



# SOY-BASED PAINTS AND COATINGS

**As one of the most readily available vegetable oils in the world, soybean oil continues to be a major ingredient in paints and coatings.**

## HISTORICAL USE OF SOYBEAN OIL

Soybean oil is the most readily available and one of the lowest-cost vegetable oils in the world today. For many years, soybean oil has been a major ingredient in making alkyd resins, which are dissolved in carrier solvents to make oil-based paints. While the production of alkyd resins, finished paints and coatings may involve proprietary formulations, the basic chemistry of converting a vegetable oil into an alkyd resin under heat and pressure is well understood.

With the growing popularity of latex, or waterborne, paints the market for alkyd resins made from soybean oil has declined, particularly in the area of architectural coatings. These low-odor, easy-cleanup products generally cost less and are now designed to perform similarly to alkyd-based coatings.

At the same time, powder coatings, radiant-cured coatings and high-solids systems have seen increased use in factory-applied coatings, replacing low-solids liquid systems. These new coatings – many of which cure through the input of energy in the form of heat, electron beam, ultraviolet radiation or other sources – contain little or no solvents.

## CURRENT RESEARCH OBJECTIVES

Research funded by the United Soybean Board (USB) has focused on several areas using soybean derivatives: creating stable, waterborne architectural coatings, stains, and sealers; finding high-performance coatings low in volatile organic compounds (VOCs) for industrial applications; replacing petrochemical polyols with soy polyol coatings; and developing new 100 percent-solids powder coatings.

All projects currently funded by USB focus on the use of soybean oil chemically modified in some manner. Funding to support research is made on a competitive basis, with strong preference given to research done with an identified commercial partner.

USB-funded activities center on the research and development drivers identified by the American Coating Association as

important to paint and coating formulators. These drivers are awareness of legislative activity (reduced VOC content in coatings), concern with rising raw material costs, customer demand for lower-cost solutions, higher-performing products, novel materials and attention to emerging markets such as smart materials and nano technology.

## OIL MODIFICATION

Soybean oil – as it is commercially available in an unrefined or refined, edible-grade state – is a fairly stable and slow-drying oil used to provide the curing or drying characteristics provided by the binder part of the coating, or as a reactive diluent with other resins. USB-funded research has explored various means of chemically modifying the oil to enhance its reactivity under ambient conditions or with the input of energy in various forms to cause the oil to copolymerize or cure to dry film. Some of these forms of modification have included epoxidation, alcoholysis or transesterification, direct esterification, isomerization, monomer modification and various forms of polymerization, including heat-bodying. The reactive linolenic-acid component of soybean oil, with its double bonds, is more useful than the more predominant oleic- and linoleic-acid components.





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## RESIN PRODUCTS

Researchers at North Dakota State University are working on modified epoxidized sucrose soyate resin for use in thermally cured systems, such as baking enamels, and new soy/urethane/acrylate resins in thermoset coatings and soy acrylic modified resins for UV curing. Also within UV-cured chemistry, Northampton Community College has developed a new soy/acrylic resin for use in UV-cured graphic art films currently under commercial development by SFC Consulting.

Iowa State University is conducting technical feasibility studies to determine if soybean oil plastic fat can be used as a substitute for paraffin and beeswax in barrier packaging coatings. Celanese Chemical is looking at various modifications of soy methyl ester to determine its compatibility and usefulness as a co-binder with vinyl acetate resins. Reichhold Chemical has developed a water-based soy latex alkyd emulsion to replace acrylic resins used in traffic paints and is currently undertaking the commercial development of this new soy chemistry.

## NEW PAINTS/COATINGS/STAIN FORMULATIONS

New Century Coatings (NCC) has developed a line of soy methyl ester stains, sealers, and architectural paints with excellent performance properties. These stains are user-friendly with deep penetration to extend the life of many different substrates. Soy-based roof coatings are currently being marketed by Green Products, Inc., a leading marketer of environmentally friendly coatings. The white-pigmented coating reflects heat and is superior to asphalt and waterborne emulsions in energy conservation, thereby earning an Energy Star Approval label.

Rust-Oleum Corporation has commercialized several new soy-based stains and finishes to include a family of Varathane® soy/urethane clear coats and a family of Ultimate Poly® soy/acrylic/urethane interior wood finishes. Both families of products are environmentally friendly offsets to solvent/oil stains that don't compromise performance.

Sherwin-Williams has successfully commercialized a family of soy/acrylic/polyester paints under the ProMar® and ProClassic® brand names. These paints are low in VOCs, environmentally friendly and easy to use. Sherwin-Williams received the 2011 Presidential Green Chemistry Challenge Award for its unique and novel technology using recycled PET bottles as part of its new resin system.

## ABOUT USB

The 69 farmer-directors of USB oversee the investments of the soy checkoff to maximize profit opportunities for all U.S. soybean farmers. These volunteers invest and leverage checkoff funds to increase the value of U.S. soy meal and oil, to ensure U.S. soybean farmers and their customers have the freedom and infrastructure to operate, and to meet the needs of U.S. soy's customers. As stipulated in the federal Soybean Promotion, Research and Consumer Information Act, the USDA Agricultural Marketing Service has oversight responsibilities for USB and the soy checkoff.

FOR MORE INFORMATION, VISIT: [SOYNEWUSES.ORG](http://SOYNEWUSES.ORG)

