



## Biorenewable Insights: Bio-Surfactants

**Bio-Surfactants is one in a series of reports published as part of NexantECA's 2018 Biorenewable Insights program.**

### Overview

Surfactants, or surface active agents, are a grouping of molecules which possess both hydrophilic and lipophilic (also known as hydrophobic) parts, making them soluble with two or more immiscible phases (e.g., oil and water). Surfactants offer a number of properties that are highly valuable in a variety of applications and industries. The surfactants industry is immensely broad, not just in terms of its applications, but also in terms of the surfactants themselves.

The surfactants industry comprises an array of molecules produced by several different routes. The diversity of the industry makes it difficult to present an entirely comprehensive view of surfactants. This report takes a news-based technology-forward approach, covering technologies in the bio-based surfactants sector where there is notable activity targeting “greener” surfactants.

A lot of innovation in the bio-surfactants industry is in an effort to replace conventional surfactants on the market, with alternatives that offer tangible sustainability and LCA improvements. The other innovation trend in surfactants is to replace petro-based raw materials with bio-based drop-ins. These are the two areas of focus for this report.

### Technologies

There is significant interest in creating more advanced bio-surfactants using genetically engineered or naturally-occurring organisms as biocatalysts. These are generally viewed as more “bio”, “green”, or “natural” than alternative technologies that convert biorenewable feedstocks using conventional chemical processes. The surfactants in Section 3.1 are “naturally occurring” materials, a term that carries with it immense marketing potential and sustainability advantages. However, despite this interest seen, developers have struggled to commercialize their technologies.

The main classes of biologically produced bio-surfactants include glycolipids, lipopeptides/ lipoproteins, and polymeric bio-surfactants, and of these, only sophorolipids (a glycolipid produced by yeasts) have achieved even limited commercial-scale success. Many of the remaining bio-surfactants are still primarily being

researched at academic institutions, with still not enough commercial potential to inspire industrial interest.

Researchers and developers face high recovery costs, high production costs, competitive and obfuscated markets, and the same scale-up risks faced in other biotechnology sectors.

Numerous fully and partially bio-based surfactants are readily available on the market, as they are based on natural oil and fat feedstocks. These are considered generally to be “conventional” surfactants, despite their renewable origins. There is little going on in terms of technical innovation in these conventional surfactant sectors. However, from a raw material perspective, developers are looking to replace petro-based inputs with bio-based drop-ins. The most notable example of this is in ethoxylates, which is covered in this report, as Croda has recently constructed a facility designed to increase the renewable carbon to 100 percent in its new line of “Eco” ethoxylates (replacing petro-based EO with its bio-based counterpart. Anellotech is also in the very early stages of marketing its bio-based BTX technology for downstream use in LAS production.

### Process Economics

Cost of production models for USGC, Brazil, Western Europe and Southeast Asia are shown for:

- Sophorolipids
- Ethanol-Based Ethoxylates
- LAS

### Capacity

NexantECA has catalogued existing and planned bio-surfactant capacity and provides project profiles.

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