IHS CHEMICAL

BP's PX Crystallization Process Offered by CB&I Lummus

PEP Review 2015-12

December 2015, Revised March 2016 **ihs.com**

PEP Review 2015-12
BP's PX Crystallization Process Offered by CB&I Lummus

Anthony Pavone
Sr. Principal Analyst

PEP Review 2015-12

BP's PX Crystallization Process offered by CB&I Lummus

Anthony Pavone, Sr. Principal Analyst

Abstract

Para xylene (PX) is a high-volume petrochemical monomer used primarily to produce purified terephthalic acid (PTA), which, in turn, is used to produce polyethylene terephthalate (PET), a polyester engineering resin. PET is used in chip form to produce blow-molded fabricated products such as water, juice, and cold beverage bottles, and in fiber form to produce textiles and industrial yarns. IHS estimated annual global production of high-purity PX in 2015 to be approximately 37 million metric tons [1].

PX is produced in dilute form industrially by the refinery catalytic reforming process, using liquid feedstocks such as wide-range naphtha, and by the chemical steam cracking process, using feedstocks including a combination of ethane, propane, n-butane, light virgin naphtha, and atmospheric gas oil. Newer technology has been commercialized for steam cracking using whole crude oil.

PX is produced in dilute form, then extracted and distilled into a mixed stream of aromatic C_8 xylene isomers—para xylene, ortho xylene (OX), and meta xylene (MX), plus C_8 ethylbenzene (EB)—which must be separated and purified to satisfy production and sales specifications for PX. PX is commercially offered in purities exceeding 99%. The mixed and dilute aromatic-rich streams from catalytic reforming and steam cracking are separated from nonxylenes and other principal aromatic components by a combination of fractional distillation (to remove benzene, toluene, and C_9+), and liquid-liquid extraction (to separate aromatics from nonaromatic alkanes and naphthenics). Due to the close boiling points of the three xylene monomers, fractional distillation is not an economically viable means to produce high-purity PX. Ortho xylene can be distilled from a mixture of meta xylene and para xylene. However, para xylene is purified from meta xylene, ortho xylene, and ethylbenzene via either molecular sieve adsorption or low-temperature suspension crystallization.

The PX molecular sieve adsorption method offered by UOP (Des Plains, IL, USA), and its licensed Parex™ technology, is the dominant commercial process for purifying PX. Other adsorption-based processes are offered by Axens and Toray. Crystallization-based PX purification technologies are offered under license by BP (formerly British Petroleum), GTC Corporation, and Chevron-Phillips. This report presents our understanding of the current generation (as of 2015) of BP crystallization technology, which claims significant economic improvements via reduced energy consumption and lower capital cost. The BP PX crystallization technology is offered by CB&I (formerly Chicago Bridge and Iron) Lummus, which signed an exclusive contract with BP in 2010.

The BP single-stage crystallization technology provided by the new BP process reduces refrigeration energy consumption by avoiding the remelting and recrystallization required by former processes, and presents a total process flow sheet with lower equipment count, and therefore lower capital cost.

Contents

Tables

Figures

Process flow diagrams

1 Introduction

IHS Customer Care:

Americas: +1 800 IHS CARE (+1 800 447 2273); CustomerCare@ihs.com
Europe, Middle East, and Africa: +44 (0) 1344 328 300; Customer.Support@ihs.com
Asia and the Pacific Rim: +604 291 3600; SupportAPAC@ihs.com