Choice of the Process

This process is named the ISOMAR process and has been patented by the UOP (Universal Oil Products) Process Division. Slightly differing processes, a brief review of which will be provided later, are also in vogue. ISOMAR involves the distillation of o- xylene from the other xylenes and then crystallizing the p-xylene. The spent mother liquor is then sent to an isomerization reactor where under high pressure of hydrogen, and in the presence of a catalyst and a high temperature, m- xylene and ethyl benzene are converted to p- xylene and o-xylene. The feed may be of any C_8 aromatic mixture, e.g. from catalytic refromates or from pyrolysis gasoline. The feed (preferably catalytic reformate since it is composed of a lower ethyl benzene composition) is sent into the first pre-fractionators where a C_8-C_9 cut is taken as the bottoms and this feed is then sent to another pre – fractionator to remove most of the C_9^+ compounds as the bottoms. The boiling point difference between o- xylene and the other isomers is then exploited to get a bottom fraction consisting of mainly C_9 and o- xylene. The C_9 impurities are mainly trimethylbenzene. The C_9 compounds and the o- xylene are then sent to another fractionator where pure o- xylene is taken as the distillate and the C_9 compounds form the residue. The distillate from the first fractionator contains all the xylene isomers and must be processed for the extraction o p- xylene. This is achieved by crystallizing the xylene mixture by any of the commercially available crystallization procedures; like Krupp-Kopper's GMBH or ARCO's process. The Krupp-Kropper's process involves a two-stage crystallization process to produce 99% pure p-xylene. The catalyst used for obtaining of the p-xylene is platinum metal under hydrogen pressure (Engelhard-Atlantic Octafining). The temperature maintained is 425^0 C as it is a temperature that the p- xylene and the o- xylene concentration are highest. The

catalyst is prepared by mixing equal amounts of silica-alumina cracking catalyst with platinized alumina.

The catalyst can be regenerated at least once by controlled combustion of the carbon, which accumulated over the life of the run.

Various other processes that differ slightly are in use. For e.g.: those patented by Maruzen Oil Co., Mitsubishi Gas Chemical Co., ARCO technology inc. various other commercial processes involve variations in the type of crystallizer or in the type of crystallizer or in the catalysts and the reactor conditions, E.g.: Atlantic Richfield Co. Transalkylation of xylenes occurs under more severe conditions and is catalysed by acid. In this case, methyl migration is intermolecular and ultimately produces benzene and hexamethylbenzene.

Xylene isomerization (ISOMAR) - UOP PROCESS DIVISION

Application: Any non–equilibrium mixture of C_8 aromatics is efficiently isomerised toward equilibrium. The desired isomer (or isomers) is separated from the reactor effluent and the remainder recycled for ultimate yield.

Charge: The feedstock may be of any C_8 aromatic mixture; e.g., from catalytic reformates or from pyrolysis gasoline. The latter often contains as high as 40% ethyl benzene, which is no detriment to the operation. Feedstocks may be pure solvent extracts or fractional heart-cuts containing as high as 25% saturates. Hydrogen supply may be from catalytic reforming or any other suitable source. Chemical hydrogen consumption is minor.

Products: The purity of the product, usually para- or ortho-xylene, or both, depends primarily on the separation procedures involved. The ISOMAR process is readily adaptable to yielding pure para-xylene when coupled with a UOP parex process unit, or with conventional crystallization, and ortho-xylene of

standard purity when coupled with efficient fractionation. Even when saturates in the feedstock are high, o-xylene purity of 99% plus may be met.

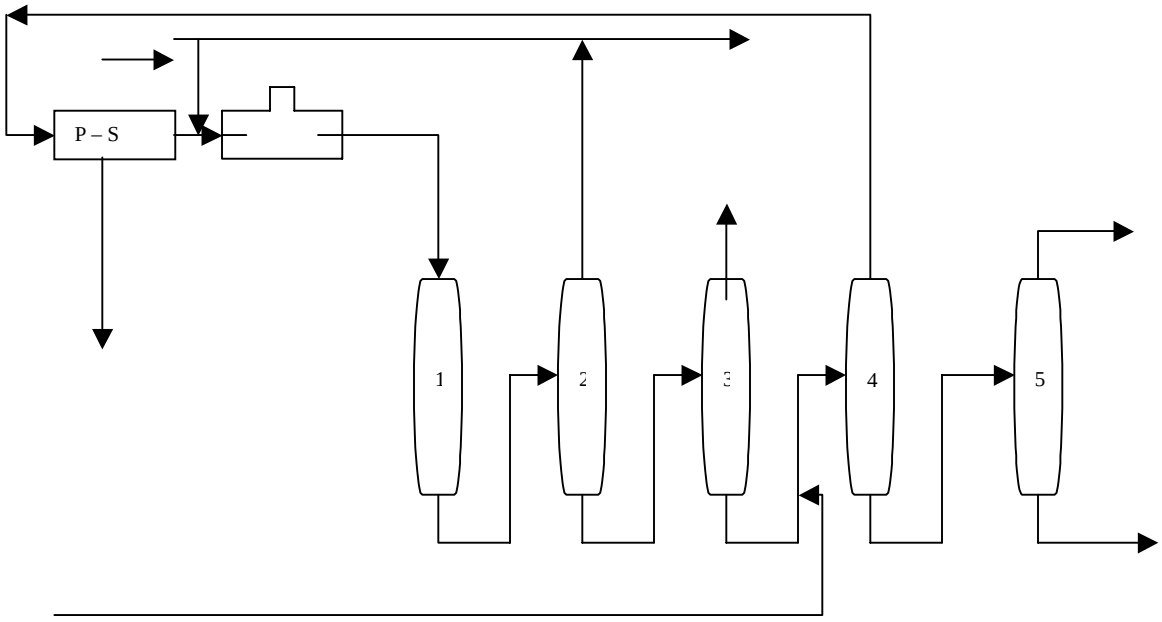
Process description: C8 aromatic reactor fed, deficient in one or more component relative to equilibrium composition, is processed over a fixed bed of catalyst in the presence of hydrogen. The liquid portion of the effluent is fractionated to remove both light and heavy aromatic by-products as well as the cracked materials resulting from inclusion of saturates in the feed. Para-xylene and/or ortho –xylene are separated from the resulting fractionation hear-cut, thereby preparing a recycle material to the ISOMAR rector. Fresh feedstock is introduced into the circuit in the most appropriate place.

Operating conditions: Temperature and pressures are moderate, permitting the use of carbon steel and other conventional equipment,

Yields*:* The following represents typical yields for two commercial operation cases: (a) with both o-xylene and p-xylene recovery; (b) with only p-xylene recovery.

Feed Composition	**(a) Wt. Units**	**(b) Wt. Units**
Ethyl benzene	17.3	17.1
P-Xylene	17.6	20.3
M-Xylene	43.3	40.9
O-Xylene	21.8	21.7
Product yield		
o-xylene	37.2	0.0
p-xylene	54.6	83.2

FLOW SHEET FOR O-XYLENE PLANT



1-5 ---------- Separation Columns

GP---------- Gas Purge

O-X---------- Ortho Xylene

Tmb ---------- Tri methyl Benzene

IR---------- Isomar Reactor

P-S ---------- Parex Saperator

R ---------- Recycle

Uses of Xylenes and Ethyl benzene

Xylenes find varied uses in the chemical industry. A mixture of para, meta and ortho xylenes is used in the production of isophthalic acid and terephthalic acid. Given the diverse uses of xylenes, and their special importance in the polymer industry, their importance can be hardly over exaggerated. Of all the xylenes, para- and ortho- xylenes are commercially the most important xylenes and together for nearly 80% of the total output. O- xylene is a less expensive starting material for the production of phthalic anhydride and offers a higher yield potential. Meta - xylene is further reacted and processed to give isophthalic acid that finds its final uses in polyester resins and alkyl resins. Ethyl benzene is directly used for the production of styrene, which finds its final uses in SBR, polystyrene plastics, S-B copolymers, styrene-divinylbenzene copolymers, styrene-alkyl polyesters and styrene-acrylonitrile plastics. Para-xylene is used in the production of terephthalic acid and dim ethyl terephthalate that find their ultimate use in the polyester resins. m-xylene, whose consumption is quite small, is used in producing isophthalic acid.