Economic Recovery of meta-Xylene

MANFRED STEPANSKI
URS HALLER
SULZER CHEMTECH

The demand for meta-xylene (m-xylene) is rising worldwide, because this compound is being used increasingly for the manufacture of the PET plastic. Sulzer Chemtech now offers an overall solution – a combination of distillation and crystallization – for the recovery of m-xylene from xylene mixtures rich in m-xylene.

1■ As a result of the increasing call for PET bottles, the demand for m-xylene (Photo: Crystals) is rising 10 to 15% per year.

In terms of world consumption, mixed xylenes are ranked second to benzene as the most important aromatic product for chemical manufacture. The typical, resulting mixture consists of the three isomers – ortho-, meta-, para-xylene – and ethyl benzene.

m-Xylene is consumed primarily for the production of isophthalic acid (IPA), which is being employed increasingly as a co-polymer in the manufacture of PET-plastic bottles (Fig. 1■). At present, the worldwide production of m-xylene is approximately 450 000 t per year. Up to now, the building of new m-xylene capacity was more of a problem than building IPA capacity, because it was extremely difficult to separate m-xylene economically.

Sulzer Chemtech has now developed an economic process for the recovery of m-xylene, which is based on the environment-friendly melt crystallization technology. The m-xylene product recovered from the mixed xylene has a purity of 99.5%.

DISTILLATION AND CRYSTALLIZATION

The process developed by Sulzer Chemtech for the purification of m-xylene is a combination of distillation and crystallization (Fig. 2■). To begin with, ethyl benzene with a purity of 99.6% is separated from the parent substance, a xylene mixture rich in m-xylene, by means of distillation. The ethyl benzene concentrates preferably in

the vapour phase and is collected as top product. The xylene-isomers remain in the sump and are routed further to the next distillation column. In the second distillative separation, the remaining light-boiling components are removed at the head of the distillation column. The higher-boiling xylenes from the sump are fed to the last column, in which the m-xylene is concentrated. The concentrated m-xylene vapours at the head of the column are condensed, cooled and pumped to the crystallization section.

This part of the plant is equipped with two static crystallizers, which operate batch-wise in an alternating mode. They feature a number of vertical plates, which are heated or cooled by an internal circulation of heat transfer medium. The plates are suspended in the melt to be purified. As soon as the crystallization operation is initiated, m-xylene crystals nucleate on the outer surface of the plates. Impurities are rejected by the growing crystals and concentrated in the remaining melt, which is drained off at the end of crystallization.

The purer crystalline layer remains adhered to the plates. It is purified further by means of "sweating", i.e. through gentle heating close to its melting point. The desired product purity can be reached in a single crystallization step.

A PROVEN SUCCESS FOR NUMEROUS COMPOUNDS

The melt crystallization process from Sulzer Chemtech is a proven technology for numerous organic chemicals, e.g. p-xylene, acrylic acid, bisphenol A, isocynates or paraffin waxes. At the same time, there is no need for any solid adsorbents, solvents, catalysts or chemicals. Furthermore, the plant is designed for zero emissions.

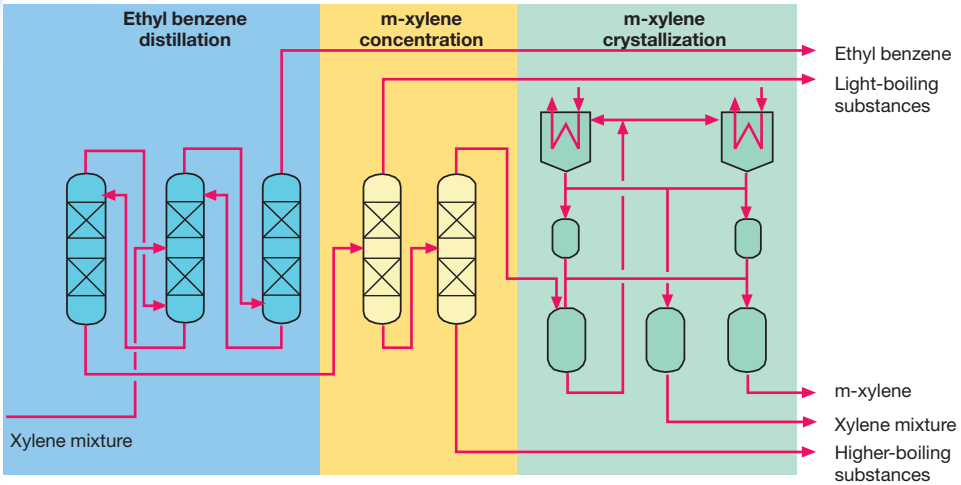
Thanks to the low pressure drop, distillation columns equipped with modern structured packings from Sulzer Chemtech facilitate efficient separation. As a result of heat integration and the optimum combination of distillation and crystallization, the operating and investment costs for such a plant are low and can be paid back within a very short time.

RELIABLE PREDICTIONS

The process design of melt crystallization plants is always based on pilot tests. Since the crystallizer consists of a row of vertically arranged crystallization elements which work under identical conditions, total similarity with regard to geometry and hydrodynamics, as well as heat and mass transfer is assured. Predictions for the full-scale employment can be made on the basis of pilot tests with just two of these elements. Extensive pilot tests have been conducted successfully for m-xylene. Marketing of the technology has commenced in the meantime. Ω

FOR MORE DETAILS

Sulzer Chemtech AG
Manfred Stepanski
Postfach
CH-9470 Buchs
Switzerland
Telephone +41 (0)81-755 45 27
Fax +41 (0)81-755 45 00
E-mail manfred.stepanski@sulzer.com



2■ *The process developed by Sulzer Chemtech for the purification of m-xylene is characterized by three steps: separation of ethyl benzene, concentration of m-xylene and the purification of m-xylene.*