



Soy-Based Emulsifiers and Wetting Agents

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Product Potential

Surfactants based on soybean derivatives can be produced to compete technically and economically with many petroleum- and oleochemical-based commercial surfactants.

These soy derivatives include industrial grade soy oil, acidulated soapstock, degummed oil fatty acids, soy methyl esters, soy protein and lecithin.

Of the surfactant market segments evaluated, four have been identified by the United Soybean Board (USB) to have the highest commercial potential for soy-derived products: personal care and cosmetics, coatings, microemulsions and agricultural adjuvants.

Market Potential

Total annual U.S. industrial surfactant market demand in cosmetics, coatings, microemulsion applications and ag adjuvants represents 410 million pounds. Of this, estimated demand opportunity for soy-derived surfactants is about 80 million pounds.

Combined, the U.S. industrial surfactants market represents about \$1.8 billion in annual sales.

Market Segments

The original USB Soy Surfactants Market Opportunity Study (1996) evaluated the market potential for soy-derived products in nine major end-use segments: emulsion polymerization, asphalt, water-based coatings, textile specialties, paper coatings, leather processing, metalworking fluids, magnetic tape coatings and oil field chemicals.

A soy surfactant technical advisory panel composed of technical and commercial surfactant experts from industry and academia identified three additional market segments: cosmetics and personal care, microemulsions and agricultural adjuvants.

They also prioritized the segments that offer the best commercial market potential for soy-based surfactant products in the following order:

- 1) Cosmetics and personal care
- 2) Coatings and emulsion polymerization
- 3) Microemulsions
- 4) Agricultural adjuvants

Cosmetics and personal care formulations are composed of numerous additives, including specialty surfactants and emollients, to provide consumer-desired performance properties. There is significant market interest in naturally derived feedstocks that are readily biodegradable, low in toxicity and have low volatile organic compound (VOC) levels.

The **coatings and emulsion polymerization** industry continues to seek products that are typically water-based emulsions, which are environmentally friendly, low in VOCs and readily biodegradable. Emulsion polymerization is a primary chemical process used to make latex-type coatings, elastomers and plastic resins.

Microemulsions are oil/water suspensions that exhibit properties between those of the two components and appear as clear solutions. Based on soy derivatives, such as methyl soyate, they are thermodynamically stable and can provide superior wetting and degreasing performance. Market application opportunities are numerous, especially in personal care (shampoos, hand lotions) and metal and precision cleaning.

Agricultural adjuvants are chemicals added to pesticide formulations to enhance or modify the properties or activity of the pesticide or spray mix.

Adjuvants improve mixing, deposition, retention, spreading, dispersion and drift control.

Adjuvants are primarily emulsifiable oils and surfactants. The agricultural industry would like these products to be readily biodegradable, have low toxicity and be cost-effective and predictable in performance. Methylated seed oils (MSOs), including soy methyl esters, are widely used today.

Physical Properties

The basic chemical composition of soy-oil derivatives provides excellent surfactant performance potential to both the surfactant manufacturers and end users. Soy-oil derivatives have high C-18 oleic acid and linoleic acid content and a high level of unsaturation. They also offer the environmental advantages of being readily biodegradable and low in toxicity.

Relative Economics

Most commercial surfactants are currently derived from petrochemical feedstocks, tallow and tall oil fatty acids.

Modified soy oil and protein-based polymeric surfactants and esters have excellent performance and economic potential in numerous industrial and consumer products.

The oleochemical industry has long recognized that soybean oil is the lowest-cost, most readily available source of C-18 oleic and linoleic acids among all the vegetable oils. Its chemical composition holds excellent application potential for soy-oil-derived industrial surfactants, when modified chemically to provide required product performance.

With rapidly escalating prices of petrochemical made from natural gas or crude oil, manufacturing costs of conventional industrial surfactants have risen significantly since 2003. Consequently, interest in developing and marketing soy-based surfactants has increased markedly.

Soy-Surfactant Opportunities

The chemistry of soy oil and protein is complex and flexible and provides a wide variety of surfactant product and application development opportunities.

The market segments targeted above represent market potential in replacing petrochemical-based surfactant products, such as NPEs (nonyl phenol ethoxylates), which are coming under increasing environmental regulatory pressures. Interest continues on the part of both producers and consumers in environmentally friendly, renewable-resource-based products – especially with the rising costs of petrochemical-based conventional surfactants. Soybean-derived surfactants can potentially meet these needs. However, interest in soy-based-surfactant development by the surfactant industry has been low.

The United Soybean Board is made up of 64 farmer-directors who oversee the investments of the soybean checkoff on behalf of all U.S. soybean farmers. Checkoff funds are invested in the areas of animal utilization, human utilization, industrial utilization, industry relations, market access and supply. As stipulated in the Soybean Promotion, Research and Customer Information Act, USDA's Agricultural Marketing Service has oversight responsibilities for USB and the soybean checkoff. 