

New Developments in Synthetic Fatty Acids¹

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Abstract

New developments in synthetic fatty acids have occurred in the last few years in Russia, Japan, the United States and Canada. In 1959 Russia decided to replace 40% of natural fatty acids in soaps with synthetic fatty acids. In 1966, 548 million pounds of C₅-C₂₀ synthetic fatty acids were produced including 288 million pounds of C₁₀-C₂₀ fatty acids. Forty million pounds of fatty acids are converted directly to the fatty alcohols for detergent use. A conservative estimate predicts that one billion pounds of synthetic fatty acids will be produced in Russia by the end of the current five-year program. Reports say that the Japanese have been interested in the oxidation of not only paraffin hydrocarbons but naphthenic petroleum hydrocarbons as well. Production of lower homology fatty acids up to butyric acid is being seriously considered in Japan. In America the most likely syntheses aside from "oxo" syntheses being considered for the manufacture of products like lauric acid is the carboxylation of the Ziegler intermediates prepared from ethylene polymerization. Some data on the current and future coconut oil consumption by major end-use for Canada and the United States are presented. Synthetic lauric acid is predicted for 1970 in the United States.

Introduction

The seriousness of the threat of synthetic fatty acids has perhaps been unintentionally overemphasized in previous studies on this subject. Whether it has or not depends on who is considering this new development: the natural lauric acid producer, the purchaser of coconut oil, or a consumer interested in the possibility of a cheaper and equivalent synthetic lauric acid. This paper discusses new developments occurring in Russia, in Japan and, the American and Canadian scene.

In 1959 the consumption of soap in Russia was estimated at 2.6 billion pounds a year, approximately 200 million pounds of toilet soap. That year the Russians initiated a Seven Year Plan to replace 40% of their soap fatty acids and 15% if their toilet soap fatty acids with synthetic fatty acids. The Russian Commissars set a very optimistic goal for this first Seven Year Plan, a production amounting to 670 million pounds of synthetic fatty acids of composition in the C₁₀-C₂₀ range suitable for the manufacture of household soap. A total consumption, and a very ambitious volume it was, 1.22 billion pounds of total fatty acids, including soap, was envisioned as a reasonable goal for the first Seven Year Plan. The facts are now in on the results of this plan. The actual production in 1966 amounted to 288 million pounds of synthetic fatty acids for the C₁₀-C₂₀ range of acids, and a total production of 458 million pounds of synthetic fatty acids from C₅-C₂₀ resulted. This is a completely noteworthy achievement on any basis. We must consider that at the beginning of the Plan there was almost no production of synthetic fatty acids in Russia. The United States production of total natural fatty acids as reported in 1967 was only 530,798,000 pounds of total acids, excluding the tall oil fatty acid types. It is more than likely that at the end of 1968 the production of synthetic fatty acids in Russia will exceed the American production of natural fatty acids of all types, excluding tall oil fatty acids.

A little review on the reasons why the Russians are making synthetic fatty acids may be important. One factor that has not always been appreciated is that there is a considerable shortage of tallow in Russia, in Europe or in

any of the other continents of our globe, and that this has not been the case in the United States, where there is an ample supply of all types of beef and other tallows, greases, etc. In the second place, Europe is still facing a shortage of food in many areas.

The Russian Government decided in 1958 that fats and oils would be diverted completely to industrial uses, and would not be used for household purposes, of which soap is a major product component. In contrast to this situation, the United States, in the last 20 years, has had tallow readily available in copious quantities until 1968. It is probable, however, that in the period 1969-1970 this situation may not continue to exist.

For the first time in the history of our country the price of tallow on the New York market rose to 9.5 cents per pound three years ago; when tallow prices increase, the price of natural fatty acids such as stearic, palmitic and oleic acids also increase. Shortly after this period, however, the price lowered, and is currently in the range of 5 $\frac{7}{8}$ to 6 cents per pound.

There are several reasons why Americans have not found it necessary to produce synthetic fatty acids: (a) There is abundant supply and diversification of vegetable oils in America, such as soya, soya soapstock, cotton, palm, cotton soapstock, greases and by-products from animal fat. (We are indeed fortunate in our country that this situation does exist. In no other country in the world is there such an abundance of tallow, animal and vegetable fat. In the last three years Argentina was converted from a tallow exporting to a tallow importing nation. All throughout Central and South America, India, China and the Philippines tallow is very scarce.), (b) In the last six years, a sound marine fat raw material situation has been developing. (A member of the Bureau of Fisheries recently put it very humorously: "The Republicans may be complaining that the country is going to the dogs; in the Bureau of Fisheries, we feel that the country is going to menhaden, herring, and pilehard."), (c) We have had an ample supply of cheap, available, unsaturated fatty acids, such as tall oil fatty acids and oleic acids from tallow and cottonseed. (d) The natural fatty acid industry has thus far provided a family of products that are inexpensively priced and of satisfactory and uniform quality, the acids that are used are mixtures of several components; the production and marketing is unlike the business of making methanol, formaldehyde, acetone, urea or ammonia and they are not marketed in bulk tonnage marketing programs. (e) Finally, there is no single market for 50 million pounds or more of any one natural fatty acid aside from tall oil fatty acid that a petroleum company can be sure it can market profitably.

But what are some new Russian developments? What has transpired in the last year or so? The Seven Year Russian Plan is concluded and a Five Year Plan is being carried out. About two years have elapsed of the second Plan. According to available data, it is two fifths complete and apparently it will be more successful than the first Seven Year Plan. The quality of the C₅-C₁₀ by-product fatty acid which is finding its way into the United States by one route or another appears to be improving in three respects: they smell better, they have better color, and they are slightly lower in peroxides and carbonyls than they were previously.

Another development that has just transpired recently is the conversion of synthetic fatty acid cuts to fatty alcohols, which reached, in 1966, the level of 10,000 metric tons in Russia alone. This conversion is accomplished by the hydrogenation of the methyl esters of synthetic fatty acids to fatty long-chain alcohols. The Russians use these alcohols just as Americans do in the preparation of synthetic detergents.

Several conclusions can be drawn from this: The

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