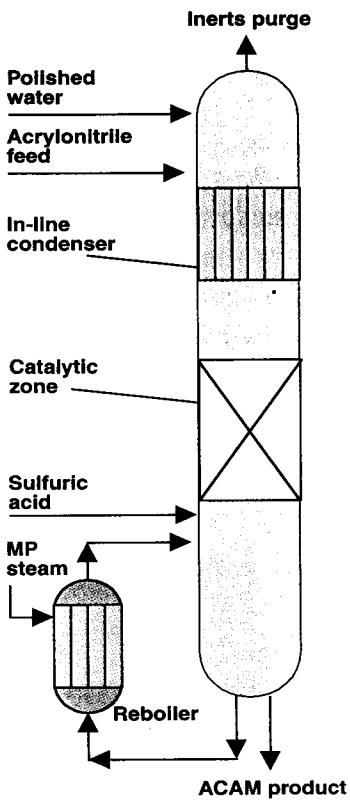
CHEMENTATOR

Commercialization is set for a one-step route to acrylamide

A one-step process for making acrylamide from acrylonitrile has been developed by Sasol Ltd. (Johannesburg, South Africa) in conjunction with Catalytic Distillation Technologies (CDTech; Houston; **abb.com /lummus**). A 5,000-m.t./yr commercial plant is in the design phase, with startup scheduled for 2002. CDTech is offering the process for license.

The chemistry is conventional in that it involves the hydrolysis of acrylonitrile on a copper oxide catalyst. The reaction is done by catalytic distillation and yields an aqueous solution of 35–50 wt.% acrylamide (ACAM), with no byproducts, says Thomas Hickey, deputy managing director. In contrast, the standard, fixed-bed route uses three reactor stages and produces a solution of about 20 wt.% ACAM and 4 wt.% unreacted acrylonitrile, which must be purified and concentrated to 50% ACAM for the market. It also produces unwanted polyacrylamide and acrylic acid.

In CDTech's method, acrylonitrile and demineralized water are fed into the top of the column and fall into the reaction zone — proprietary packing bearing the catalyst, located in the middle of the column. H_2SO_4 is pumped into the bottom to control the pH and inhibit polymerization in the reboiler. Byproduct formation is avoided by the short residence time, says Hickey. The heavier ACAM falls as soon as it forms and is removed from the bottom of the column, while unreacted material circulates in the upper zone until it is converted. Hickey says the capital cost is about half that of a new, fixed-bed unit, while the operating cost is about 25% lower.



A simpler route to isobutylene

The standard method for obtaining high-purity (99.9%+) isobutylene from its fellow olefins in a mixed-C_4 stream starts with the production of methyl *tert*-butyl ether (MTBE), made by reacting isobutylene with methanol. The isobutylene is recovered by "back-reacting" to its component parts. Since the MTBE reaction is very selective for isobutylene, the resultant product is very pure.

Now, CDTech (see previous item) has developed a more straightforward method that costs about 30% less than the MTBE route, says Timothy McGuirk, a principal engineer. The feed, a C_4 stream from an ethylene cracker, is hydrogenated to cut the butadienes content to about 1%. The stream is then fractionated by catalytic distillation, to separate the lighter isobutylene from heavier normal butenes.

The critical part is the separation of the isobutylene from 1-butene, its close-boiling cousin. This is done by isomerizing 1-butene to heavier 2-butene in the column, using a standard hydrogenation catalyst. A drawback is that the isobutylene is typically only 90–94% pure, since it contains isobutane and a trace amount of 1-butene. However, McGuirk says that while this makes the isobutylene unsuitable for butyl rubber, it can be processed to polyisobutylene or polybutylene, which are used to control viscosity in lubricants and other products.

Protest greets EPA's 15-ppm sulfur rule for diesel fuel

The long-awaited U.S. regulation on the sulfur content of diesel fuel has finally been issued by the Environmental Protection Agency (EPA; Washington, D.C.). Scheduled to take effect in June 2006, it will require a sulfur content of only 15 parts per million (ppm), down from the current level of 500 ppm. EPA estimates the requirement could raise the cost of diesel fuel by 4–5¢/gal. Refiners have the option of producing 20% of their diesel fuel as 500-ppm fuel until Dec. 31, 2009, and of participating with neighboring refiners in an averaging, banking and trading program.

Simultaneously, the Agency issued new regulations that call for producers of diesel-powered trucks and buses to reduce emissions of nitrogen oxide (NOx) to 0.20 grams per brake-horsepower/hour (from the present 4 g/bhp/h); hydrocarbons to 0.14 g/bhp/h (now 1.3 g/bhp/h), and particulates (soot) to 0.01 g/bhp/h (0.1 g/bhp/h). The standards for engine manufacturers will be phased in between 2007 and 2010 and will require catalytic aftertreatment and soot traps.

In response, the National Petrochemical & Refiners Assn. (NPRA; Washington, D.C.) issued a statement saying that EPA's "rush to implement a premature, costly and unrealistically low standard will seriously endanger national supplies of diesel fuel." New technologies that might have been able to mitigate the cost impact of producing low-sulfur fuels will not be available in time to meet the 2006 deadline, says NPRA.

Gas-to-liquids

Domestically produced gas-to-liquids (GTL) fuels, made from natural gas, have been designated by the U.S. Congress as alternative fuels, as defined under the Energy Policy Act of 1992. The measure is part of the Omnibus spending bill, signed last month by President Clinton.

GTL fuels contain no sulfur or aromatics and can be substituted for conventional diesel fuel to achieve lower emissions, notes Rentech, Inc. (Denver, Colo.). Rentech, which offers a Fischer-Tropsch GTL process, was among the organizations that supported the legislation. Rentech adds that GTL fuels can be blended with conventional diesel fuel to meet the 2006 diesel standard (see adjacent story, left).

Wastewater phosphates

Showa Engineering Co. (Tokyo) is offering an improved activated-sludge method for treat-

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