ABSTRACT:
Sulfonation reactor technology has improved to minimize downtime with permanently calibrated feed distribution systems. Since these feed distribution systems are designed with superior “micro mole ratio control” for exact distribution of the feedstock and the SO3-in-air, it is possible to produce the highest quality surfactants. Two of the five current Chemithon/IT Chemithon reactor designs that are used widely in the detergent and specialty chemical markets are profiled to demonstrate the distribution mechanisms and relative application strengths. The reactors are “NCR” designs, i.e., “no calibration required” at site.

The uniform ratio between reagents is ensured by uniform distribution of the liquid and a homogeneous configuration of the reaction chamber. A calibrated slot is created around the upper ends of all reaction tubes by means of a precision machined set of plates and spacer piece. This arrangement distributes a uniform thin film to all reaction tubes and on the perimeter of each tube. The distribution cartridge:
- is very simple, static and removable
- can be easily and rapidly removed, cleaned and installed
- does not require calibration
- can be bench tested
- can be easily reconditioned
- allows drainage of oleum condensates
- allows design of compact reactors
- allows simple modification of slot thickness (for special feed materials)

The feed material is distributed onto all of the reaction tube walls through the reagent feed cartridge which also distributes the SO3-in-air and barrier air. This reactor design has more volume per tube than other MTR types and better control of the organic film. Sulfonic acid exits the reaction tubes and flows into the gas/liquid centrifugal separator at the bottom of the reactor.

The IIT Chemithon MTR uses a “pneumatic barrier” system to protect the organic distribution system from progressive charring, a condition that reduces product quality in conventional MTR systems and causes frequent washouts. A dry air is injected through the distribution cartridge which prevents SO3 and oleum from contacting the organic in the distribution slots. The system results in longer runs at high product quality levels that reduce production losses and maintenance costs by minimizing washout frequency and eliminating corrosion at the distributor. This also lowers the risk of equipment corrosion and minimizes acid waste water. The barrier system also serves to protect the reactor distribution system in the event of a power cut-off or failure of the organic feed system. It does not produce off-spec material as do systems which depend on feeding organic through the reactor.

The following conclusions apply to BOTH the IT Chemithon MTR and the Chemithon AFFR reactors:

1) The removable organic distribution cartridge (MTR) and flanges (AFFR) are factory calibrated prior to installation in the reactors and, due to the unique designs and materials of construction (316 stainless steel and high nickel alloys), do not require periodic recalibration.

2) Both designs significantly minimize shutdowns for reactor maintenance. “Streaming factors” exceed 95%. Large, 20,000 MT/hour plants such as Procter & Gamble Mariscala and ITC base their figures on an 8,400 hour/year operation. Zschimmer & Schwarz Koblenz has similar figures.

3) Both designs ensure consistent reaction conditions and product quality. In today’s economic climate, it is necessary to maximize the utilization of capital equipment. Permanently calibrated sulfonation reactor distribution systems constitute a significant step toward more efficient plant operation.