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CARBOXYLIC ACIDS, FATTY ACIDS FROM TALL OIL

Tall oil fatty acids (TOFA) consist primarily of oleic and linoleic acids and are obtained by the distillation of crude tall oil. Crude tall oil, a by-product of the kraft pulping process, is a mixture of fatty acids, rosin acids, and unsaponifiables (1). These components are separated from one another by a series of distillations (2). Several grades of TOFA are available depending on rosin, unsaponifiable content, color, and color stability. Typical compositions of tall oil fatty acid products are shown in Table 1 (see Tall oil).

At present, tall oil fatty acids are produced by six companies using 12 fractionating plants in the United States, one in Canada, 13 in Europe, two in Japan, one in New Zealand, and at least one in Russia. Worldwide crude tall oil fractionating capacity in 1988 was estimated at slightly over 1.4 million metric tons and the fractionating capacity in the United States at just over 900,000 t. Domestic production and prices of TOFA during the last 10 years are shown in Table 2. TOFA pricing is strongly dependent on soya fatty acid prices since these materials are often used in the same application.

Tall oil fatty acids have a variety of applications (Table 3). The largest uses of TOFA traditionally have been in coatings, primarily alkyd resins (qv) where grades of higher rosin content predominate (5). Since the 1970s their use as chemical intermediates in applications, which includes manufacture of dimer acids (qv) (6) and epoxidized TOFA esters (7), has exceeded their use in coatings. Other areas of significant use are in soaps, detergents (qv) (8), and ore flotation (qv) (9).

Table 1. Typical Fatty Acid Composition of Tall Oil Products

	CAS Registry Number	Crude tall oil, %	Crude fatty acid, %	<2% Rosin in fatty acid, %	Distilled tall oil, %
		Fatty acids normalized to 100%			
$C^{16}H_{32}O_2$	[57-10-3]	6.3	1.6	0.4	
$C_{17}H_{34}O_2$	[506-12-7]	1.5	0.7	0.7	
$C_{18}H_{36}O_2$	[57-11-4]	1.5	2.2	2.3	1.4
$C_{18}H_{34}O_2$	[112-80-1]	39.8	42.3	46.4	22.9
$C_{18}H_{32}O_2$	[60-33-3]	34.0	34.8	36.3	22.0
$C_{18}H_{32}O_2$ (isomers)	[26764-25-0]	10.2	12.7	10.3	24.6
$C_{19}H_{38}O_2$	[646-30-0]	1.2	1.1	1.1	1.1
$C_{20}H_{36}O_2$	[25448-01-5]	4.6	4.7	2.4	28.0
Rosin acids		40	7	1	30
Unsaponifiables		8	2.5	1.5	2

Table 2. Production[a] and Prices[b] of TOFA

Year	Crude tall oil, 10^3 t/yr	TOFA, 10^3 t/yr	Approximate average price of TOFA, ¢/kg
1980	795.7	184.7	48–51
1981	799.0	184.8	37–42
1982	715.6	166.1	37–42
1983	790.9	192.5	44–46
1984	796.1	214.0	51–73
1985	785.3	186.6	80–84
1986	814.9	195.1	44–71
1987	862.1	209.5	37–53
1988	869.2	217.6	42–55
1989	901.5	219.3	55–59

[a] Ref. 3.
[b] Ref. 4.

Table 3. U.S. Markets for Tall Oil Fatty Acids, 10^6 kg[a]

Year	Intermediate chemicals	Protective coatings	Soaps and disinfectants	Flotation	Other uses
1980	70.7	30.5	10.2	5.4	27.3
1981	77.2	34.4	10.6	7.3	32.5
1982	78.3	32.7	9.8	4.0	25.6
1983	77.0	34.5	11.0	4.1	32.7
1984	80.5	32.3	12.4	4.3	56.6
1985	62.1	27.5	13.3	4.8	43.2
1986	66.6	29.1	12.8	3.4	44.6
1987	80.1	25.9	18.0	4.5	54.5

[a] Ref. 3.

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