Abstract

Process Economics Program Report 34B

PHTHALIC ANHYDRIDE

(October 1998)

Worldwide consumption of phthalic anhydride (PA) reached 6.6 billion lb/yr in 1996, and is projected to reach 7.9 billion lb/yr by 2001. About 90% of consumption is concentrated in 3 major uses: (1) PA esters are widely used as plasticizers for polyvinyl chloride resins; (2) unsaturated (thermosetting) polyesters find major uses to fabricate fiberglass-reinforced parts such as boats and bath tubs; and (3) glycerol-phthalate alkyd resins are a widely used base for paints.

Since our first PA reports, PEP Report 34 (March 1968) and PEP Report 34A (June 1974), respectively, several aspects of PA production have changed: o-Xylene is now the major feedstock, whereas naphthalene's use as a feedstock has diminished to about 16% of the total. Catalyst improvements allow smaller reactors. Improvements in equipment and safety release device designs provide for safe operation within the explosive limits of the higher o-xylene loadings desired. And environmental concerns now require the addition of an exhaust gas incinerator.

Currently, almost all PA is manufactured by the single fixed bed oxidation reactor process with conventional switch condensers that collect PA as a solid, and fully developed technology is available for licensing from several sources.

We show that economic improvements over the fixed bed process are possible with (1) a dual fixed bed reactor design with o-xylene injection in between, and (2) a design in which PA is recovered as a liquid by using a eutectic of PA and maleic anhydride (MA) as the cooling/scrubbing fluid. In addition, we examine the technology for producing PA in a fluidized bed reactor (currently, not a practical option), and discuss the improvements needed in catalyst attrition resistance and life required for the process to compete with fixed bed technology.

The liquid recovery system requires less capital, has a lower product value, and produces more steam that is available for export than does the single fixed bed; the dual bed system offers an additional improvement in economies. Moreover, the effects of liquid recovery and dual bed systems appear to be additive if the systems are implemented in the same plant.

No commercial liquid recovery systems have been announced, but the dual reactor system has been, in part, commercialized by BASF and plans to commercialize a similar system have recently been announced by Nesté. We show that fluidized bed technology offers promise, and we quantify the additional catalyst improvements required to realize this potential.

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