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Integrated Cumene-Phenol/Acetone/Bisphenol A- Part II: Phenol

PEP Review 2020-10

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Abstract

The dominant commercial production of phenol proceeds via cumene hydroperoxide (CHP) route. Over 95% of the world's phenol production is based on this technology and the rest is produced via toluene oxidation or recovered from coal tar.

The cumene oxidation (Hock process of 1944) consists of two fundamental chemical reactions: Firstly, cumene is oxidized with oxygen to become cumene hydroperoxide (CHP). Next, CHP is then cleaved to phenol and acetone by using a strong mineral acid as catalyst. In these early years, the cumene oxidation technology was based solely on wet oxidation since the 1960's. Then, dry oxidation was introduced. New plants today would use dry oxidation technologies because they are easier to control, operate, and require fewer numbers of equipments, as well as needing much lower consumption of chemicals and are more energy efficient.

Previously, Process Economics Program (PEP) report RW 2020-09 titled: *Integrated cumene-phenol/acetone/bisphenol A–Part I Cumene* was published April 2020, which covered the zeolite-base cumene technology by Badger process for 500,000 metric tons/yr. The economics from this report will be integrated with the cumene process, from RW 2020-09 and shown in the summary section 2 of this report. Then after this report, RW 2020-11 titled: *Integrated cumene-phenol/acetone-bisphenol A–Part III Bisphenol A* will be published. The final report of the series will represent the integrated value chain for all three technologies: *cumene-phenol/acetone-bisphenol A.* This report presents a detailed economic evaluation for phenol by KBR's (Kellogg Brown & Root, Inc.) Medium Pressure-Dry Oxidation process technology and KBR's Advanced Cleavage System.

The analysis and technoeconomic results that follow are based on a design capacity of 400,000 metric tons (2.4 million pounds) per year of phenol and approximately 246,000 metric tons (1.5 million) per year of acetone. While the capital and production cost results herein are presented on a US Gulf Coast basis, the accompanying iPEP Navigator Excel-based data module (available with the electronic version of this report) allows for results viewing for other major regions, along with conversion between English and metric unit.

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