

most of its properties with other oils prepared from related plants, viz: *Pinus sylvestris*, *Pinus picea*, and *Pinus abies* in so far as these are known, and could probably be used for similar purposes.

No. 17 though obtained from a closely allied plant is an oil of quite a different character, but the data at present available is too insufficient to admit of a satisfactory prediction of its constituents. It might be of interest to note here that J. J. Rein, in a work entitled "The Industries of Japan," mentions the fact that an oil is prepared by the Japanese from the fruit of *Tumion nucifera* and used by them in their kitchens.

In conclusion I wish to express my thanks to Prof. Rising for suggestions received during the course of the work and also to the officials of the Experiment Station at Berkeley, through whose kindness I was enabled to obtain the samples of pure olive oil.

THE DETERMINATION OF PHOSPHORIC ACID BY THE MOLYBDATE-MAGNESIA METHOD, AND BY VOLUMETRIC METHOD.¹

BY B. W. KILGORE.

Received September 30, 1895.

I N a summary statement of the results obtained last year by the members of the Association of Official Agricultural Chemists and other chemists cooperating with them by the official molybdate method on a solution of C. P. disodium hydrogen phosphate, I called attention² to the fact that the results of nearly all of the analysts (twenty-eight) were high and some of them very materially so. The larger number of these analysts were experienced in this class of work. From this and other reasons I argued that the molybdate method, as usually worked, has a tendency to give high results, and that these high results are due to an excess of magnesium in the magnesium ammonium phosphate precipitate.

For the investigation of phosphoric acid methods for this association for 1895, two chemically pure phosphate solutions and one mixed fertilizer were employed.

¹ For description of this method, see methods of the Association of Official Agricultural Chemists for 1895.

² This Journal, 16, 793.

No. 1 was a solution of the same phosphate worked upon last year, and contained ten grams chemically pure disodium hydrogen phosphate to the liter, the theoretical percentage of phosphorus pentoxide in this salt being 19.826.

No. 2 was No. 1 diluted with five parts of water, and therefore contained the equivalent of 3.304 per cent. phosphorus pentoxide in 50 cc.

Fifteen chemists reported forty determinations on solution No. 1, the highest of which was 20.50 per cent., and the lowest 19.75 per cent., the former being 0.674 per cent. above the theory, and the latter 0.076 per cent. below. The average of all results was 20.044 per cent., or 0.218 per cent. above the theoretical content; the variation between the highest and lowest results was 0.75 per cent.; the variation below the theory was 0.076 per cent., and above the theory 0.674 per cent. Fourteen per cent. of the determinations were within 0.05 per cent. of the theory; thirty-three per cent. within one-tenth; and fifty-six per cent. within two-tenths. On the whole these results make a slightly better showing toward accuracy than did those of last year on the same phosphate, but like the results of last year, most of them are high. In 1894 there were two results below the theory, 19.74 and 19.78 per cent.; this year there are also two, 19.75 and 19.77, the lowest of the former being 0.08, and of the latter 0.07 per cent. below the theory; while the highest results of the two years were 0.84 and 0.76 per cent. above the theory.

On sample No. 2, containing 3.304 per cent. phosphorus pentoxide, there were forty-two determinations reported, the highest of which was 3.65 per cent., or 0.346 per cent. above the theory; and the lowest was 3.20 per cent., or 0.104 per cent. below the theory. The average of all results was 3.43 per cent., or 0.126 per cent. high. Out of forty-two results on this sample, four were below the theory. These variations being 0.10, 0.02, 0.02, and 0.01 per cent.

The foregoing adds strength to the remarks made on this subject last year, that the molybdate-magnesia method gives high results in the hands of nearly all workers, and may give extremely high ones in the hands of some.

We do not believe, however, that there is any well established

method of sufficient rapidity that suits our needs better or with which we can get better results, when proper precautions are taken, than the molybdate method.

It may be of interest here to give also a brief summary of the results on these same phosphate solutions by the volumetric method as investigated this year. The results were obtained by some of the same chemists who analyzed these samples by the gravimetric method. This was the first time the volumetric method in its present form had been used by most of them.

Thirteen chemists reported thirty-one determinations on solution No. 1 and thirty-three on No. 2 by the volumetric method. Seventy-three per cent. of all the results on No. 1 were within 0.05 per cent. of the theory, and ninety-three per cent. were within one-tenth per cent., there being only three results varying more than one-tenth. On sample No. 2 eighty-five per cent. of the results were within 0.05 per cent. of the theory, and all were within one-tenth.

The results upon which the foregoing discussion is based will appear in the proceedings of the A. O. A. C. in the "Report on Phosphoric Acid," made by the writer to that association at its recent meeting.

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THE VOLUMETRIC ESTIMATION OF MANGANESE.

BY GEORGE AUCHY.

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IN this Journal, 17, 5, Mr. W. H. Thomas describes his experience with Low's and with Volhard's method of determining manganese. The latter he finds reasonably accurate. The former not at all so. Some ten or twelve years ago, in the transactions of the American Institute of Mining Engineers, Williams' method in steel, which is based on the same principle as Low's method in ores, was the subject of considerable controversy; some claiming, others disputing its accuracy. And although the weight of the testimony seemed to be in favor of the method, nevertheless, the close of the discussion left the matter still somewhat in doubt.

Are methods based upon this principle reliable? Mr. Thomas'