

SALT, BROMINE, AND CALCIUM CHLORIDE.

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SALT.

The United States furnishes practically all the salt consumed by its people. In 1916 more than 99 per cent of all the salt used in this country was made here, and the value of the salt exported was more than twice as great as that of the salt imported. The total quantity of salt produced has increased steadily for many years. The imports have taken a sharp slump in the last four years, and the exports have increased about 50 per cent in the five years preceding 1916. The imports and exports, however, form a very minor part of the industry. The marketed domestic production of salt in the United States has increased from 20,000,000 to nearly 40,000,000 barrels in 15 years and is now increasing at a much more rapid rate. The war in Europe has stimulated industries in this country that require salt for chemical or metallurgic purposes, with the result that the natural growth in demand due to increased population is augmented to a marked degree by industrial needs.

The production in 1916 is estimated at 43,000,000 barrels of 280 pounds, or nearly half a barrel for each individual in the country, compared with 38,000,000 barrels in 1915. For many years the mines and manufacturing plants have not been producing anything like their capacity, and the 5,000,000-barrel increase in 1916 is only an indication of what can be done if a demand arises for enlarged output. Most of the plants can largely increase their present yield. The rock-salt mines are capable of extension and already are so developed that only additional labor and machinery would be needed to double their output. Most of the solar evaporators could increase their acreage and consequently their production.

Prices of salt are increasing and may continue to increase so long as the present unsettled conditions continue. Some grades of salt have doubled in value since 1915; others have increased 50 per cent. This increase is chargeable not only to increased demands of labor and cost of supplies but also to the larger margin of profit to which

producers feel entitled under present circumstances. Heavy charges against the cost of production are wages and fuel. Labor is demanding and receiving higher pay, and coal at some salt works has been hard to get and expensive. One producer reports coal increased in cost from 80 cents to \$5.50 a ton.

The production of salt must continue, as for many years past, to increase. The use of salt in food for men and animals naturally demands enlarged output to keep pace with increased population; its use as a source of chlorine and hydrochloric acid and in many chemical and metallurgic industries that are rapidly developing also demands larger output, though some of these industries may be much less active after present hostilities cease. Attention to sanitation is spreading in great waves, even to remote districts, and carries with it a demand for glazes and enamel on pottery and hardware, and for refrigeration and preserving foodstuffs, all of which take large quantities of common salt.

Fourteen States reported production in 1915. Salt of all grades is made from the lump salt used in salting cattle to the finest table and dairy salt. Rock salt is mined in New York, Michigan, Kansas, Louisiana, and Utah. Salt is produced from natural and artificial brines obtained from wells in several States and from the waters of Great Salt Lake and of the Pacific Ocean. It is also obtained from deposits in playas in Nevada, Texas, and New Mexico. New York, Ohio, and Michigan are the main source of salt for the Eastern States, Kansas and Oklahoma for the Central States, Louisiana and Texas for the South, and Utah and California for the West. In each of these general localities the supply is apparently inexhaustible. In New York, for example, an area of 2,000 square miles in the central counties from Oneida Lake to Lake Erie is underlain with a rock-salt deposit whose thickness ranges between 8 feet and 318 feet. This deposit alone would supply the whole United States for thousands of years. The present production, both by mining and from artificial brines, is negligible in comparison with the latent possibilities.

In Kansas a deep well struck rock salt at 690 feet below the surface and penetrated 600 feet of rock salt in beds from 5 to 60 feet thick. A large area in this State is underlain by salt, which is mined by many shafts and obtained by pumping brine. Drilling for oil in Texas and Louisiana has revealed the presence of tremendously thick deposits of rock salt at a depth of a few hundred feet. Thicknesses of 2,000 feet are common, and one drill hole passed through more than 3,000 feet of rock salt. Most of the salt made in Utah is produced by evaporating the water of Great Salt Lake, and in California by evaporating sea water. These sources are inexhausti-

ble, and the limit of production by solar evaporation will therefore never be reached.

BROMINE.

Bromine is made in connection with the manufacture of salt in Michigan at Mount Pleasant, Isabella County; at Midland, Midland County; near Saginaw and at St. Charles, Saginaw County; and at Bay City, Bay County; in Ohio at Pomeroy, Meigs County; in West Virginia at Mason and Hartford, Mason County; and in the Kanawha Valley at Malden, Kanawha County. In Michigan the bromine has been marketed in the form of fine chemicals, but the great increase in demand brought on by the war has caused a great deal of the bromine to be marketed as such. Along Ohio River, where there is cheap transportation by rail and water and cheap coal and gas and where salt and bromine occur naturally, bromine has been produced for export for many years to be made into fine chemicals. Here is an opportunity which the American chemist should not neglect.

The element bromine does not occur in native form but is derived in large quantities from natural brines. It is used as an oxidizer in many chemical reactions instead of chlorine and for dissolving gold and separating it from platinum and silver; also in disinfectants and bromine salts and in making aniline colors. Recently it has been extensively used in making the asphyxiating gases employed in the European war.

In 1915 there was a significant increase over the production of the previous year, the total output in the United States being 855,857 pounds, valued at \$856,307, or about \$1 a pound. The comparatively low price indicated by the total figures is due to the fact that considerable bromine was sold at prices specified in contracts made before the demand increased and to the further fact that the figures indicate prices at point of production and hence do not include the cost of freight. The price of bromine during the first half of 1916 ranged from \$4.75 to \$6.50 a pound in New York, as a result, at least in part, of the unprecedented demand from abroad. In March, 1917, it had fallen to \$1.30 a pound.

As the quantity of bromine marketed in 1915 was an increase of nearly 50 per cent over the production of each of the two preceding years, and as the number of wells is few where there might be many, it is assumed that this quick response to a sudden demand is only a suggestion of what may be done in case of continued and increased demand. The statistics of production for 1916 are not yet available (April, 1917); it is believed that there was a very considerable decrease in the quantity of bromine made from natural brine but an increase in the total value of the product.

CALCIUM CHLORIDE.

Calcium chloride is made from natural brines at Mount Pleasant and Saginaw, Mich.; Pomeroy, Ohio; and Mason, Hartford, and Malden, W. Va. As the same brines yield salt and bromine, practically every constituent in them is turned to profit. Calcium chloride is used as the circulating fluid in refrigerating plants, in cement concrete, and in automobile gas-engine water jackets to prevent freezing, and, on account of its power of absorbing moisture, for laying dust on roads, drying gases, vegetables, and fruits, and dehydrating organic liquids. Calcium chloride in solution is especially valuable in automatic sprinkler systems and in fire buckets.

The quantity of calcium chloride produced from natural brines and sold in the United States has recently been about 20,000 short tons a year, valued at \$6 to \$6.50 a ton. This does not include the output obtained in the manufacture of soda, as calcium chloride so obtained is not an original constituent of brine. Large quantities made in the manufacture of soda have been wasted, and it is hoped that new uses may be found for this by-product.

Since the first half of 1916 there has been a demand for this material which has raised the price. In March, 1917, 70 to 75 per cent fused calcium chloride was quoted in the New York market at \$26 to \$30 a ton, and granulated calcium chloride has recently been quoted as high as \$40 a ton. Fused lump calcium chloride that used to retail for 15 cents a pound was quoted in April, 1917, at 90 cents. It is believed that the supply can easily be kept ahead of the demand.