



## TECH 2021S7: Sulfonation Technologies

**Sulfonation Technologies** is one in a series of reports published as part of NexantECA's 2021 Technoeconomics – Energy & Chemicals (TECH) program.

### Overview

Sulfonation and sulfation are chemical reactions used in the surfactants industry to add a polar sulfonic ( $-\text{SO}_3\text{H}$ ) or sulfate ( $-\text{OSO}_3\text{H}$ ) group to organic molecules. Anionic surfactants produced via sulfonation/sulfation include linear alkylbenzene sulfonate (LAS), sodium laureth sulfate (SLES) and sodium lauryl sulfate (SLS), as well as various other alcohol sulfonates (AS), alcohol ether sulfonates (AES), methyl ester sulfonates (MES) and alpha olefin sulfonates (AOS).

The report provides a comprehensive analysis of sulfation/sulfonation technology used to produce surfactants, including the cost of production and market dynamics. The following issues are addressed:

- What impact could regulatory developments such as the recent 1,4-dioxane New York ban have and how can producers respond?
- Which regions and products have the lowest cost of production? How could this change, depending on raw material price fluctuations?
- What are the business strategies of the key producers?
- What challenges will face both new entrants and established players in the value chain?

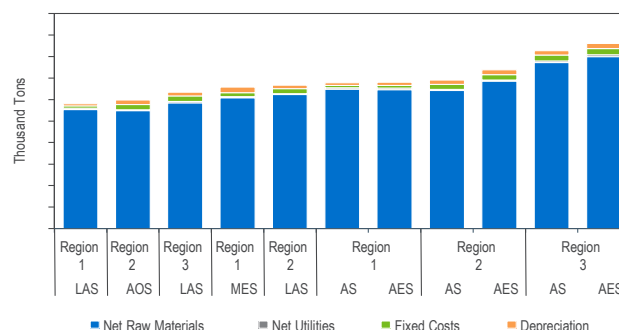
### Commercial Technologies

NexantECA has assessed the process technologies provided by Desmet Ballestra Italy (DBI) and Chemithon, the main licensors for sulfonation technology (several producers, such as Stepan, also have in-house sulfonation technology). The unit operations and plant configurations required for different products including LAS, AES, AS, MES and AOS are discussed.

### Process Economics

The economic analysis provides an overview of production costs for DBI and Chemithon technology in the United States, Western Europe and China in 3Q 2021. Estimates are included for alpha-olefin sulfonates (AOS), linear alkylbenzene sulfonates (LAS), methyl ester sulfonate (MES),  $\text{C}_{12}\text{-C}_{14}$  alcohol sulfonate (AS) and  $\text{C}_{12}\text{-C}_{14}$  alcohol ether sulfonate with 2 moles of ethylene oxide (AES).

Summary of Economics for Production of Various Sulfonates in Key Regions, Q3 2021



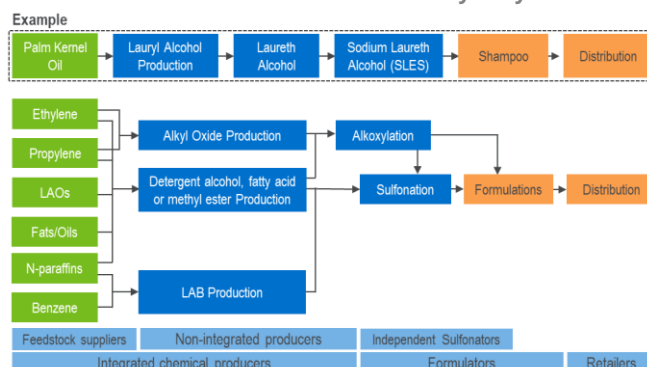
### Commercial Overview

The largest market for sulfonated products is household detergents, accounting for over half of total consumption, with considerable demand into personal care, industrial and institutional cleaners, construction, agrochemicals, paint, coatings and inks, textiles and oil and gas. Sulfonated surfactants are found in dishwashing liquids, laundry powders, and shampoos.

A growing population and improving standard of living, particularly in the developing countries, underlies growth in surfactant markets. The COVID-19 pandemic led to increased consumption of detergent products in households, offsetting a slight decline in industrial uses.

The supply landscape, including upstream raw material supply, demand and trade for sulfonated surfactants are analyzed, including commentary on market drivers and constraints.

### Sulfonation Value Chain and Key Players



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- Chemistry
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- Overview of product applications and markets for new as well as established products
- Regional supply and demand balances for product, including capacity tables of plants in each region
- Regulatory and environmental issues where relevant

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**Technology and Costs** comprises the Technoeconomics – Energy & Chemicals (TECH) program, the Biorenewable Insights program (BI), and the new Cost Curve Analysis. These programs provide comparative economics of different process routes and technologies in various geographic regions.

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