

SODIUM SULFATE

By Dennis S. Kostick

Sodium sulfate, also known as disodium sulfate (Na_2SO_4), is an inorganic chemical that has several important industrial uses. It is produced from naturally occurring sodium-sulfate-bearing brines or crystalline evaporite deposits, and as a byproduct from different chemical processes, such as ascorbic acid, battery acid recycling, boric acid, cellulose, chromium chemicals, lithium carbonate, rayon, resorcinol, and silica pigments. The byproduct sodium sulfate is considered a waste product but has marketability; both types of sodium sulfate, however, have several important and useful applications in various consumer products, such as in soaps and detergents, pulp and paper, and textiles.

Production

Domestic production and inventory data for natural sodium sulfate are developed by the U.S. Geological Survey (USGS) from monthly and annual surveys of U.S. operations. Of the two natural sodium sulfate operations to which a survey request was sent, both responded, representing 100% of the natural sodium sulfate data used in this report.

Data for synthetic sodium sulfate were collected by the U.S. Department of Commerce, Bureau of the Census, from quarterly and annual surveys (aggregate data published in Current Industrial Reports, Inorganic Chemicals, MQ28A and MA28A) of companies engaged in recovering and selling byproduct sodium sulfate. Any revised Bureau of the Census data have been included using the most recent statistics. These data are aggregated with USGS natural sodium sulfate data and included in several tables.

Two companies produced natural sodium sulfate from a total of two plants, one each in California and Texas. The domestic natural sodium sulfate industry supplied 55% of the total output of U.S. sodium sulfate. Because of the location of these plants, most natural sodium sulfate is marketed in the West and southern Gulf areas. Based on final 1996 data from the Bureau of the Census, byproduct material was supplied by 14 establishments located primarily in the Midwest and Mid-Atlantic regions. The number of plants, by process, was natural, two; viscose rayon, three; sodium dichromate, one; and phenol, boric acid, formic acid, and other, eight. Total rated production capacity in 1997 was 762,000 tons, and the industry operated at 76% of this capacity.

Domestic natural sodium sulfate production increased about 4% in 1997. Final 1997 statistics on synthetic sodium sulfate are unavailable because these data are usually subject to major revisions in updated reports issued by the Bureau of the Census.

However, based on preliminary Bureau of the Census data for total sodium sulfate, 580,000 tons was produced in 1997, of which 318,000 tons was from natural sources and 262,000 tons was from

byproduct sources. Ending inventories of natural sodium sulfate were 26,000 tons.

In December, IMC Global, Inc., announced that it would purchase the Harris Chemical Group, Harris' subsidiary Great Salt Lake Minerals, and Harris' Australian affiliate Penrice Soda Products Pty. Ltd. for \$450 million in cash and assume about \$950 million of debt. Harris Chemical, with annual sales of \$850 million, has operations in the United States, Australia, Canada, and Europe, and produces soda ash, sodium sulfate, sodium bicarbonate, boron chemicals, magnesium chloride, potash, and salt (Chemical Market Reporter, 1997a). IMC Global, which produces phosphate, potash, and salt, has annual sales of about \$3 billion (IMC Global, 1997).

Consumption

The estimated distribution of sodium sulfate by end use was soap and detergents, 42%; textiles, 15%; pulp and paper, 12%; glass, 11%; and other, 20%. Miscellaneous uses included sodium sulfate for carpet fresheners, starch manufacture, etc. Based on preliminary byproduct sodium sulfate production data, apparent consumption decreased 8% to 636,000 tons.

The U.S. sodium sulfate industry continued to benefit from the strong demand for detergents and general supply shortages of sodium caused by the decline in Canadian sodium sulfate production and the reduction in sodium sulfate exports from Mexico. The demand for less expensive consumer products led detergent manufacturers to reformulate powdered home laundry products using more sodium sulfate as a filler.

An estimated 44% of the total sodium sulfate consumed in the United States is for use as a filler in powdered laundry detergents. Many areas in the country have adopted phosphate bans or limitations because phosphatic detergents contribute to the environmental problems of eutrophication. The affected areas represent about 33% of the U.S. population. In response to this environmental issue, detergent manufacturers have reformulated many of their detergents by switching from sodium tripolyphosphate (STPP) to tetrasodium pyrophosphate, which has the same building power as STPP but requires less to be used, thereby reducing the amount of phosphate released into the environment. These reformulations used more sodium sulfate as filler, which was beneficial to the sodium sulfate industry.

Some domestic detergent manufacturers began adding additional quantities of sodium sulfate to powdered laundry products, reportedly to substitute for higher priced zeolites and surfactants.

The use of sodium sulfate in textiles apparently is increasing, according to industry sources. Salt traditionally has been used in the dyeing process to separate organic contaminants, promote

“salting out” of dyestuff precipitates, and blending with dyes to standardize concentrated dyes. The equipment used in this process used stainless steel, which was susceptible to corrosion because of the salt. The textile industry began replacing the salt with sodium sulfate, which is not corrosive to the manufacturing equipment.

Stocks

Yearend 1997 inventories of natural sodium sulfate stored by the two producers were 26,000 tons, which was a 37% increase over that of 1996. The material stockpiled was anhydrous sodium sulfate. Synthetic sodium sulfate was marketed mainly through major chemical distributors, which have separate storage facilities from the producers.

Prices

Producers of natural sodium sulfate tend to market and sell most of their own product, but most synthetic producers use major chemical distributors or chemical supply companies as sales agents. The principal product made and sold by the synthetic sodium sulfate producer is the primary economic factor. Because sodium sulfate is considered a waste product, it will be sold at a price that ensures prompt sales. This practice tends to set the rates at which the natural product can be sold.

The list prices quoted in trade journals or by producers of all grades of sodium sulfate differ from the annual average values reported by the USGS. This value represents the amount of total revenue of domestic natural sodium sulfate sold at list prices, spot prices, long-term contracts, discounts, and export divided by the aggregated quantity of sodium sulfate sold. The published value does not necessarily correspond to the posted list price.

The average value increased from \$88.90 per metric ton in 1996 to \$109.13 per metric ton in 1997 for bulk sodium sulfate, f.o.b. mine or plant. Price increase announcements were made in late 1997 by Saskatchewan Minerals, a division of Goldcorp. Inc., and Millar Western Industries, both of Canada, that raised the off-list price by US\$10 per ton in the United States and C\$10 per ton in Canada effective October 1 (Chemical Market Reporter, 1997b,c). U.S. natural producers Cooper Natural Resources (formerly Elf Atochem North America Inc.) also followed the price initiative by \$10 per ton effective October 1 or as contracts allow (Chemical Market Reporter, 1997d).

Foreign Trade

Sodium sulfate exports in 1997 amounted to 86,300 tons, according to Bureau of the Census data. Of this quantity, crude sodium sulfate exports of 72,500 tons was exported to 15 nations. Colombia received the largest share; about 26% of the total, followed by Canada, 25%, and Argentina, 23%. Anhydrous sodium sulfate exports to 15 countries was 13,800 tons. Mexico imported the most; nearly 90% of the total. The value of total sodium sulfate exports was \$125.14 per ton.

Imports of sodium sulfate in 1997 were 150,000 tons, or 15% less than the 177,000 tons imported in 1996. More than 9,000

tons of anhydrous sodium sulfate were imported in 1997, primarily from Canada and Belgium. Shipments from Canada represented nearly 93% of total imports of anhydrous sodium sulfate. India, Israel, Japan, and Mexico shipped the remainder. Imports of crude sodium sulfate were almost exclusively from Canada. The total value of all sodium sulfate imports was \$104 per ton.

World Review

Approximately 67% of the world sodium sulfate production in 1997 was from natural sources; the balance was represented by synthetic sodium sulfate recovered from various chemical and manufacturing processes. Although the USGS collects or estimates data from 31 sodium sulfate-producing countries, other countries are known or assumed to have produced synthetic sodium sulfate, but production statistics are not reported, and available information is inadequate to make reliable estimates of output.

Although the United States is one of the largest producers in the world of natural and synthetic sodium sulfate, its share has decreased from 23% of world production total in 1980 to 11% in 1997.

Chile.—Atacama Minerals Corp. received approval of an environmental impact statement for its Aguas Blancas project near Antofagasta. The project, which is scheduled to commence production in early 1999, will reportedly annually produce 300,000 tons of sodium sulfate, 70,000 tons of potassium nitrate, and 1,000 tons of crude iodine. Total projected costs are about \$100 million, including \$59 million for the processing facilities and \$13 million for additional infrastructure, roads, and water supplies (Chemical Market Reporter, 1997e).

Mexico.—Industrias de Penoles at Quimica del Ray completed an expansion that raised sodium sulfate production capacity by 20% to 600,000 tons. The market for sodium sulfate has been growing in Mexico, which supported the decision for the company to increase capacity (Chemical Market Reporter, 1997f).

Outlook

Sodium sulfate consumption by the soap and detergent industry, which has been the largest consumer of sodium sulfate, will continue to remain strong because of the demand for powdered home laundry products. South America continues to be a major region for increased sodium sulfate consumption. In areas with a depressed economy, powdered home laundry detergents are more in demand because they are less expensive than liquid concentrates or compact alternatives.

U.S. consumption, which had been declining for many years, appears to be growing because of supply and demand changes in North America and in other parts of the world where sodium sulfate trade was important. Domestic sodium sulfate production should remain adequate to meet consumption requirements.

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TABLE 1
SALIENT SODIUM SULFATE STATISTICS 1/

(Thousand metric tons and thousand dollars)

	1993	1994	1995	1996	1997
United States:					
Production, natural	327	298	327	306	318
Production, synthetic	210	293	318	296 r/	262
Synthetic and natural:					
High Purity	320	W	W	W	W
Low Purity (99% or less)	217	W	W	W	W
Total 2/	537	591	645	602 r/	580
Value 3/	\$41,100	\$48,000	\$54,500	\$53,500 r/	\$63,300
Per ton	\$76.53	\$81.25	\$84.55	\$88.90	\$109.13
Exports	89	65	66	86	86
Value	\$8,540	\$7,020	\$7,250	\$9,140	\$10,800
Imports for consumption	163	190	206 r/	177 r/	150
Value	\$13,600	\$15,700	\$17,700 r/	\$17,100 r/	\$15,600
Stocks, Dec. 31: Producers	42	34	16	19	26
Apparent consumption	616	724	803	690	636
World: Production	4,980 r/	5,180 r/	5,310 r/	5,370 r/	5,520 e/

e/ Estimated. r/ Revised. W Withheld to avoid disclosing company proprietary data.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Includes natural and synthetic. Total production data for synthetic sodium sulfate, obtained from the Bureau of the Census, were revised in third quarter 1996 MQ28A Inorganic Chemicals, Current Industrial Report.

3/ The value for synthetic sodium sulfate is based upon the average value for natural sodium sulfate.

TABLE 2
U.S. PRODUCERS OF NATURAL AND SYNTHETIC SODIUM SULFATE IN 1997

Product and company	Plant nameplate capacity (thousand metric tons)	Plant location	Source
Sodium sulfate, natural:			
North American Chemical Co., Westend plant	204	Trona, CA	Dry lake brine.
Cooper Natural Resources Inc. 1/	141	Seagraves, TX	Do.
Total	345		
Sodium sulfate, synthetic:			
Courtaulds North American Inc.	45	La Moyne, AL	Rayon manufacture.
East Penn Manufacturing	4	Lyons Station, PA	Battery recycling.
Flour Corp., Doe Run Co.	14	Boss, MO	Do.
FMC Corp.	41	Bessemer City, NC	Lithium carbonate.
4M Paper Corp.	6	Ft. Madison, IA	Pulping process.
GMB Technologies	27	Columbus, GA	Battery recycling.
Hampshire Chemicals 2/	3	Deer Park, TX	Pulping process.
Do. 3/	8	Nashua, NH	Chelating agents.
Indspec Chemical Corp.	35	Petrolia, PA	Resorcinol manufacture.
J. M. Huber	33	Etowah, TN	Silica pigment.
Do.	18	Havre de Grace, MD	Do.
Lenzing A.G.	41	Lowland, TN	Rayon manufacture.
Occidental Chemical Corp.	109	Castle Hayne, NC	Sodium dichromate manufacture.
Roche Vitamins & Chemicals 4/	24	Belvidere, NJ	Ascorbic acid.
Teepak, Inc.	9	Danville, IL	Cellulose manufacture.
Total	417		
Grand total	762		

1/ Formerly Ozark-Mahoning Co.

2/ Formerly Pineville Kraft.

3/ Formerly W.R. Grace & Co.

4/ Formerly Hoffman-La Roche, Inc.

TABLE 3
SODIUM SULFATE YEAREND PRICES

(Dollars per ton)

	1996	1997
Sodium sulfate (100% Na ₂ SO ₄):		
East, bulk, carlot, works, freight equalized	113.00-114.00	113.00-114.00
Gulf, bulk, carlot, same basis	110.00	110.00
West, bulk, carlot, same basis	127.00	127.00
Salt cake (100% Na ₂ SO ₄):		
East, bulk, f.o.b. works	82.00	82.00

Sources: Chemical Marketing Reporter. Current Prices of Chemicals and Related Materials. v. 251, no. 1, January 6, 1997, p. 28, and v. 253, no. 1, January 5, 1998, p. 28.

TABLE 4
U.S. EXPORTS OF SODIUM SULFATE, BY COUNTRY 1/

Country	Disodium sulfate, salt cake		Disodium sulfate, other		Total	
	Quantity (metric tons)	Value 2/	Quantity (metric tons)	Value 2/	Quantity (metric tons)	Value 2/
1996:						
Argentina	--	--	2,300	\$800,000	2,300	\$800,000
Australia	--	--	34	508,000	34	508,000
Belgium	28	\$4,130	--	--	28	4,130
Brazil	15,100	1,400,000	65	663,000	15,200	2,070,000
Canada	26,100	2,120,000	--	--	26,100	2,120,000
China	16	3,500	15	19,800	31	23,300
Colombia	23,800	1,170,000	5	4,680	23,800	1,180,000
Costa Rica	60	14,400	--	--	60	14,400
Dominican Republic	--	--	19	6,300	19	6,300
Guatemala	8,530	1,050,000	--	--	8,530	1,050,000
Haiti	--	--	9	18,900	9	18,900
Israel	--	--	5	7,500	5	7,500
Italy	55	8,240	--	--	55	8,240
Jamaica	80	12,800	--	--	80	12,800
Malaysia	--	--	1	3,360	1	3,360
Mexico	1,870	280,000	778	282,000	2,640	563,000
Netherlands	56	8,290	--	--	56	8,290
New Zealand	--	--	5,370	508,000	5,370	508,000
Panama	--	--	3	4,840	3	4,840
Peru	--	--	1,190	173,000	1,190	173,000
Philippines	142	34,000	--	--	142	34,000
Saudi Arabia	--	--	3	2,520	3	2,520
Spain	--	--	5	12,600	5	12,600
St. Kitts and Nevis	22	2,880	--	--	22	2,880
Thailand	--	--	1	7,590	1	7,590
Venezuela	19	2,760	--	--	19	2,760
Total	75,900	6,120,000	9,810	3,020,000	85,700	9,140,000
1997:						
Argentina	16,900	2,410,000	1,280	446,000	18,100	2,850,000
Australia	5,800	651,000	7	47,500	5,810	698,000
Brazil	--	--	21	139,000	21	139,000
Canada	18,300	1,500,000	--	--	18,300	1,500,000
China	126	22,800	31	44,000	157	66,800
Colombia	18,900	954,000	1	6,340	18,900	961,000
Costa Rica	365	98,200	--	--	365	98,200
Croatia	--	--	6	81,100	6	81,100
France	--	--	10	3,600	10	3,600
Ghana	--	--	19	7,110	19	7,110
Guatemala	4,640	480,000	--	--	4,640	480,000
Haiti	--	--	25	58,400	25	58,400
Hong Kong	201	32,000	--	--	201	32,000
India	17	2,500	--	--	17	2,500
Italy	3,170	134,000	--	--	3,170	134,000
Jamaica	102	15,400	--	--	102	15,400
Mexico	3,740	559,000	12,400	3,040,000	16,200	3,590,000
Netherlands	24	3,570	1	2,690	25	6,260
Panama	--	--	8	15,500	8	15,500
Singapore	--	--	(3/)	3,060	(3/)	3,060
Sweden	--	--	1	8,260	1	8,260
Taiwan	97	14,400	--	--	97	14,400
Thailand	134	23,300	--	--	134	23,300
United Kingdom	--	--	2	23,200	2	23,200
Total	72,500	6,890,000	13,800	3,920,000	86,300	10,800,000

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ F.a.s. value at U.S. ports.

3/ Less than 1/2 unit.

Source: Bureau of the Census.

TABLE 5
U.S. IMPORTS OF SODIUM SULFATE, BY COUNTRY 1/

Country	Disodium sulfate, salt cake 2/		Disodium sulfate, Glauber's salt 3/		Disodium sulfate, other 4/		Total	
	Quantity (metric tons)	Value 5/	Quantity (metric tons)	Value 5/	Quantity (metric tons)	Value 5/	Quantity (metric tons)	Value 5/
1996:								
Belgium	--	--	--	--	300	\$84,000	300	\$84,000
Canada	60,000	\$5,670,000	87,400	\$8,350,000	28,400	2,470,000	176,000 r/	16,500,000 r/
Germany	1	1,480	--	--	56	25,200	57	26,600
India	--	--	--	--	229	254,000	229	254,000
Japan	--	--	121	53,700	7	8,000	128 r/	61,700 r/
Mexico	--	--	--	--	414	140,000	414	140,000
United Kingdom	32	3,150	--	--	--	--	32	3,150
Total	60,100	5,680,000	87,500	8,410,000	29,400	2,980,000	177,000 r/	17,100,000 r/
1997:								
Belgium	--	--	--	--	441	112,000	441	112,000
Canada	53,200	5,340,000	86,500	8,590,000	9,190	1,100,000	149,000	15,000,000
India	47	15,300	--	--	184	208,000	231	223,000
Israel	--	--	212	64,900	6	22,800	218	87,700
Japan	--	--	3	5,480	94	112,000	97	118,000
Mexico	--	--	71	72,200	--	--	71	72,200
Total	53,200	5,360,000	86,700	8,740,000	9,910	1,550,000	150,000	15,600,000

r/ Revised.

1/ Data are rounded to three significant digits; may not add to totals shown.

2/ Salt cake is HTS No. 2833.11.1000.

3/ Glauber's salt is HTS No. 2833.11.5050.

4/ Other is HTS No. 2833.11.5010.

5/ C.i.f. value at U.S. ports.

Source: Bureau of the Census.

TABLE 6
SODIUM SULFATE: WORLD PRODUCTION, BY COUNTRY 1/ 2/

(Metric tons)

Country 3/	1993	1994	1995	1996	1997 e/
Natural:					
Argentina (mirabilite)	6,554	7,978	10,604	21,726 r/	15,000
Canada 4/	320,000	317,000	311,000	323,000 r/	305,000 p/
Chile	1,433 r/	1,668 r/	2,488 r/	1,745 r/	1,800
China e/ 5/	900,000 r/	950,000 r/	1,000,000 r/	1,160,000 r/	1,450,000
Egypt e/	25,600 6/	25,000	25,000	25,000	25,000
Iran e/	280,000 6/	280,000	280,000	280,000	280,000
Mexico (bloedite) e/	500,000	527,228 6/ 7/	500,000	525,000	525,000
Netherlands e/	20,000	20,000	20,000	20,000	20,000
South Africa	36,380	44,544	43,971	46,947 r/	55,000
Spain e/ 8/	650,000	600,000	637,525 r/ 6/	630,000 r/	600,000
Turkey (concentrates)	170,680	307,049	314,192 r/	300,000 e/	300,000
Turkmenistan e/	100,000	100,000	100,000	100,000	100,000
United States	327,000	298,000	327,000	306,000	318,000 6/
Total	3,340,000 r/	3,480,000 r/	3,570,000 r/	3,740,000 r/	3,990,000
Synthetic: e/					
Austria	120,000	120,000	100,000	100,000	100,000
Belgium	250,000	250,000	250,000	250,000	250,000
Bosnia and Herzegovina	1,000	500	500	500	500
Brazil	9,000	9,000	9,000	9,000	9,000
Chile 9/	46,000	43,168 r/ 6/	43,000 r/	40,000 r/	41,000
Finland	30,000	30,000	34,000 r/ 6/	36,000 r/ 6/	36,000
France	62,000	65,000	117,000 r/ 6/	124,000 r/ 6/	120,000
Germany	106,789 6/	113,000 6/	110,000	120,000	120,000
Greece	6,000	6,000	6,000	6,000	6,000
Hungary	6,000	6,000	6,000	6,000	6,000
Italy	125,000	125,000	125,000	125,000	125,000
Japan	229,346 6/	200,111 6/	206,893 6/	193,439 r/ 6/	195,000
Macedonia	1,000	1,000	1,000	1,000	1,000
Netherlands	15,000	15,000	15,000	15,000	15,000
Pakistan	1,000	1,000	1,000	1,000	1,000
Portugal	50,000	50,000	50,000	50,000	50,000
Serbia and Montenegro	3,668 6/	3,500	3,500	3,000	3,000
Spain	150,000	150,000	150,000	150,000	100,000
Sweden	100,000	100,000	100,000	-- r/	--
Turkey	30,000	30,000	30,000	30,000	30,000
United Kingdom	90,000	90,000	60,000	70,000	50,000
United States 10/	210,000 6/	293,000 6/	318,000 6/	296,000 r/ 6/	262,000 6/
Total	1,640,000	1,700,000	1,740,000 r/	1,630,000 r/	1,520,000
Grand total	4,980,000 r/	5,180,000 r/	5,310,000 r/	5,370,000 r/	5,520,000

e/ Estimated. p/ Preliminary. r/ Revised.

1/ World totals, U.S. data, and estimated data are rounded to three significant digits; may not add to totals shown.

2/ Table includes data available through May 20, 1998.

3/ In addition to the countries listed, Norway, Poland, Romania, and Switzerland are believed to have produced synthetic sodium sulfate, and other unlisted countries may also have produced this commodity, but production figures are not reported; general information is inadequate for the formulation of reliable estimates of output levels.

4/ Excludes byproduct production from chemical plants.

5/ Both natural and synthetic.

6/ Reported figure.

7/ Series reflects output reported by Industrias Penoles and an additional 22,000 tons estimated production by Sulfato de Viesca.

8/ N₂SO₄ content of glauberite and thenardite.

9/ Byproduct of nitrate industry.

10/ Derived approximate figures; data presented are the difference between reported sodium sulfate production (natural and synthetic not differentiated) and reported natural sodium sulfate sold by producers (reported under "Natural" in this table).