



Application Information

# Improved Process Stability in Acrylic Acid Production Through NIR Online Monitoring



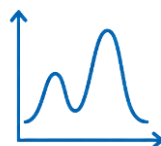
## INDUSTRY

Petrochemical  
Industry



## APPLICATION

Acrylic Acid  
Production



## TECHNOLOGY

UV/Vis/NIR  
Process Analytics



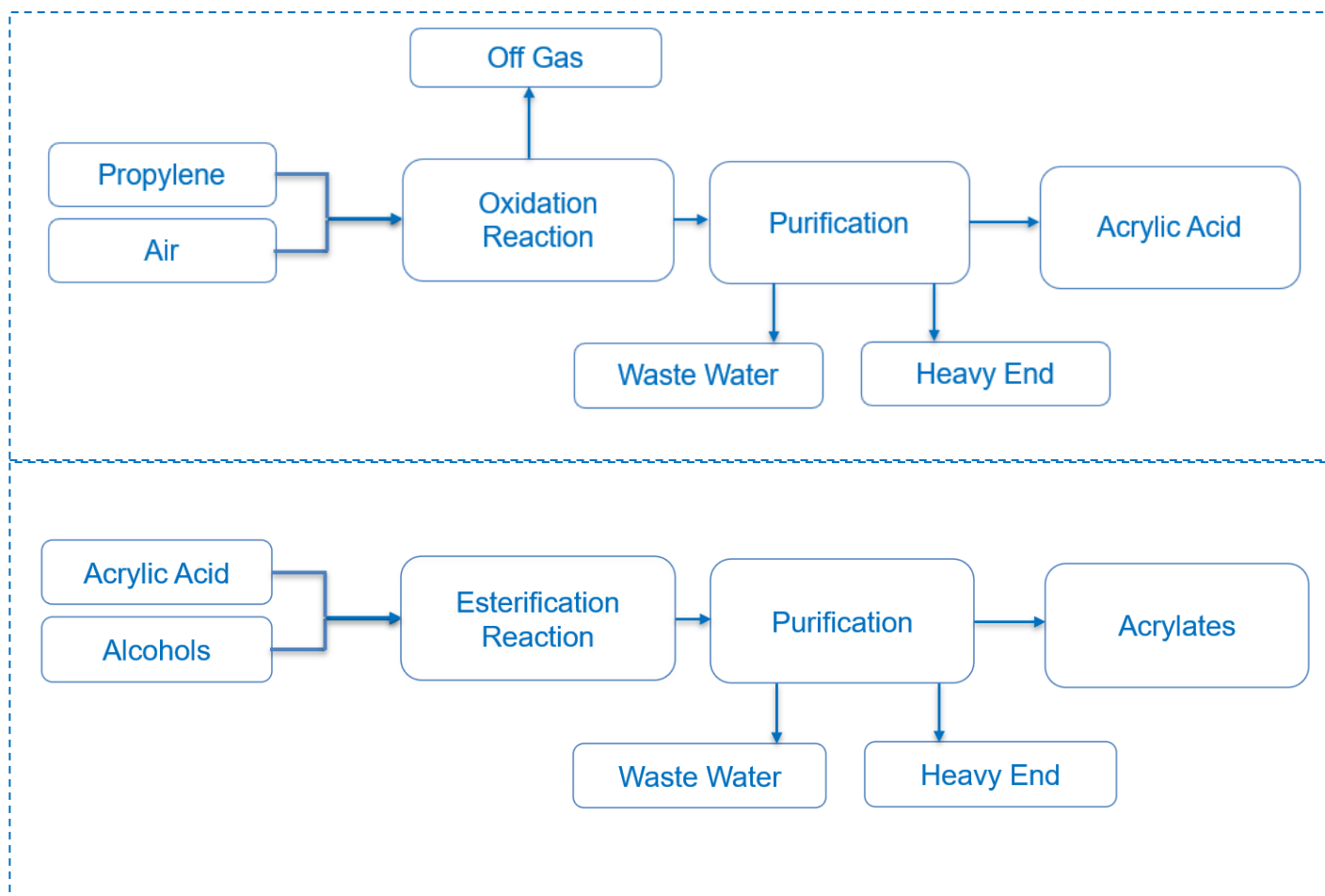
## PRODUCTS

Hellma Falcata XP 12

## 1 RELEVANCE

### High-purity acrylic acid and acrylate esters are key raw materials for the industrial production of acrylate-based polymers

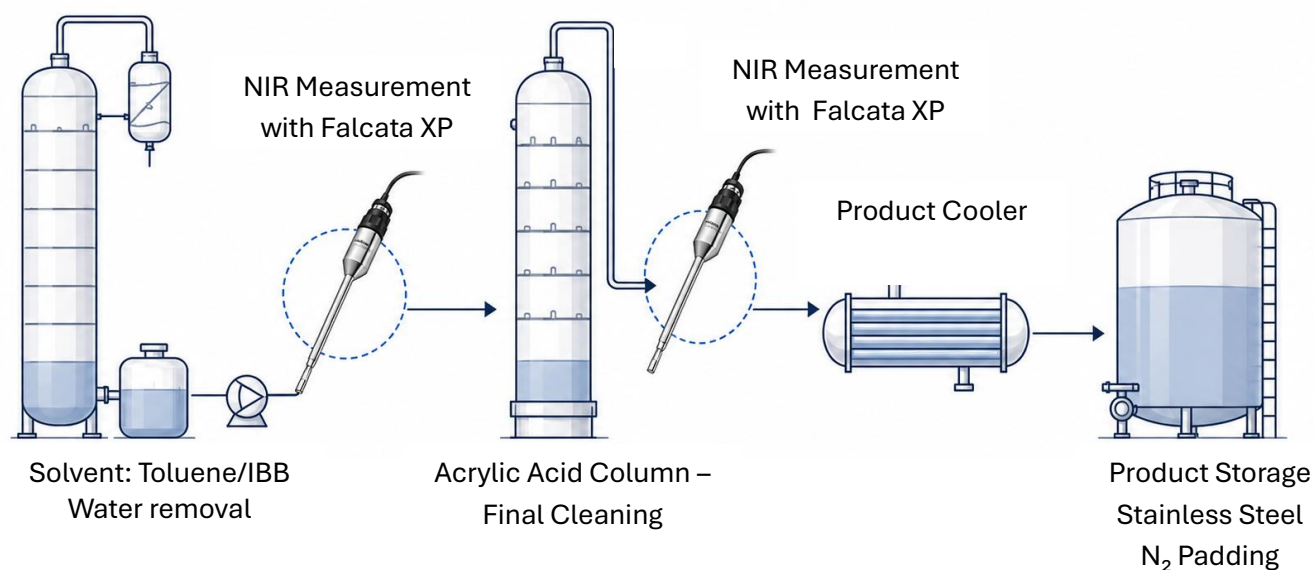
Acrylic acid and acrylate esters are important starting materials and serve as key monomers for downstream polymerization processes, including the production of superabsorbent polymers (SAP), acrylate dispersions, coatings, adhesives, and sealants. In industry, acrylic acid is produced using established, licensed processes in which propene is first converted to acrolein and then to acrylic acid in a two-step gas-phase oxidation. This process is illustrated below using the Mitsubishi AA/AE process as an example:



## 2 KEY POINTS

### Robust NIR process analytics ensures compliance with specifications during acrylic acid dewatering under challenging conditions

In the industrial acrylic acid process, NIR spectroscopy is frequently used in the azeotropic distillation column to determine the endpoint of dehydration in the liquid phase. This involves monitoring the water content in the acrylic acid solution and helps to ensure that the necessary specifications for subsequent purification are met. Water is removed from the process through distillation using a carrier such as toluene or isobutylbenzene (IBB). Precise control of the dehydration process increases process stability and energy efficiency and optimizes throughput.



Measurement in acrylic acid production places special demands on the process measurement technology used. Acrylic acid can crystallize upon cooling. Crystals can adhere to seals and cause damage or hardening of the seals. A brazed metal connection without an elastomer seal reduces such potential buildup and weak points. In addition, high-purity acrylic acid tends to undergo spontaneous polymerization under unfavorable process conditions, such as changes in temperature or pressure. Such polymerization can occur particularly when normal process operations are disrupted and can lead to the formation of polymer deposits on the probe's optical surfaces. This can impair the functionality of the probe and complicate maintenance, cleaning, repair, or removal.

### 3 SOLUTION

#### The transflection probe enables reliable monitoring even of turbid media prone to polymerization

In the acrylic acid manufacturing process, small amounts of polymers, inhibitors, or other trace substances can lead to turbidity or slight deposits. For applications of this type, measurement with a transflection probe is particularly well suited because it delivers stable and interpretable signals even in highly absorbent and slightly turbid acrylic acid solutions.

The Hellma **Falcata XP** transflection probe with a brazed titanium housing offers a suitable design solution for this purpose. The optical windows of the measuring head are brazed directly into the titanium housing. This eliminates the need for elastomer seals, resulting in high chemical resistance. At the same time, this design reduces potential weak points such as aging seals, gaps, and dead spaces where polymerized material could accumulate.

The monolithic, hermetically sealed measuring head reduces the number of potential leak points and interfaces, contributing to high pressure and temperature stability. Titanium also offers good mechanical strength and corrosion resistance, making it suitable for use under the demanding process conditions of acrylic acid production.

#### HELLMA TRANSFLECTION PROBE FALCATA XP



#### SPECIAL FEATURES

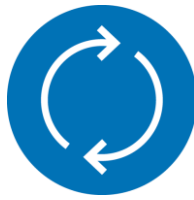
- ✓ Compact Construction
- ✓ Rugged Design
- ✓ Exchangeable Pathlength Tips
- ✓ Compatible with **Knick Ceramat** and **SensoGate** retractable fittings

## 4 BENEFITS



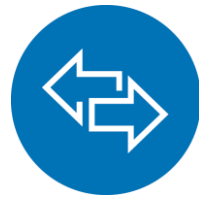
### INDUSTRIALLY TESTED

The **Hellma Falcata XP** has already been successfully tested under industrial conditions in acrylic acid production at a major European facility.



### LONG-TERM USE

Titanium offers high corrosion resistance, thereby contributing to the probe's long-term mechanical and chemical durability.



### HIGH PROCESS RELIABILITY

Stable and analyzable measurement signals are achieved, even with slightly turbid and highly absorbent media.



### Further Information

[Process Applications: Resins and Monomers](#)

[Mitsubishi\\_AA\\_AE\\_Process](#)