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

PEP Review 2020-10
July 2020
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.
# Contents

1. **Introduction** 5

2. **Summary** 7
   - KBR’s Medium Pressure-Dry Oxidation phenol process technology and KBR’s Advanced Cleavage System 7
   - Cumene by Badger Process Technology 8

3. **Industry status** 12
   - Phenol 12
   - Acetone 13
     - KBR Recent License Awards 15

4. **Technology review** 17
   - History 17
   - Feed quality
     - Cumene 17
   - Product quality
     - Phenol 18
     - Acetone 18
     - Alpha-Methylstyrene product (optional) 19
   - Chemistry 19
   - Noncatalyzed radical chain oxidation 21
     - Thermal decomposition of cumene hydroperoxide 21
   - Oxidation of cumene 22
   - Process overview 23

5. **Economic evaluation—KBR phenol process** 25
   - Process description 25
     - Section 100—Cumene oxidation and concentration 25
     - Section 200—Cleavage and neutralization 26
     - Section 300—Product recovery 26
       - Acetone fractionation 26
       - Phenol fractionation and heavies removal 27
     - Section 400—Dephenolation 27
     - Section 500—Alpha-methyl styrene hydrogenation 27
   - Process discussion 34
     - Waste effluents 34
     - Vent system and emergency relief 35
     - Materials of construction and storage 35
   - Cost estimates 35
   - Capital costs 36
Tables

Table 2.1 Phenol from KBR process via Cumene from propylene by Badger process 9
Table 3.1 Grassroots phenol plants employing Licensed KBR Phenol Technology since 2000 16
Table 4.1 Cumene purchase quality 17
Table 4.2 Phenol product quality 18
Table 4.3 Acetone product quality 18
Table 4.4 Reaction and product recovery section 24
Table 5.1 Phenol by KBR process—Design basis 28
Table 5.2 Phenol by KBR process—Stream flows 29
Table 5.3 Phenol by KBR process—Major equipment 31
Table 5.4 Phenol by KBR process—Utilities summary 34
Table 5.5 Phenol by KBR process—Summary of waste streams 35
Table 5.6 Phenol by KBR process—Total capital investment 37
Table 5.7 Phenol by KBR process—Total capital investment by section 38
Table 5.7 Phenol by KBR process—Total capital investment by section (concluded) 39
Table 5.8 Phenol by KBR process—Variable costs 41
Table 5.9 Phenol by KBR process—Production costs 42
Table 5.10 Environment footprints for the KBR phenol process 44

Figures

Figure 1.1 Phenol and Acetone key components in cumene value chain 5
Figure 2.1 BFD of KBR Phenol process technology 7
Figure 2.2 Block flow diagram for Badger process 8
Figure 2.3 Production and Variable cost breakdown 11
Figure 3.1 World: 2019 phenol demand 12
Figure 3.2 World: 2019 phenol demand by region 13
Figure 3.3 World: 2019 acetone demand 14
Figure 3.4 World: 2019 acetone demand by region 15
Figure 4.1 Cumene oxidation’s side reactions 23
Figure 4.2 BFD of KBR Phenol process technology 24
Figure 5.1 Phenol by KBR process—Capital investment 40
Figure 5.2 Phenol by KBR process—Net production costs 43
Figure 5.3 Phenol by KBR process—Product value 43

Appendix D Figures

Figure 1 Section 100 Cumene Oxidation and Concentration 61
Figure 2 Section 200 Cleavage and Neutralization 62
Figure 3 Section 300 Product Recovery 63
Figure 4 Section 400 Dephnolation and Section 500 AMS Hydrogenation 64