

Production of Phenol and Acetone by Cumene Cracking

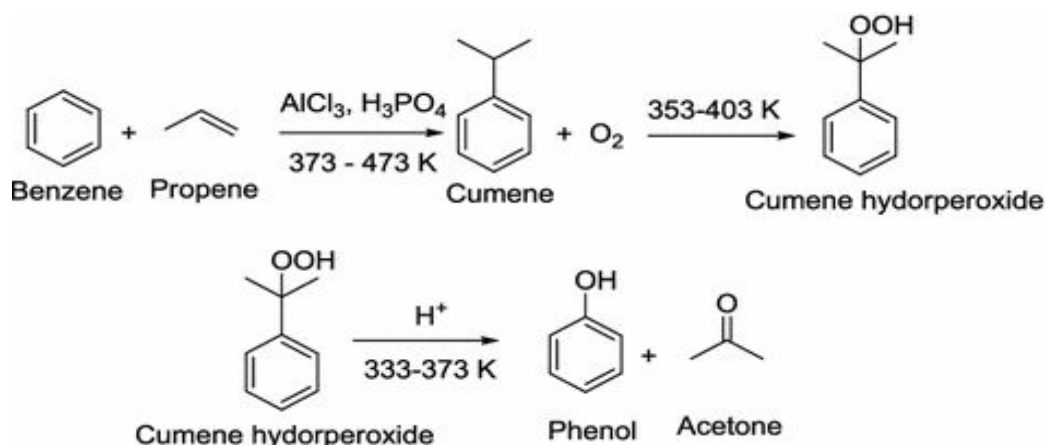
Aarsh Dodhia , Harsh Srivastava
Department of Chemical Engineering
Indian Institute of Technology, Bombay

Introduction

Cumene process is the most widely used process for generation of Acetone (it constitutes ~80-90% of production).

Raw Materials required: Cumene and oxygen.

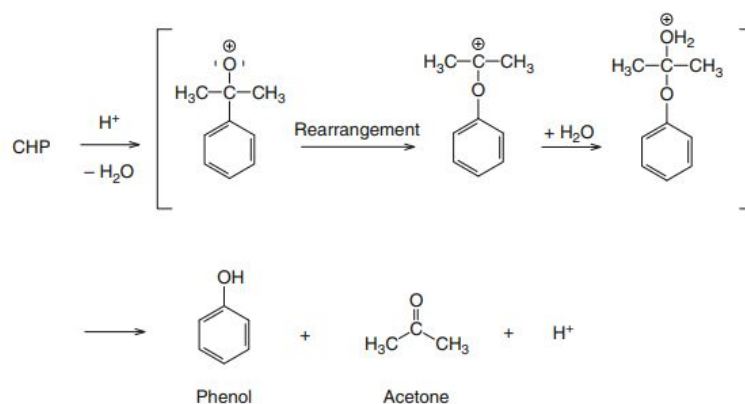
- Yield of acetone is higher than any other route (>99.7 wt%)
- Phenol is generated with Acetone, which can be sold separately.
- Intermediates like Ethyl Benzene, Propyl Benzene etc are formed and the plant is economical if the areas have a demand for phenol as well.



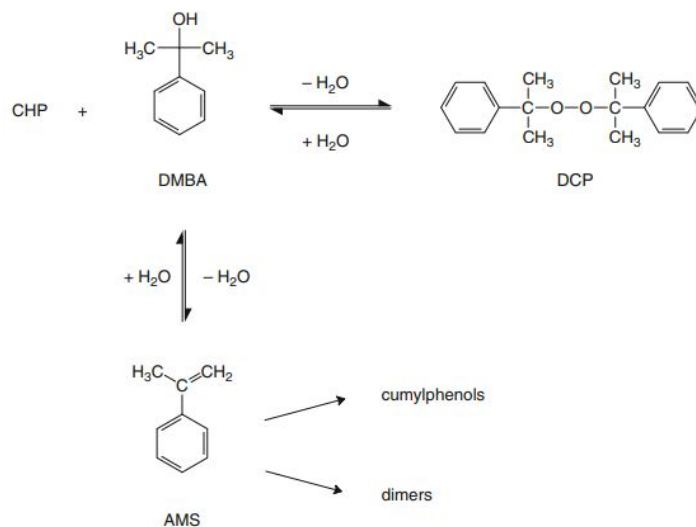
Oxidation of cumene to CHP in air/oxygen

- The reaction is autocatalyzed by CHP
- The exothermic reaction occurs at 80-120 C, 4 bar in bubble column reactors
- Several by-products like DMBA, ACP, MHP etc are formed
- Phenol is a strong inhibitor of oxidation reaction, thus recycle cumene must be completely free of phenol
- In cleavage section
 - CHP decomposes into phenol and acetone exothermically
 - DMBA gets dehydrated to AMS
- 6 distillation columns used to get high purity acetone & phenol

Mechanism of cleavage of CHP



Side reactions



- DCP converts to CHP and DMBA in the reactor, which gets cleaved
- Addition of NaPh stops all acid catalysed reactions of AMS
- AMS gets hydrogenated to cumene over Pd crystals in fixed bed reactor
- Cumylphenols, dimers and aldehydes are removed via distillation
- Acidic ion exchange resins used in fixed-bed phenol treatment reactor

References

- Weber M., Weber M. (2010) Phenols. In: Pilato L. (eds) Phenolic Resins: A Century of Progress. Springer, Berlin, Heidelberg