Technical News Features

Fatty Alcohols: Natural or Petrochemical Feedstocks in the 1980s?

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ABSTRACT

The economics of fatty alcohol use and production is reviewed. Beyond that in place or announced, there is little likelihood of more US fatty alcohol capacity in the next ten years. Barring a cataclysmic event, the real price of ethylene will increase at a rate approximately equal to the rate of increase for coconut oil price in the next ten years. Producers of fatty alcohols will be indifferent, if feedstock economics are the only consideration, between natural and petrochemical raw material bases for this class of oleochemicals.

Fatty alcohols are the detergent-range, 12-carbon and higher, linear aliphatic alcohols. This class of oleochemicals is the largest volume group of industrial chemicals manufactured and marketed in the United States that can be produced from either petrochemical feedstocks or from natural fats and oils. The alternative manufacturing possibilities for fatty alcohols are both long-standing, commercially facile processes. Although there are physical and functional differences between "natural" and "petrochemical" alcohols, the choice of manufacturing hardware between the two routes has in the past rested basically on raw material economics.

US capacity for C_{12+} alcohols is shown in Table I. These figures take into account both present capacity and recently announced plans for the building of new facilities.

Conoco, prior to its acquisition by DuPont, had been contemplating the construction of a large fatty alcohol facility based on oleochemical hydrogenation. It now appears that plans for this plant, which would have complemented an existing petrochemically derived alcohol plant, have been postponed or scrapped.

Thus, of the six present and potential producers, three are, or will be in the next two years, tied to oleochemical feedstocks, and three are now basing production on fossil fuel derivatives. No producer now appears to be planning to have the best of both worlds, that is, to produce alternatively or simultaneously from petrochemical *and* oleochemical feedstocks.

American fatty alcohol demand and end-use by markets is shown in Table II.

In 1979, exports amounted to 179 million pounds and there was virtually no fatty alcohol importation into the United States. US consumption of the alcohols grew at ca. 5% per year during the period 1975-79. Exports are likely to decrease as alcohol plants are built in coconut oil-producing locations (1).

Fatty alcohol production has gone through three phases. In the earliest stage, all-natural production was the only method known to the still relatively small industry. The advent of Ziegler and oxo chemistry in the 1950s brought about the construction of petrochemically based alcohol facilities and a great surge in detergent-range alcohol production. This second phase – the petrochemical era – reached its high point in the early 1980s, at which time natural alcohols represented only ca. 16% of total US fatty alcohol production. Now, the third phase – the renaissance of natural processing – will bring natural alcohol back to ca. 30% of total US capacity by the mid-1980s.

What, then, does the future, until the end of this century, hold for this business? When might new plants be built? Would they be more likely to be petrochemical plants or oleochemical processors? And is it conceivable that either of the two sets of processors will be forced out of business because theirs will have become an economically uncompetitive route to fatty alcohols?

Even if there were to be no substantial external shocks to affect alcohol demand, such as the replacement of alcohol sulfates or alcohol ether sulfates with alpha olefin sulfates in detergent formulations, a historically "normal" growth rate in detergent alcohol consumption would mean

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TABLE I

US C_{12+} Alcohol Capacity

Company	Capacity (million pounds) Present	Capacity (million pounds) Announced	Route P = petrochemical F = from fats and oils
Conoco	135		Ziegler (P)
Ethyl	210		Ziegler (P)
P & G	120	65-75(1982-3)	Oleochemical hydrogenation (F)
Shell	550		Modified oxo (P)
Sherex	20		Oleochemical hydrogenation (F)
Union Carbide/Henkel	———	110(1984)	Oleochemical hydrogenation (F)
Total	1035	175-185	

Total mid-1980s capacity = ∿ 1.2 billion pounds.

TABLE II

US Fatty Alcohol Consumption (1979)

End use	MM Pounds	
Detergents		437
Alcohol sulfates	153	
Alcohol ethoxylates	133	
Alcohol ether sulfates	142	
Alcohol glyceryl ether sulfates	9	
Methacrylate esters		56
Fatty amines		19
Thiodipropionates		4
Other derivatives		14
Free alcohols		43
Total		573

Source: Chemical Economics Handbook, SRI International.

sufficiency of facilities, with present and announced capacity, until the early 1990s. In the early part of this decade, it may be that fatty alcohol producers will find themselves in the same unenviable demand/capacity predicament that polyolefin producers are in now (1982).

In the late 1970s and in 1980, as OPEC prices surged and then peaked – at least for a while – there was a steady stream of reported plans, and some actuality, for the development and accelerated use of fuel and chemical stocks based on renewable resources. The writer and others (2,3) suggested then that the succeeding ten years, and perhaps the balance of the 20th century, could show a moderation, or a flattening in real terms, in the rate of increase of crude oil and petrochemical prices, and that gasohol and other fuels and chemicals based on crop resources could lose their economic attractiveness. Now, in 1982, gasohol has virtually disappeared in this country; Conoco's (or DuPont's) decision not to pursue natural fatty alcohols may be based on similar analysis.

In the long economic run, trends in commodity prices have always been linked with one another even in the case of commodities as disparate as ethylene and edible fats and oils such as coconut oil, tallow, and soybean oil. This commodity price linkage, in all likelihood, will intensify in the years to come, as the strongest price-influencing factors, such as inflation, become more uniform, worldwide phenomena rather than being confined to individual nations or to regions.

Ethylene and coconut oil destined for chemical production can both be termed byproducts. Prices in the two cases are determined largely by supply/demand considerations for crude oil and natural gas, on the one hand, and edible oils, on the other. Factors that can affect the supply side are the ability (or inability) of producing cartels to fix production and price levels; capacities; and the effects of inflation on production, processing, shipping costs, and cost of capital – all factors which do, or can, have similar effects on crude oil and coconut oil. On the demand side, factors

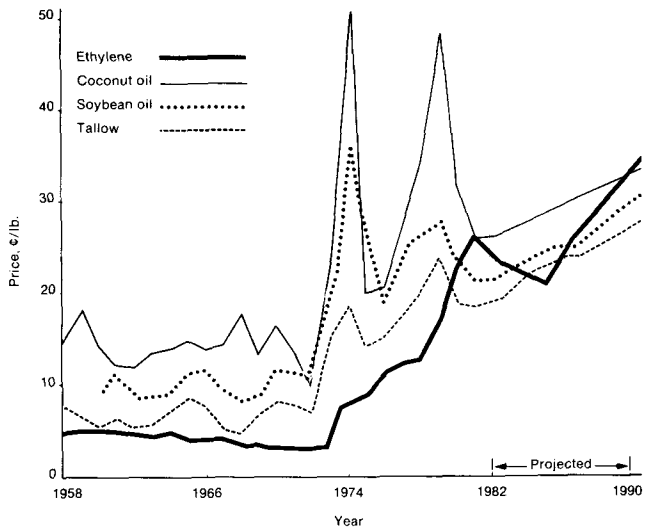

FIG. 1. Nominal prices on four commodities, 1958-1990, actual and projected. Coconut oil: crude, West Coast; ethylene: US International Trade Commission (through 1979); soybean oil: crude, Decatur; tallow: bleachable, Chicago.

affecting US pricing of the two commodities – ethylene and coconut oil – are the substitutability of other fuels for fuel oil and natural gas, and other food oils and fats for coconut oil; conservation; and the strength of the dollar – all factors with unequal impact on ethylene and coconut oil, but having tendencies toward similar effects.

Figure 1 plots nominal prices for ethylene, coconut oil, inedible tallow, and soybean oil since 1958, and essays some price estimates for the balance of the decade. This assumes a rate of price inflation of ca. 6%/year for that period.

The conclusion, then, is that ethylene prices will remain soft, and then rise modestly, and that natural fat and oil prices will probably climb to a higher plateau. This conclusion is based on a "long-term commodity linkage" concept: short-term "natural" fat and oil prices have been too low for producers' economic well-being; short-term petrochemical prices have already softened, reflecting capacity and production gluts; longer-term mutual price equilibration of the two types of commodities will follow.

REFERENCES

1. See Chemical Week, Feb. 24, 1982 (p. 25) for announcement of new Philippines oleochemical plant.
2. Leonard, E.C., Presentation at the AOCS meeting, New Orleans, May 1981.
3. Singer, S.F., The Wall Street Journal, Feb. 4, 1981.