

SULPHUR.

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Practically every industry requires the use of sulphur in some form, and the United States, to be industrially independent, must therefore have an adequate supply. That this country has enough sulphur to support its present industries, even under the requirements imposed by the drain of a vast foreign demand, seems to have been demonstrated by the record of the last three years.

The two main sources of the element sulphur are the native mineral and the sulphides. Each year at least 300,000 long tons of native sulphur and \$1,250,000 long tons of sulphides are used, mostly for the manufacture of sulphuric acid. In 1916 about 25 companies were producing sulphur and about 100 companies were mining sulphides mainly for their sulphur content.

NATIVE SULPHUR.

More than 98 per cent of the native sulphur produced in the United States at this time comes from deposits in Louisiana and Texas, but deposits that have been or might be productive are known in Wyoming, Nevada, Utah, California, Colorado, Oregon, and Alaska.

Louisiana and Texas apparently produce enough sulphur to supply even an extraordinary demand, for the combined output of these two States, although the production has not been vigorously pushed, has so greatly exceeded the amount sold that large stocks of sulphur have been accumulated. Even under the conditions that now prevail this country exports much more sulphur than it imports. The excess in 1916 amounted, in round figures, to 107,000 long tons, valued at \$2,100,000; in 1915 to 11,000 tons, valued at \$250,000; in 1914 to 72,000 tons, valued at \$1,300,000; and in 1913 to 66,000 tons, valued at \$1,100,000. The great falling off of exports in 1915 may have been due in part to the increased use of sulphur in industries in this country. In part, however, probably in large part, the decrease was due to the difficulties and dangers of transportation to foreign ports. At first sight this explanation does not seem to

be borne out by statistics regarding imports of either sulphur or pyrite, for the quantities imported in 1913, 1914, and 1915 show no appreciable change. This comparison, however, is not pertinent, for whereas practically all the sulphur and pyrite imported by the United States comes from and passes through regions that are comparatively peaceful, most of the sulphur exported by the United States goes to or through regions now in the midst of war. That the falling off of exports in 1915 was due to a cause other than dearth of raw material in the United States is clearly shown by the record for 1916.

Large reserves of sulphur have already been accumulated, so that considerable increase in demand could be supplied for some time by drawing against these reserves even if only a normal production was maintained. Without these reserves and easily worked deposits this country would have extreme difficulty in supplying enough sulphur to meet its most urgent normal needs. As a preparedness measure, therefore, the other deposits that are now idle should be thoroughly developed, search should be made for new deposits in areas where the geologic conditions are similar to those in the vicinity of the known deposits, and the deposits of sulphide ores should be intensively developed.

SULPHIDES.

The United States in 1913 produced about 350,000 long tons of pyrite and imported about 850,000 tons. If these figures represent the normal condition of the industry, it is evident that ordinarily the United States uses each year about 850,000 tons more pyrite than it produces. The imported pyritic ore has an average sulphur content of approximately 45 per cent, so that 380,000 tons of native sulphur would be required to make up this deficiency if the importation of pyrite were cut off. In 1916 we exported 107,000 tons of sulphur more than we imported. If the exportation of sulphur were prohibited, as it doubtless would be if imports of sulphides were cut off, this excess amount would therefore be available and at the 1916 rate would make up nearly one-third of the deficiency that would be created by the shutting out of imported pyrite. The deficiency could be reduced still more by drawing on the reserves of sulphur already mentioned, but doubtless it would be far better not to use the high-grade native sulphur for many of the purposes for which pyrite may be used, but rather to save more of the sulphur from the sulphide ores and to hunt for and develop additional deposits of sulphides.

Scores if not hundreds of deposits of sulphides situated in many States in the Union are mined. Most of these deposits owe their main value at the present time to their content of gold, copper, zinc, or metals other than sulphur. At most of the smelters that

treat these ores the sulphur is neglected and allowed to escape, thus not only causing a direct loss but in some localities ruining the adjacent country by the fumes, which are highly injurious to vegetation. Processes for the recovery of the sulphur from these gases have been so perfected that even under normal conditions they will ordinarily pay well for their installation, and when a national demand for sulphur arises their adoption will become imperative. By this means a large volume of sulphur now worse than wasted would be made available.

With a greater demand for the metals doubtless most of these deposits would be much more actively mined for their copper, lead, or zinc content, so that the treatment of the ores would furnish an increasing amount of fumes available for sulphur recovery. Under these circumstances a considerable volume of sulphur would be produced and could make up a large share of the deficiency caused by cutting off the importation of sulphides.

If these two measures, however, still did not provide enough sulphur, recourse should be had to the opening and development of many of the now inactive sulphide deposits that are widely distributed throughout the country. Little doubt is felt that if cost should cease to be the controlling factor, or if prices should sufficiently advance, an adequate supply of sulphur from these sulphides could be obtained. Moreover, if the metallurgic problems connected with the recovery of sulphur from low-grade ores of mixed sulphides were successfully solved, many deposits of sulphides now unsuitable for commercial purposes could be developed, and therefore inventive genius should be directed at once toward this end.

SULPHURIC ACID.

According to preliminary estimates the United States in 1916 produced about 4,500,000 tons of sulphuric acid of a strength of 50° Baumé and nearly 1,000,000 tons of acid of strength higher than 66° Baumé. This amount exceeds the amount of similar acids produced in 1913 by more than 950,000 tons of 50° Baumé acid and by more than 900,000 tons of acid of strengths higher than 66° Baumé.

Almost no sulphuric acid is imported into the United States, and but a relatively small amount is exported, even under the conditions now prevailing. The reports of the Bureau of Foreign and Domestic Commerce show that in 1916 a little over 600 tons of acid was imported and about 33,000 tons was exported.

Sulphuric acid for the production of munitions of war, for refining petroleum derivatives, and for the manufacture of superphosphates and artificial manures for use in agriculture is required in increasing quantities. Means for augmenting the supply of part of

the raw material for these purposes have already been discussed, but other resources must be available before a greatly increased amount of acid can be produced. It is important to realize that ordinary concentration plants for making acid of the strongest grades from weaker acid can be built in a relatively short time, but it will take much longer to build plants designed for the production of the acid itself.

About 200 plants, widely distributed throughout the United States, are now engaged in the manufacture of sulphuric acid. Most of these plants are in the neighborhood of the larger cities, and many of those in the East are on navigable waterways, as well as on railroads.