Self-production of Bisphenol-A and Raw Materials for Flame Retardant Applications

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1. Motivation and Goals

- Design a chemical plant to produce 200,000 MT/yr of bisphenol-A (BPA) and its raw materials (acetone and phenol)
- Shift Albemarle from purchasing BPA to self-producing it
- Evaluate the economic benefit of this shift

2. Applications of BPA

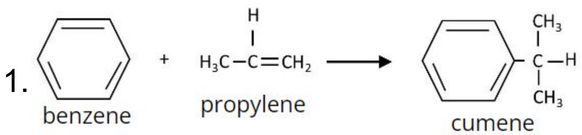
Acetone + Phenol ⟶ BPA ⟶ TBBPA

- TBBPA is a flame retardant used in: cell phones, vehicles, household appliances, etc

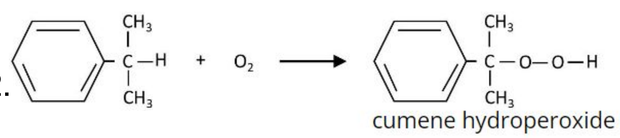
3. Reactions

Acetone and phenol production:

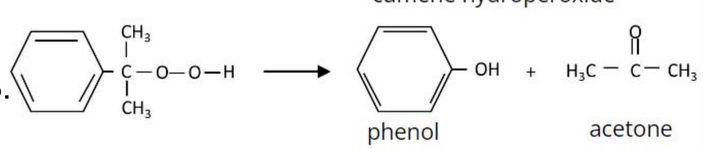
1. benzene + propylene ⟶ cumene



2. cumene + O_2 ⟶ cumene hydroperoxide

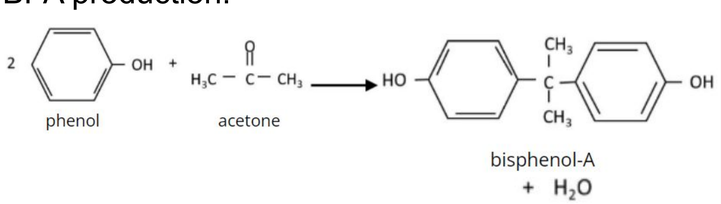


3. cumene hydroperoxide ⟶ phenol + acetone



BPA production:

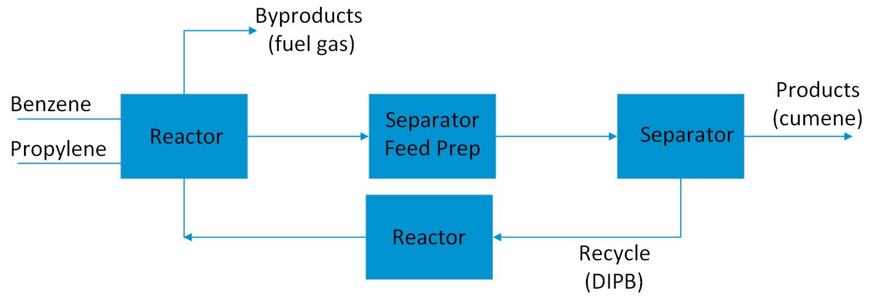
2 phenol + acetone ⟶ bisphenol-A + H_2O



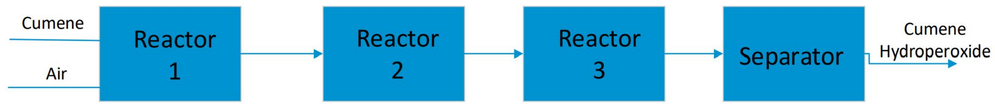
4. Processes Overview

Acetone and Phenol Production:

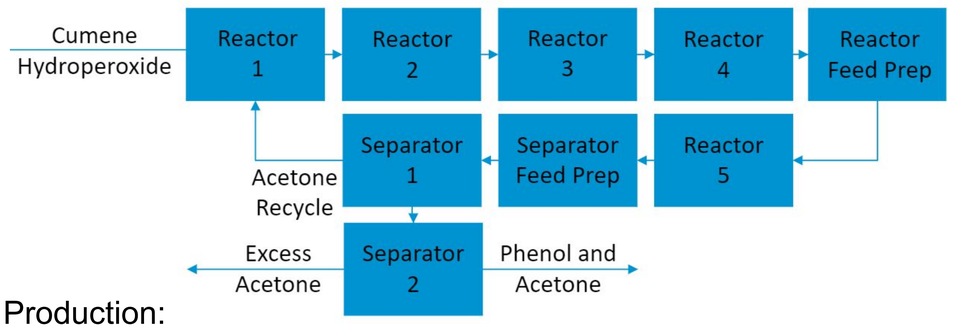
1. Cumene synthesis



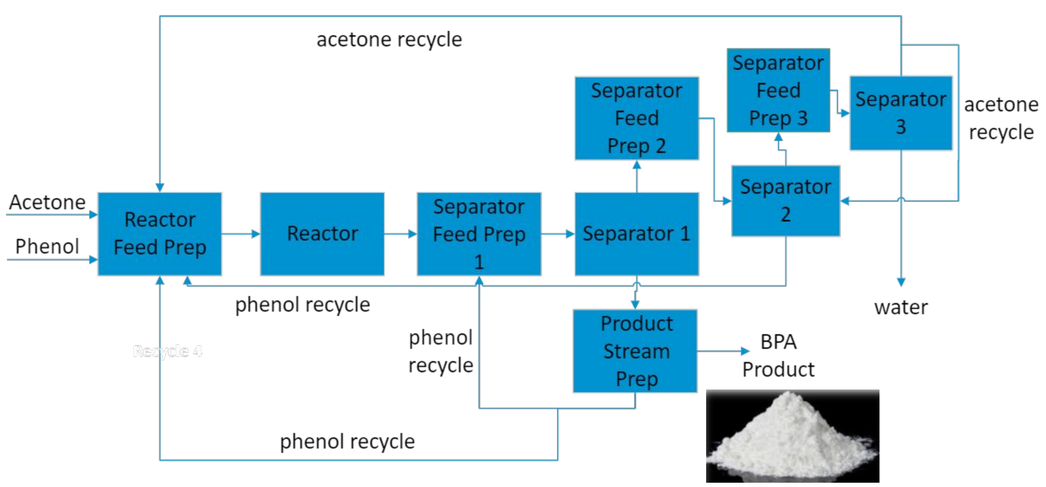
2. Cumene oxidation



3. Cumene hydroperoxide (CHP) Decomposition



BPA Production:



5. Economic Analysis

Cost of Manufacturing
$602MM/year

- Calculated based on raw material cost, labor cost, utilities cost, wastewater treatment cost, and maintenance cost

Gross Sales of BPA
$608MM/year

Gross Sales of Acetone
$30MM/year

- All excess acetone will be sold

Profit After Tax
$28MM/year

- Initial capital investment = **$82MM**
- Payback period = **3 years**

6. Sustainability

no GHG emissions

14.5MM MT/yr of water (utilities)

BPA/phenol environmentally toxic, use wastewater treatment

7. References