Phenol Production by ExxonMobil 3-step Process

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Abstract

In 2017, the world demand for phenol was ~12.8 million tonnes. The three largest contributors to the worldwide capacity in 2017 were Northeast Asia, United States, and Western Europe. The largest end-use for phenol is in the manufacture of bisphenol A (BPA). Although it is under regulatory pressure for health and safety reasons, BPA is the key building block for making polycarbonate and epoxy resins. The next largest use for phenol is in the production of phenol–formaldehyde (PF) resins. PF resins are used primarily in wood adhesives, for example, for bonding the layers of plies in exterior plywood.

Since its commercialization in the early 1950s, the cumene hydroperoxide (CHP) process has become the dominant technology for phenol production. Well over 90% of the world phenol production is based on this technology. A drawback of this process is the substantial production of acetone coproduct. While well-established global markets for acetone exist, the demand for this coproduct has not always kept pace with the demand for phenol in certain regions. This has been a factor stimulating interest in new “non-coproduct” phenol technologies, which would produce phenol directly from benzene.

More recently, ExxonMobil has developed a 3-step route from benzene to phenol that co-produces cyclohexanone, which has excellent commercial value and market compared to acetone. This PEP review evaluates the ExxonMobil’s 3-step process for the production of phenol, using benzene as feedstock and provide the economics for the process at the US Gulf Coast. The process shows excellent product economics and higher product yield and could be the future phenol production process.

There is no commercial reference available yet for this process, our plant design and economics are based on the patent’s information and the author’s engineering judgement. This review also includes the market status assessment of supply and demand trends for phenol and cyclohexanone, with the iPEP Navigator tool attached to the electronic version of this review as well.

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