PERP Program
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Isoprene (98/99S2)

The global market for isoprene was greater than 600,000 tons for 1998 including the Former Soviet Union (FSU). The size of the non-FSU market is about 320,000 tons dominated by polyisoprene which accounts for about 50 percent of demand. Thermoplastic elastomers, SIS/SEPS, will drive isoprene growth over the short to medium term. In the world, excluding the FSU, demand growth is likely to be of the order of four percent per annum once East Asia has recovered from its recent economic turmoil.

The post Second World War period saw a number of developments in isoprene technology. Feedstocks included isobutylene/formaldehyde, isoamylenes, propylene, acetylene, etc. Extraction from the steam cracker C_5 stream was a relatively late development. The driver for isoprene development was the belief that natural rubber would be in short supply and a synthetic equivalent, polyisoprene was needed. However, natural rubber supply has become more abundant. Rubber prices fell and certain polyisoprene/isoprene plants were forced to close. Today extraction, isobutylene/formaldehyde and dehydrogenation (FSU only) are the only commercial technologies in operation.

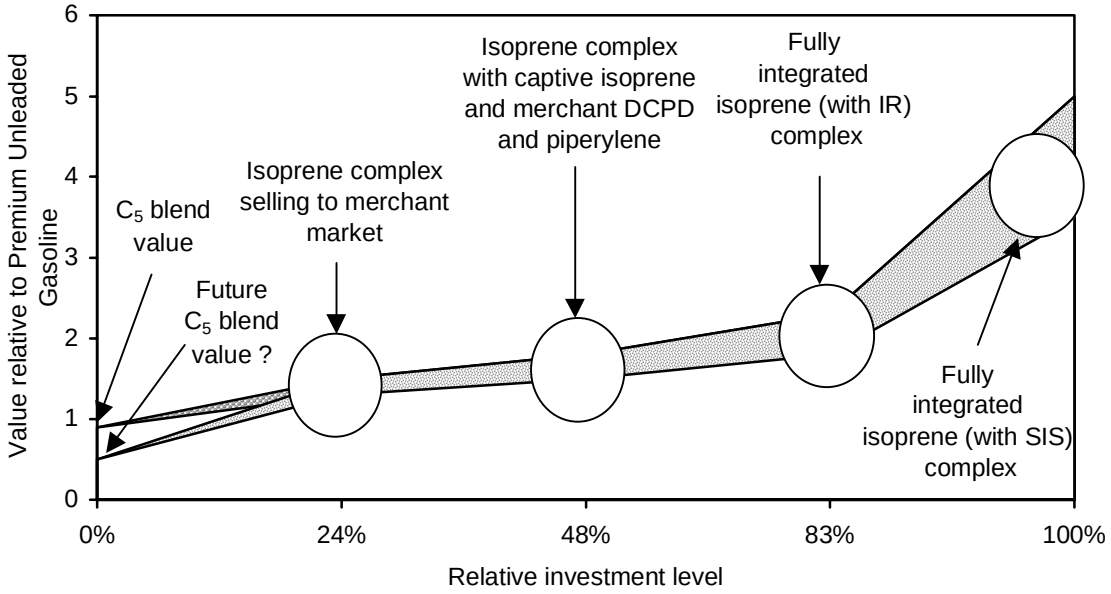
A fully integrated isoprene extraction plant is the lowest cost process. However, extraction economics are very heavily dependent on co-product credits for DCPD, piperylene and C_5 raffinate.

The market is heavily captive, but there may be room for more producers under the right circumstances. Firstly a reliable, large supply of unsaturated C_5 stream is needed and so the plant needs to linked to a world-scale naphtha cracker with access to C_5 stream imports. There are opportunities in Europe and Asia for such a plant provided the product can find a market. There may also be a case for synthetic isoprene, again in the right situation.

Unlike butadiene, isoprene remains an untapped resource. For those already in the C_5 business it can provide a good source of added value for a cracker operator with appropriate downstream interests.

The figure below illustrates schematically the kind of value that can be added to this stream through processing to obtain isoprene, DCPD, piperylene and derivatives. A plant dedicated to merchant sales of isoprene and DCPD, could obtain an effective C_5 value of 1.3xPMG. A fully integrated complex could obtain a much higher effective value for the stream. Thus appropriate use of the C_5 steam can provide additional value for the steam cracker and the ethylene margin.

FIGURE I.F.1
POTENTIAL VALUE ADDED TO THE CRACKER C_5 STREAM THROUGH ISOPRENE EXTRACTION



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This report examines the production economics for several routes to isoprene. In addition the costs of production for many isoprene derivatives are presented.

Isoprene Routes

Extraction from C5 Stream
Isopentane Dehydrogenation
Isobutylene Carbonylation
Acetylene-Based
Isoamylene Dehydrogenation
MTBE Oxidation
Dehydration of 2-methylbutanal

Isoprene Derivatives

CIS-Polyisoprene
SIS
Butyl Rubber
SEPS

Isoprene supply/demand outlook to the year 2020 are given for the U.S., Western Europe, Eastern Europe, and Japan.