

causing frequent stoppages for cleaning and other trouble.

Pyrites acid is now largely purified by precipitating the arsenic as sulphide with sulphureted hydrogen, and for this purpose the chamber O.V. is frequently diluted with water to a suitable strength before the removal of the arsenic can be accomplished with certainty. The arsenic, moreover, exists in chamber O.V. in the state of trioxide and pentoxide As_2O_3 and As_2O_5 , respectively. It is well known that the latter oxide is more difficult to precipitate with sulphureted hydrogen than the trioxide, and means are sometimes adopted to reduce the higher oxide to the lower state before precipitating the arsenic as sulphide. Any dilution of the acid before purifying represents at first sight so much more fuel consumed in its concentration, but as a matter of fact, the amount of waste heat passing away from the platinum pans and boiler allows a certain latitude in extending the system of leaden pans, so that the diluted vitriol (say 90° Twaddell) may be concentrated before reaching the pan corresponding to No. 1 of the above series, and thus the expenditure of extra coal is avoided.

The following figures relating to the work done by such a system, concentrating brimstone vitriol, are compiled from results obtained in actual practice. The acid from the strongest leaden pan registered on the average about 290° F., and a sp. gr. of 1.70 (= 140° Twaddell) at 60° F. The O.V. of 168° Twad. finished per shift of 12 hours amounted to 8,750 lb., equal to about 50 carboys (10 gallons capacity) each containing 175 lb. acid. The strength of the concentrated acid is given as 168° Twad., but in reality it seldom comes so high as this—usually 165° to 166° Twad. The reason of this is well known. The coal consumed per day of 12 hours amounted, on an average, to 16 cwt. 3 qrs. 10 lb., which includes that used for heating up. This gives a consumption of coal equal to 37.8 lb. per carboy of acid made, or 4.65 lb. O.V. were concentrated per lb. of coal used.

The distillate from the first platinum pan is practically water vapor containing only small traces of acid. It is usually allowed to escape into the atmosphere. That, however, from the second platinum pan is stronger in acid, and is conducted by a leaden pipe to the vitriol chambers, where it is used instead of steam.

The strength of the acid boiled off in the platinum boiler and condensed in the Liebig's condenser varies a good deal: it is chiefly controlled by the work of the leaden pans. If the acid leaving these pans is below 140° Twad. (cold), then the distillate condensed in the platinum tube is about 90° Twaddell; but if it be maintained at that strength, the average distillate will reach as high as 110° Twaddell. There are other conditions which control the strength of this weak acid, such, for example, as the nature of the firing, whether it be hard or medium. Excepting the presence of hyponitric acid, and this, it may be remarked, is seldom found in it, this acid is very pure when obtained from brimstone O.V. It is stored in large earthenware vessels and concentrated by itself in glass retorts for laboratory and pharmaceutical purposes.—*Chemical Trade Journal*.

THE SOLUBILITY OF THE PHOSPHORIC ACID OF BONE MEAL.

By H. OTTO.

THE consumption of bone meal in the west of Germany has declined so much during the last two years that producers find it difficult to dispose of a good product even at low prices. The cheapness of superphosphates, and especially the extraordinary demand for basic slag meal, are the principal causes.

Probably no manurial substance has given rise to so many publications and theoretical researches as basic slag. In P. Wagner's memoirs on this subject the phosphoric acid of basic slag is almost without exception represented as superior to the phosphoric acid of other manures. It is in the first place remarkable that in Wagner's comparative manurial experiments the efficacy of bone meal takes so low a relative position. In these experiments it seems to have resulted that the phosphoric acid of bone meal scarcely occasioned an increase of the crop, and that its efficacy was always less than that of the phosphoric acid of basic slag.

Quite opposite views are put forward in the publications of Prof. Marek, of Königsberg, and Prof. Holdeffels, of Breslau. The latter, in his treatise on "Das Knochenmehl, seine Beurtheilung und Verwendung" (Bone Meal, its Valuation and Use), says (p. 168), referring to the experiments of Marek: "According to these decidedly trustworthy results bone meal has a considerable manurial value, so that it may be included among the most certain and efficient manures. This conclusion is the more trustworthy, as it agrees with the practical experience of many decennia and is fully confirmed daily."

These contradictions can scarcely be accidental, and I can only assume that the bone meal used in Wagner's experiments was not a good product. The chief part of the bone meal at present met with in commerce is produced from bones which have been freed from fat by means of benzene. The meals are either simply ground bones or mixtures of bone meals freed from glue, and so-called "stamp meal," obtained in the manufacture of granulated bones. Of the mixtures of horn meal, blood meal, crude phosphates, and a little bone meal, which unfortunately are also met with in trade, I am not about to speak. These occur now less and less frequently since several experimental stations have declared an energetic war against them.

The bone meal obtained from bones deprived of fat contains always from 4% to 5 per cent. nitrogen, and 21 to 23 per cent. phosphoric acid (P_2O_5), rarely more than 2 per cent. of fat, generally less; all bone meals containing less than 4 per cent. N and 20 per cent. P_2O_5 are not purely degelatinized meals, or the entire substance of the bone has not been used in their manufacture.

It is remarkable that such a bone meal, which, according to Heyden, Holdeffels, Marek, etc., is an excellent manure, should prove inert according to Wagner.

When the basic slag in the state of meal was especially recommended to farmers as an especially effective phosphoric manure, it was sought to prove the solubility of the phosphoric acid by means of Wag-

ner's citrate solution. In fact, the phosphoric acid of basic slag, if ground sufficiently fine, is to a great degree soluble in this citrate.

In the conviction that a bone meal almost deprived of fat must give up its phosphoric acid to a slightly acid solution of ammonium citrate, I examined various samples of bone meal exactly according to Wagner's citrate method as laid down on December 19, 1885, and found that according as the meal had been more or less finely ground from 8.05 to 9.15 per cent. of the P_2O_5 was rendered soluble, or from 38.28 to 41.20 per cent. of the total weight of the meal.

From these results it is clear that the phosphoric acid of bone meal freed from fat, but not from gelatin, is very readily soluble. If we consider further that on account of the large percentage of gelatin the solubility in the soil will be increased by the products of decomposition formed during decay, we may assume with certainty that such bone meals must possess a considerable manurial value.—*Chemiker Zeitung; Chem. News*.

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