

Biodegradable Oils From Alternative Crops

Agricultural business is fluctuating and unpredictable. Weather patterns, consumer demand, and geography can lead to market gluts, often in the wheat and corn sectors. One solution to this economic problem is to find new and profitable uses for alternative crops. This strategy could result in farm diversification and less overproduction of crops like corn and soybeans.

ARS chemists Terry A. Isbell and Steven C. Cermak have found a potentially profitable new use for high-oleic oilseeds crops. They've made environmentally friendly, effective lubricants containing estolides, which are fatty acids from oilseeds such as high-oleic sunflower and high-oleic safflower.

Isbell and Cermak, who are at the National Center for Agricultural Utilization Research (NCAUR) in Peoria, Illinois, recently received two U.S. patents on the technology.

The new vegetable-based, biodegradable oils can be used as hydraulic fluid in heavy equipment or as crankcase fluid. Industrial-sized production of the starting material was done at a pilot plant at NCAUR.

These lubricants compare favorably to those produced from soybean and canola. "Tests show that the estolide-based lubricants have excellent pour points in cold temperatures, better oxidative stability than most petroleum lubricants currently on the market, and good lubricity. These properties all exceed those of soybean- and canola-based products," says Isbell. "The exception is the price of the starting material. Soybean oil costs about 13 cents per pound, and oleic acid is 75 cents per pound. But the estolides require far fewer additives than traditional vegetable oil lubricants, which makes their final market cost identical."

Their superior properties make estolides good candidates for many lubricant applications, particularly where enhanced performance and biodegradability are required, says Isbell.

This research was done under a cooperative research and development agreement (CRADA) with Lambent Technologies of Chicago. The company was acquired in 1998 by Petroferm of Fernandina Beach, Florida.

Meanwhile, ARS scientists on the West Coast are exploring ways to boost domestic production of castor plants, which yield versatile, top-quality, high-priced oil. Chemist Thomas A. McKeon and plant physiologist Grace Q. Chen are doing the work at the ARS Western Regional Research Center in Albany, California.

Castor oil is used for making premium lubricants for heavy equipment and for jet engines. It is also used in paints, coatings, plastics, antifungal compounds, shampoo, and cosmetics.

McKeon and Chen are using techniques of modern biotechnology to remove castor's ability to manufacture its potent toxin, ricin, and to keep the plants from synthesizing allergens that can cause hives, asthma, or anaphylactic shock. The team was the first in the world to genetically engineer castor plants. They are seeking a patent for their work.

The two are now experimenting with another approach to shuttling strategic genes into castor. And they're investigating whether castor can yield new chemicals that could replace petroleum-derived compounds. The Dow Chemical Company, headquartered in Midland, Michigan, is funding part of the work under terms of a CRADA with ARS. Castor Oil, Inc., of Plainview, Texas, is also a partner in this research.

Castor thrives in sunny climates, so it could be produced, for instance, in the southern United States.—By **Sharon Durham** and **Marcia Wood**, ARS.

This research is part of Quality and Utilization of Agricultural Products, an ARS National Program (#306) described on the World Wide Web at <http://www.nps.ars.usda.gov>.

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A field of safflower, *Carthamus tinctorius*.

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SCOTT BAUER (K9200-2)



Castor beans.