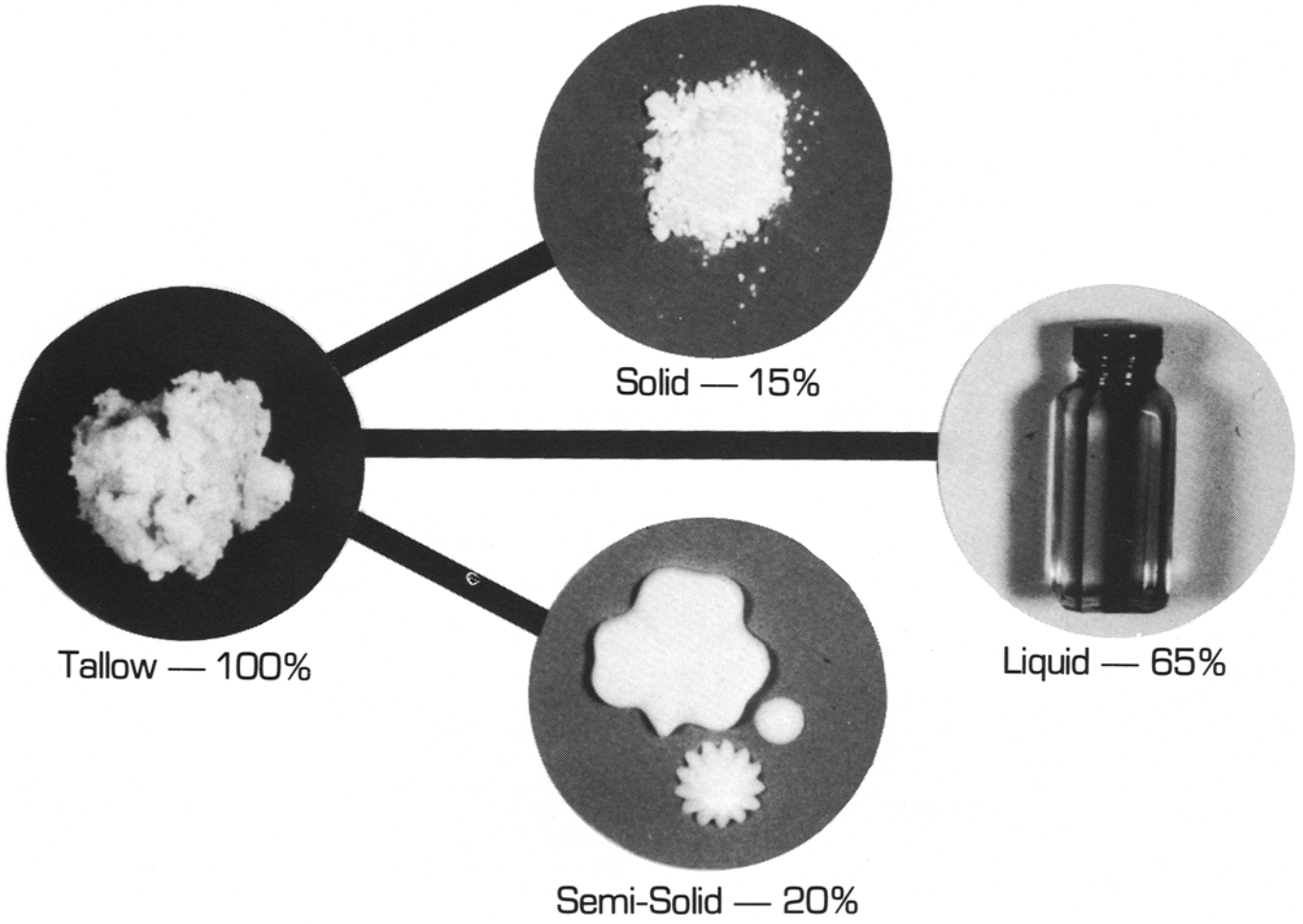
TALLOW — new uses for an old product?



Tallow—second only to soybean oil in the amount of fats and oils produced in the United States—is usually thought of as an ingredient for soap, but at the USDA's Eastern Regional Research Center (ERRC), tallow is being used to produce chocolate candy bars, a general purpose edible oil, and, as if to come full circle, a soap-based detergent.

It it appears the ERRC researchers are aiming a bit high, this is the same facility that developed dehydrated potato flakes—instant mashed potatoes—and also developed a whey-soy beverage that provided a nutritious replacement for overseas aid programs when nonfat dry milk supplies dwindled a few years ago.

Located in Wyndmoor, PA, within the corporate limits of Philadelphia, the center consists of seven laboratories, five of which are commodity-oriented and two, discipline-oriented. The five commodity laboratories are the Animal Fats Laboratory (which directs most work with tallow), Dairy Laboratory, Hides and Leather Laboratory, Meat Laboratory, and Plant Products Laboratory. The two discipline labs are the Engineering and Development Laboratory and the Physical Chemistry Laboratory.

ERRC researchers cite several reasons for promoting the use of tallow—First, tallow is a plentiful commodity. The USDA Economic Research Service has estimated that domestic inedible tallow and grease production during 1976/77 will be about 5.4 billion pounds—continuing the U.S. role as the world's largest producer. Edible tallow (prepared under strict sanitary conditions and government inspected) probably will total about .5 billion pounds. ERRC staffers say that up to 70 per cent of tallow production could be handled to meet edible classification standards. Second, tallow is relatively cheap, averaging 15 cents a pound during 1975/76. Third, tallow is a renewable resource, unlike the petroleum to which tallow is closely related chemically. With about 40 to 50 percent of current production being exported, there's ample product for expanded domestic use.

What are ERRC researchers doing with tallow?

Less than they were before a cutback in federal funds last October curtailed all work on using animal fats as basic raw materials for lubricants or plastics. Many of those projects were aimed at using tallow-derived products to replace fossil-fuel products. ERRC staffers like to point out that petroleum prices are still rising and there could be another oil embargo, but animal and vegetable fats and oils offer an alternative source of renewable raw materials.

A tallow fractionation program thus far has produced five fractions of tallow that can be deivided into three portions. The first is a solid portion that can be used to harden shortenings and margarines without hydrogenation. The second is a semisolid portion, compatible with cocoa butter, that can be used to replace cocoa butter in chocolate candy bars. Imported cocoa butter was listed at $2.60 a pound late last year. The third portion is a liquid, called "beef oil" at ERRC, that shows promise as a general purpose oil. One frying test showed a consumer taste preference and a longer shelf life snack foods prepared with beef oil.

The cocoa butter replacement is perhaps the best known of the projects. Dr. H.L. Rothbart, head of the physical chemistry laboratory team that developed the product, says various candy makers have tested the product and said it performed as well or better than cocoa butter. With tallow at 15 cents a pound and cocoa butter at $2.60 a pound, there's an incentive. An economic evaluation of the product was published in JAOCS in July 1976 with the conclusion, "The initial cost comparisons indicate that the products which result from beef tallow fractionation can compete economically with cocoa butter and other vegetable oils in the food and confectionary industries."

The solid portion—consisting of the first two fractions—"can be used to harden shortenings and margarine stock in place of hydrogenated oils," the March 1976 patent states. "Not only is the hydrogenated step eliminated, but the product is free of oleic acid isomers common to partially hydrogenated oils. It can also be blended with liquid oils with or without catalytic rearranging to formulate specialty shortenings. Its high ratio of stearic acid makes it valuable for many nonfood uses including cosmetic bases, pharmaceuticals, soaps and as a commercial source of stearic and palmitic acids."

The semisolid portion yield is about 20 percent of the total product in the process, which has been scaled up to 350 pounds of tallow in a batch. The solid portion is about 15 percent. The third portion—beef oil—totals about 65 per cent of the yield.

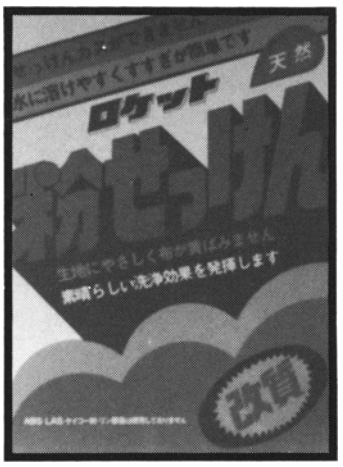
The beef oil does not require winterization to remain liquid at 45 C, but does require a crytallization inhibitor in order to remain clear during longterm storage at 40 F. It is potentially useful in salad oils, margarines, liquid shortenings or, as previously mentioned, as a frying oil.

Frank Luddy, one of the researchers on the fractionation program, said some performance studies remain uncompleted. Dr. H.L. Rothbart, head of the fractionation team, says potentially useful work remains.

One firm has expressed interest in obtaining a license for the patent. The ERRC's Industrial Development staff will forward inquiries from potential users to that firm.

One research project unaffected by the federal fund reduction is the surfactants research program led by Dr. Warner Linfield. The project is funded as an antipollution project in that it seeks surfactants with minimum adverse effects on the ecology. The research began in 1970-71.

The work to produce a phosphate-free detergent already has found commercial application—in Japan. At least two detergent manufacturers there are marketing products based on ERRC research.



Why Japan and not the United States?

First of all, Dr. Linfield says, Japan has a sizable soap-production capacity—the capability of processing tallow. The United States, with its emphasis on detergents based entirely on synthetic ingredients, lacks that capacity. Japan also shows a strong enthusiasm for innovation, he says, whereas in the United States there is less economic incentive for innovation.

Dr. G. Maerker, head of the ERRC Animal Fat Products Laboratory, adds a few more reasons.

"In Japan, washing is done almost exclusively in cold water," Dr. Maerker says, "and they use the same detergent for washing dishes that they use for washing clothes. Japanese seem to have skin that is sensitive to petro-based detergents and there is a strong consumer movement toward ecologically safe products. The Japanese think it's worth paying the extra penny or two."

The Far East is a prime customer for U.S. tallow, accounting for about half the U.S. export trade. Palm oil is a potential competitor in that area.

Linfield sees several areas that need further work before the project could be termed completed.

"We've got to work in process development to produce lime-soap-dispersing agents, working with industry," he said. "We need to streamline the formulation to reduce costs—an area where we've barely scratched the surface. We could expand research to include toilet soaps and analytical techniques."

Also on his list are formulation studies, formulation processing studies, and market reearch studies.

The Animal Fats Laboratory was still working late last year to determine what projects it would undertake after the unexpected fund reduction. Center officials were not yet able to be specific and were reluctant to speculate on possible projects.

But the ERRC's animal Fats laboratory is one of the few laboratories in the nation working exclusively on new or better uses for animal fats such as tallow.

Federal agricultural research takes two directions—one aimed at increasing production, the other at making better use of what's being produced. At the animal fats laboratory, the staff thinks there are quite a few good ways to make use of tallow—the nation's second largest supply of fats and oils. •

Regional Centers affected by fund cut

The Eastern and Northern Regional Research Centers of the USDA's Agricultural Research Service have been most affected by a $2 million reduction in federal funds for reasearch on industrial uses of fats and oils during the current fiscal year.

ARS internal reallocation of funds eased the impact on the two centers. No staff reductions have been forced, but some researchers have retired and others have been reassigned without replacement. Some research projects have been halted, others curtailed, and another group faces elimination if financing is not renewed.

The reduction was specifically mandated by the Office of Management and Budget for FY 1977 (which began Oct. 1, 1976) in preparing the budget. "A $2,000 thousand decrease is requested in 1977 to reflect the increased capacity of industry and commodity groups to fund research in this area," the budget appendix said. The "area" referred to was oil utilization marketing, which includes regional centers' work on industrial uses of fats and oils.

The Senate restored $1.5 million of the proposed cut when it acted on the budget. The House approved the budget with the full $2 million cut. The joint conference committee accepted the House position, but aded a sentence to the budget telling ARS to continue research on industrial uses of fats and oils. In effect, the funds were to be reduced, but ARS was told to continue the work.