PERP Program
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Chem Systems' Process Evaluation/Research Planning program has published a new report, ***Hydrocarbon Resins (99/00S10)***.

Hydrocarbon resins are low molecular weight amorphous polymers with low softening temperatures and exhibit “Tack”. The global market for hydrocarbon resins in total is around 3 million tons for the year 2000 of which around 850 000 tons are synthetic resins. Natural resins, e.g. rosins and terpenes, can be wood derived while synthetic resins are derived from petrochemical streams (C_5, C_9+) and coal tar.

Synthetic hydrocarbon resins are termed aliphatic (C_5 derived), aromatic (C_9 derived) or waterwhite (mainly hydrogenated) grades. The synthetic resin market as a whole is growing at around 3.6 percent per year on average. The market is dominated by the developed economies although Asia is becoming more important.

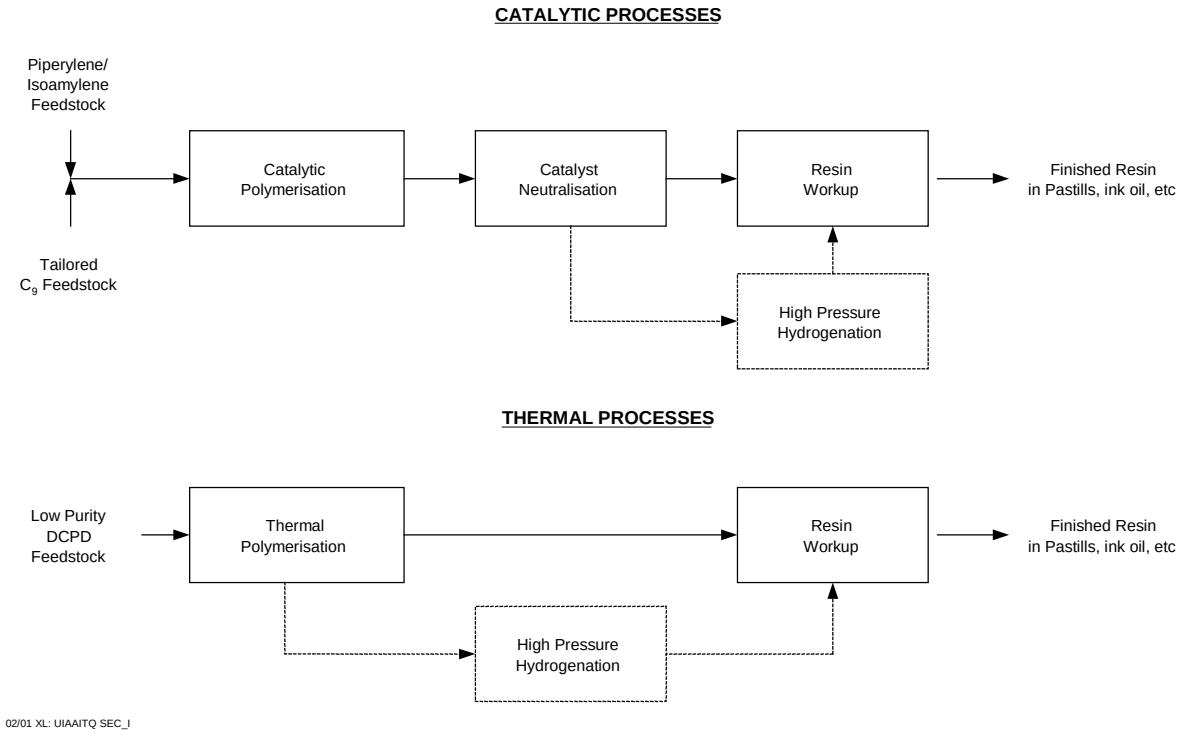
Resin technology is based mainly on Lewis acid catalyzed/cationic polymerization and can be followed by hydrogenation to improve properties such a color and saturation. Cyclopentadiene resins are produced via thermal processes. Production cash costs for a Q3/2000 USGC basis range from $740 per ton for commodities (aromatic) to $820 per ton for waterwhite (integrated basis). Speciality grades based on pure monomers cost $2,000 per ton to produce. Capital investment ranges from $60 millions for 40,000 tons per year for aliphatic resins to $38 million for waterwhite resins due to the high investment associated with high pressure hydrogenation. However, at the time of publication, margins and returns are reasonable, especially for integrated producers with waterwhite grades.

Exxon is the world leader in synthetic resins in this increasingly global business with capacity in the US, Western Europe, Japan and recently China. Other major producers include Hercules, Neville, Eastman and Nippon Zeon. Different producers have access to different feedstocks and this dictates the markets they participate in, namely: adhesives, printing inks, coatings, rubber and plastics compounding and a whole host of miscellaneous applications. Hydrocarbon resins are rarely used alone and usually in small but important quantities.

Hydrocarbon resins can provide the steam cracker with a high value added option for upgrading C_5 and C_9+ streams. Investments in DCPD and C_9 removal are modest and can give rise to relatively high values for these streams on a cash breakeven basis when coupled with downstream resin production. DCPD extraction with waterwhite resin production is likely to provide better returns than a full C_5 complex with isoprene, DCPD and piperylene consumed captively.

The figure below illustrates two basic philosophies in hydrocarbon resin production, namely catalytic and thermal processes. DCPD containing streams react by thermal treatments to produce polymers with terminal unsaturation. DCPD resins can be stabilized by high pressure hydrogenation and the result is a waterwhite resin. Catalytic processes involve Lewis acid catalyzed cationic polymerizations. Some resin systems use two catalytic stages to impart specific properties. Resin containing streams must then be treated with alkali to neutralize entrained catalysts. Resin work-up involves settling tanks to separate polymer from an aqueous phase containing alkali and neutralized catalyst residues. In both cases careful distillation is generally used to remove solvents and unreacted hydrocarbons. Resins can be made in solid form as pastilles, liquid forms, solutions in ink oil, etc.

SCHEMATIC HYDROCARBON RESIN PROCESSES



The process technology, production economics, and markets for aliphatic, aromatic, C_5-C_9, cycloaliphatic resins and their hydrogenated derivatives are presented in this new PERP report.