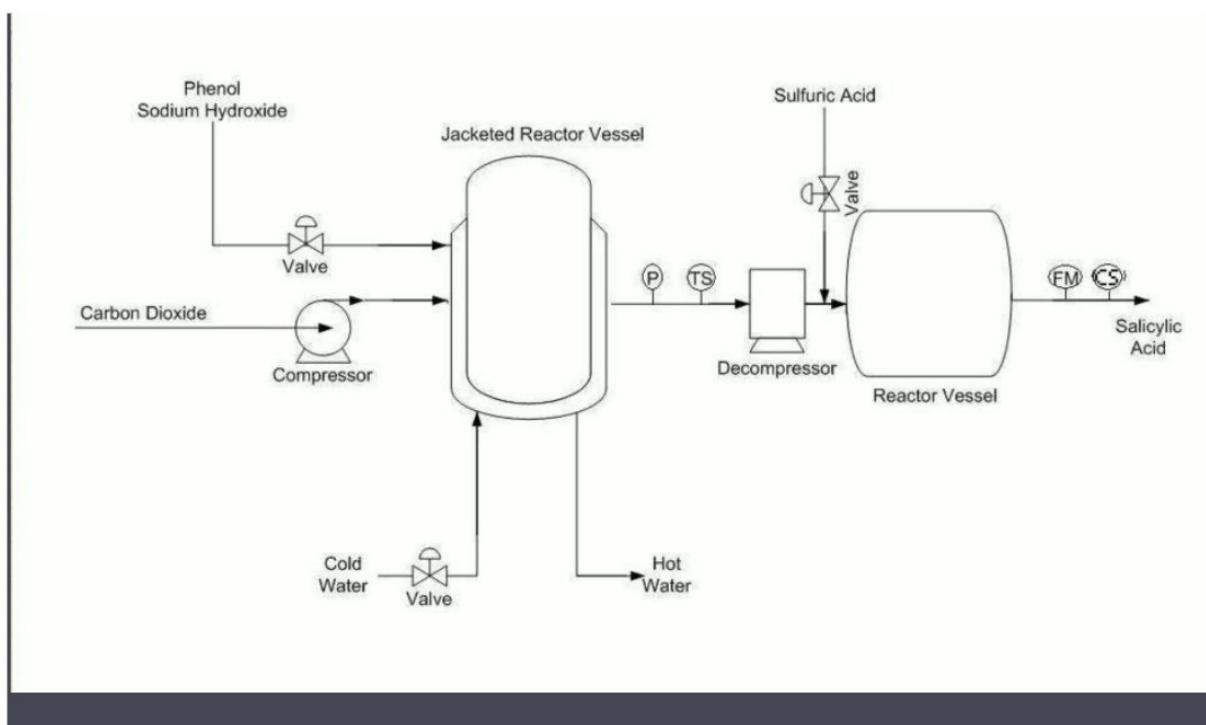
Chemical Formula: $C_7H_6O_3$

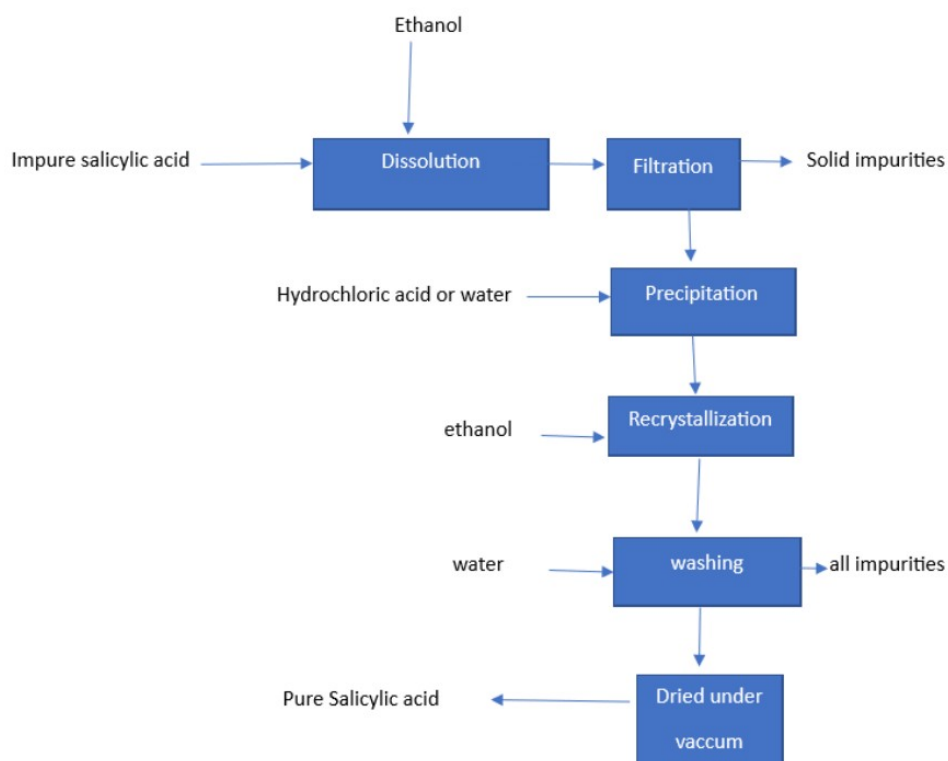
Chemical Name: Salicylic Acid

Process Title: Kolbe-Schmitt

Process Description:

- Give the block diagram for the feasible process (as determined in market analysis report).
List all unit operations and process conditions.





It involves several unit operations and process conditions, which are outlined below:

1. **Mixing:** Phenol and sodium hydroxide are mixed together in a suitable reactor or vessel. The ratio of phenol to sodium hydroxide can vary depending on the desired reaction conditions.
2. **Heating:** The reaction mixture is heated to a specific temperature, typically in the range of 80-150°C. The exact temperature may vary depending on the specific reaction conditions and catalyst used.
3. **Reaction:** The phenol and sodium hydroxide react to form sodium phenoxide, which then undergoes a decarboxylation reaction to yield salicylate.
4. **Cooling:** After the reaction is complete, the reaction mixture is cooled to room temperature. This may involve using a cooling jacket or other cooling methods to bring the temperature down to a safe handling range.
5. **Acidification:** The reaction mixture, which now contains salicylate, is acidified using a suitable acid, such as hydrochloric acid, to convert the salicylate to salicylic acid.
6. **Crude Salicylic Acid:** Obtained as a product of the Kolbe-Schmitt reaction may contain impurities.
7. **Dissolution:** The crude salicylic acid is dissolved in a suitable solvent ethanol to create a solution.
8. **Filtration:** The solution is filtered to separate the solid impurities from the dissolved salicylic acid.

9.Precipitation: A suitable precipitant, such as water or hydrochloric acid, is added to the filtered solution, causing the salicylic acid to precipitate out of the solution in the form of solid crystals, while impurities remain dissolved or separate as a separate phase.

10.Recristallization: The collected salicylic acid crystals may undergo recrystallization in a suitable solvent, such as ethanol, to further purify the product.

11.Washing: The separated salicylic acid may be washed with water or other solvents to remove impurities and residual reactants

12.Drying: The purified salicylic acid crystals are typically dried to remove any remaining solvent and moisture.

- b. Give the material balance for a scaled-up process plant with capacity of 1000 kg/day. (If needed, simplify the calculations by stating assumptions)

1.To produce 1000 kg of pure salicylic acid we need to produce 9043 mol=1247,943g

2.sulfuric acid required is=9043*0.5*98=443,352 g

3.phenol required is = 850,042 g

4.sodium hydroxide required =361,720 g

5.carbon di oxide required=397,892 g

- c. List the capacity of reactors needed and evaluate the cost. Use Glass lined Carbon steel (GS lined CS) as the material of construction (MOC). Use the pressure according to reaction conditions. You will use only 70% of the total volume. If you design a 1000 L reactor, you can only fill 700 L reaction mixture.

Capital cost (only for the reactor):

Equipment	Design Capacity (L)	No. of units	Cost/unit (in dollar)	Total Cost
Reactor 1 Jacketed reactor vessel	3500	1	45000	45000

Reactor 2	3000	1	9000	9000
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References: Provide reference for a research paper or an actual patent.

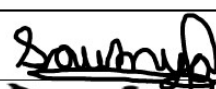
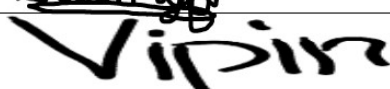
1. <http://www.matche.com/equipcost/Reactor.html>

List the contributions of each author:

Vipin Kumar- has done block diagram and listed all unit operations and process conditions.

Himanshu Patel- has done material balance and evaluated the cost and volume of reactor 1 and 2.

Sign the pdf and upload.

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