

Abstract
Process Economics Program Report 88B
ALKYLATION FOR MOTOR FUELS
(June 2001)

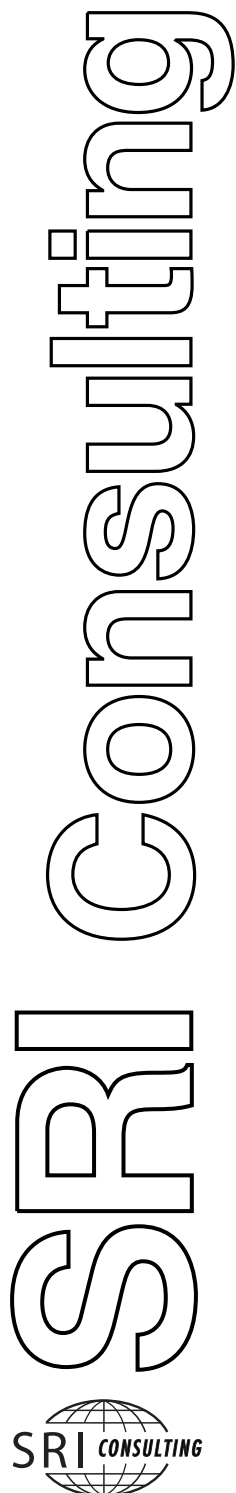
The catalytic addition reaction of isobutane with light olefins to form highly branched paraffins is the alkylation process employed in the petroleum refining industry to produce a gasoline blending component called alkylate. Commercial alkylation catalysts are sulfuric acid or hydrofluoric acid. The C₅+ highly branched paraffins have very desirable qualities that make alkylate a premium blending stock, especially favored environmentally.

The prospects for alkylate demand for gasoline continue to grow, driven by the increasing demand for gasoline and influenced by contrary environmental needs. On the one hand, the reduction in gasoline specifications for aromatic, olefins and sulfur contents and for lower volatility (Reid vapor pressure) are potentially creating huge demand for high octane alkylate. Additional demand is being created by the ban on MTBE in California and potentially elsewhere. On the other hand, perceived environmental and safety risks involved in handling HF and sulfuric acid catalysts are restricting influences.

A combination of industry efforts has reduced the risks of HF release. Equipment has less acid inventory and a lower probability of release. Additional mitigation equipment can be installed and improved procedures implemented. Risk is further reduced by quick acid dump systems. Phillips has successfully commercialized the ReVAP process developed with Mobil that uses a new HF catalyst containing a proprietary vapor pressure reduction additive that inherently reduces risk both at the plant and during transportation. Two plants are licensed in California. UOP is offering for license a solid acid alkylation process, the Alkylene™ Process, that avoids the problems of both liquid acids.

Butylenes are the predominant alkylation olefins. Some propylene is alkylated along with the butylene. Amylenes are less attractive but can be successfully alkylated if contaminants, mainly diolefins, are selective hydrogenated and cyclopentene kept out of the amylene distillation cut. STRATCO has developed a sulfuric acid process that improves the economics of alkylating propylene and amylenes. With the changes in gasoline specifications, also alkylating some amylene is an increasingly more attractive option to provide high octane gasoline stock.

The report presents an overview of the alkylation market environment, technology development, and economics since PEP Report 88A, *Alkylation for Motor Fuels*, issued in 1993. The report will be of value to people involved in planning refining investments or research and development as well as those involved with planning, managing, operating or designing existing alkylation plants. This report will be especially of value to refiners worldwide who have to respond to the markets demand for cleaner fuels and safer processes.



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