New Markets for Tallow Through Research

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Abstract

It is postulated that expanded markets and a more stable price structure for rendered animal fats can be attained through research to develop new products and new uses for these commodities. An industry-supported research program to accomplish this must be designed to develop high volume, low cost products with a reasonable chance to fulfill a market need. Thus the technical research must be accompanied by, and integrated with, market research and careful estimates of production costs. The Fats and Proteins Research Foundation has used these guidelines in the research that it has supported for the past eight years. The following new uses and new products from inedible animal fats have been developed: (1) an air-entraining agent for concrete; (2) a water repellent coating for concrete; (3) a fat-containing admixture for concrete; and (4) a fat-coated urea for ruminant feeds. The estimated market potential for tallow and other animal fats for these new products is 200–400 million pounds annually in the United States by 1980.

Introduction

Approximately five billion pounds of inedible rendered animal fats are produced annually in the U.S. Of this amount approximately 2.8 billion pounds are exported and the remainder is used domestically as follows: one billion pounds in animal feeds, 650 million pounds in soap, 600 million pounds for fatty acid production, 100 million pounds for lubricants and similar oils, and the remainder for a number of other miscellaneous uses.

These animal fats complete on the world market not only with animal fats from other countries but also with all other fats and oils, both natural and synthetic, and with petroleum derived products that may have a more stable price structure. To assure a continuing profitable market for these animal by-product materials, it is essential that expanded uses be developed for these fats.

Integrated Research and Market Analysis

Producers of animal fats, renderers and meat packers, for the most part sell their products as a commodity in the high volume markets outlined above. Individual producers may improve their profits by upgrading their fats or by using these fats as raw materials for the manufacture of products that no longer compete on a commodity market. But *all* producers of animal fats can significantly benefit from the development of a new use for animal fat only if that new use is a high volume one. Thus industry-supported research to discover new uses for animal fats must be critically evaluated on the basis of the probable total market for the end product. Furthermore it is almost axiomatic that a product must be inexpensive to command a high volume market. This imposes an additional restriction on the research in that any process to convert animal fats to a new useful product cannot require expensive chemicals or costly multistage processing techniques. Consequently industry-supported research to develop new uses for fats must be accompanied by careful market analysis and cost of production estimates at every stage of the research and development program. Also the studies must be so oriented that every advantage can be taken of the unique chemical and physical nature of the fats.

Using these guidelines, an effective program of research to develop new uses for animal fats would logically proceed stepwise as follows: (1) Generation of ideas for new uses for animal fats; (2) Preliminary screening of these ideas for technical feasibility and possible market potential for the end product; (3) "Quick and dirty" laboratory experiments to confirm, or reject, the technical feasibility of the required chemical or physical process to produce the desired end product; (4) Development of "rough" cost estimates for the production of the desired end product, if successfully produced in Step 3; (5) Laboratory bench scale production and preliminary testing of the end product; (6) Market survey to determine the probable potential market for the product with the properties and estimated production costs established in Step 5; (7) If justified by the market survey, pilot scale production and extensive testing of the product; (8) Commercialization.

In our experience only about one fifth of the ideas generated survive Step 2; only 1–2% of the ideas generated have been carried through Step 7(1). If one wishes to relate research costs to commercialization of a new use or a new product, it can be stated that *on the average* a well-managed research organization may be expected to develop one commercially applied product, process or new use for each 100 innovative ideas generated and each $500,000 spent on research and development.

New Products From Animal Fats

Using the philosophy and approach outlined above some modest success has been achieved through research supported by the Fats and Proteins Research Foundation (FPRF) at Battelle Memorial Institute and other research organizations. Several new products derived from fats have been developed and evaluated.

Air Entraining Agent for Concrete

9-(or 10-) Carboxy stearic acid (9-CSA) is an excellent air entraining agent for concrete (Table I). It is particularly effective in concrete products containing fly ash, and is superior to some products in current use in that the correct amount of air is entrained in small, closely spaced bubbles. The estimated annual potential sales for the products in the United States is less than one million dollars annually.

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TABLE I
Salt Scaling of Air-Entrained Concrete

Type of concrete	Air-entraining agent	Air-entrained, %	Scaling 108 cycles, g
Ordinary	Commercial	5.8	34.7
	9-CSA	6.5	10.7
Fly ash B	Commercial	6.0	108.8
	9-CSA	6.4	14.3
Fly ash C	Commercial	6.3	32.8
	9-CSA	5.7	31.8

TABLE II
Water Absorption of Concrete Slabs Given Different Coating Treatments

	Water absorption, %, after immersion for		
Coating	1 day	14 days	25 days
None	11.0	11.5	11.5
Silicone	11.0	11.5	11.5
TCST[a]	2.0	4.5	5.7

[a] Trichlorosilanated tallow.

Environmental Control Committee Asks Help of AOCS Members

The AOCS Environmental Control Committee is attempting to collect information on environmental control processes and techniques being applied by companies represented by members of the Society. To accomplish this, a letter was distributed in late August to these companies, and some 30 days later a second letter was mailed, specifying the format of the desired information. Cooperation of members in obtaining information from their organizations would be appreciated. The guideline is reprinted below:

I. Name and address of your company.
II. Name and title of person from whom further information can be obtained.
III. Industry classification(s), i.e., tall oil, vegetable oil refining, etc.
IV. Pollution category, i.e., air, liquid, solid waste.
V. Abstract defining the environmental problem encountered and successful and unsuccessful efforts toward solutions or anticipated efforts in that direction.
VI. Names and addresses of consultants you have used, if any, in your attempts to solve the problem.

As information is received by the AOCS, it will be reviewed and filed in the library at the Champaign office for the benefit of Society members.

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TABLE III
The Influence of a Fat-Containing Admixture on the Plasticity of a Mortar Mix and Strength and Water Repellency of Mortar Cubes

	No admixture	Admixture
Flow, %	48.0	68.0
Compressive strength, psi		
3 days	2284	1920
21 days	3715	4232
28 days	4498	4292
Water absorption, %		
1 day	6.3	4.0
3 days	6.5	4.5
7 days	6.5	5.0

Water Repellent Coating for Concrete

Trichlorosilanated tallow (TCST) imparts a high degree of water resistance to concrete and mortar products when applied to dry surfaces in a 15% solution of mineral spirits at a level of 3 g TCST/sq ft. The research on production and evaluation of the product has been previously described (2) and was presented at the 1966 AOCS Fall Meeting. The composition and use of TCST as a water repellent is covered by a U.S. patent (3) and a number of foreign patents. TCST can be produced by reacting tallow with trichlorosilane using UV or ionizing radiations as a free-radical inducing catalyst. The product is an excellent water repellent (Table II) and resists weathering because it bonds to the masonry surface. Solutions of TCST in mineral spirits are somewhat sensitive to water which necessitates the use of a scavenger to react with the HCl formed. Similar products can be produced from other unsaturated fats or fatty acids but their water repellent properties are not as good as those of the product produced from tallow. The estimated potential market for the product is at least eight million pounds annually in the U.S. Estimated production costs are substantially less than those for the silicone water repellent coating materials now commercially available.

Fat-Containing Admixture for Concrete

Many attempts have been made to increase the water resistance of concrete products by adding fat or fat derivatives to the cement mix. This has almost universally resulted in a loss of strength in the finished concrete products. Through research supported by the FPRF a fat-containing emulsion has been developed which can be added to the wet cement mixture to improve the workability of the mix and water resistance of the finished concrete products (Table III). The composition of the admixture is covered by a U.S. patent (4) and applications for a number of foreign patents have been filed. If the emulsion were used in 10% of the Portland cement products in the U.S., 100–200 million pounds of animal fat would be required annually depending on the emulsion concentration in the cement mixture. It is estimated that the emulsion could be produced, distributed and incorporated into Portland cement mixes at a cost of two dollars per cubic yard of concrete or other similar products.

TABLE IV
Influence of Fat Coating Urea on Rumen Ammonia and Blood Urea

	Uncoated	Coated
Rumen ammonia		
Peak time, hr	3	2.5
Concentration, mg/100 g	85	70
Blood urea		
Peak time, hr	6	4
Concentration, mg/100 g	.22	.18

Fat-Coated Urea for Ruminant Feeds

Approximately 355,000 tons of urea is used currently as a source of nitrogen (protein) in ruminant feeds in the United States. More would be used, particularly in dairy cattle feeds, if the rate of ammonia formation in the rumen could be reduced. Research sponsored by FPRF at Battelle demonstrated that urea prills could be uniformly coated with hydrogenated tallow to any desired level by using a fluidized bed technique for coating. The effects of the coating on the ammonia and urea concentrations in the rumen and blood of sheep have been reported by Tyznik and Kunkle (5). Coating urea to a level of 24% significantly reduced the concentration of rumen ammonia and blood urea in sheep (Table IV). A survey to estimate the potential market for tallow-coated urea indicates that 345,000–445,000 tons might be used by 1980. This would require 200 million pounds of tallow for coating. This estimate is conservative but is dependent upon expected favorable results from additional technical research on the production and testing of tallow-coated urea. Preliminary estimates for manufacturing tallow-coated urea indicate a cost of $5–$15 per ton of coated product depending on the proportion of hydrogenated tallow required for coating. We are now ready for pilot scale production and extensive testing of the product.

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