THE PREPARATION OF FIFTIETH NORMAL POTASSIUM HYDROXIDE.*

BY WILLIAM J. THOMPSON AND J. P. SNYDER.

The directions of the United States Pharmacopoeia under the preparation of $N/50$ Potassium Hydroxide instruct one to prepare this solution by the dilution of either 20 mils of normal potassium hydroxide or 200 mils of $N/10$ potassium hydroxide at standard temperature to exactly 1000 mils. It furthermore states that the titer of this solution be verified by running it against 0.1881 gramme of potassium bitartrate, phenolphthalein being used as indicator. This solution is employed in conjunction with $N/10$ sulphuric acid in the titration of alkaloids with hematoxylin, cochineal, methyl red or iodeosin as indicators. The relative value of the two volumetric solutions should be determined each time, using indicator employed in the assay. The $N/10$ sulphuric acid according to the Pharmacopoeia is standardized against anhydrous sodium carbonate using methyl orange as the indicator. In addition, under $N/10$ sulphuric acid, we read, "This standard solution is employed in conjunction with the $N/50$ potassium hydroxide volumetric solution in the titration of alkaloids, using cochineal, methyl red, iodeosin, hematoxylin as indicators." For this purpose a special experiment should be made in which an accurately measured volume of 10 mils of the $N/10$ sulphuric acid should require 50 mils of the $N/50$ potassium hydroxide volumetric solution at standard temperature for complete neutralization. In analyzing the above methods for the standardization of the solution employed in the titration of alkaloids, the question naturally arises to which should we adjust or factor the solutions, to the $N/50$ potassium hydroxide standardized against potassium bitartrate using phenolphthalein as indicator, or to the $N/50$ sulphuric acid standardized against anhydrous sodium carbonate, methyl orange as indicator.

In truth, the directions of the Pharmacopoeia seem very indefinite on this point and indeed if it is possible to accurately interpret which to use as a basis for adjustment, serious errors may be introduced by switching the solution standardized with a certain indicator to a determination in which another indicator is used. For experience shows that for highly accurate work it is advisable to standardize volumetric solutions against material which will permit of the use of the same indicator used in the determination. But in the case of methyl red which we presume is used almost to the exclusion of all other indicators in the titration of alkaloids, it is not adapted for use with carbonates or organic acids, and as both potassium bitartrate and sodium carbonate fall under these heads, a direct standardization of the solution against these materials, using methyl red as indicator, is impossible. Recently, while in conversation with a gentleman, who had charge of a large laboratory where numerous samples of U. S. P. materials were tested daily, he informed us that he met this condition by disregarding the U. S. P. method of standardization of acid alkali solution, and determined their strength according to the sulphuric acid solution which was standardized by the barium sulphate method.

It is true that in many instances the error introduced would not be serious, as in the case of belladonna leaves or drugs containing about the same proportion of alkaloids, as the error of one percent in the solution would not be sufficient to

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affect the results of two different laboratories working on the same samples. However, in the case of Opium or Extract of Nux Vomica where the alkaloidal content is relatively high, an error of one percent in the solution would introduce considerable difference in the results. It is our opinion that many times the different reports of laboratories when working on the same material may be traced to the different methods used in standardizing the solutions, and it is highly desirable that the Pharmacopoeia should give us very definite instructions as to how the solutions should be prepared and standardized, in order that chemists working upon alkaloidal determinations may all be on the same basis.

While the barium sulphate method of standardizing sulphuric acid undoubtedly yields excellent results, it is rather lengthy, as it requires that the precipitate of barium sulphate should be allowed to collect for at least 12 hours before filtration. We have been able to obtain excellent results by following out the method of G. Incze, *Z. Anal. Chem.*, 56, 177–91 (1917); *J. Soc. Chem. Ind.*, 36 (1917) (of which the following brief description is found in *Chemical Abstracts*, Vol. 2, No. 21, p. 2865):

"Yellow mercuric oxide is a trustworthy substance for use in standardizing acid solutions. It is readily obtained in a pure state, is free from water of crystallization and is not hygroscopic. Its use depends upon the reaction $HgO + 4KI + H_2O = K_2(HgI_4) + 2KOH$. At least 9 molecules of potassium iodide must be added for each molecule of mercuric oxide. In practice, it is advisable to add a somewhat larger proportion of potassium iodide, as for example: Ten mils. of a 60 percent potassium iodide solution to 0.4 Gm. of mercuric oxide. As soon as the mercuric oxide is dissolved in the potassium iodide solution titrate the mixture with the acid solution to be standardized using methyl orange, phenolphthalein, or methyl red as indicator. The yellow mercuric oxide as bought is usually pure, but if desired it can be made by dissolving 100 Gm. of mercuric chloride in 1000 mils of warm water, cooling the solution and then adding 625 Gm. of a 6.4 percent sodium hydroxide solution. The mixture should be well stirred during the addition of the sodium hydroxide. The precipitate is collected and washed until the washings are no longer alkaline to phenolphthalein, air dried and stored in black glass bottles."

We have tested several lots of mercuric oxide and found the substance to be of high degree of purity, all that we examined showing a percentage better than 99.8 per cent of mercuric oxide when determined electrolytically and since this salt may be so accurately determined by the electrolytic method, it is readily possible to know the exact percentage of mercuric oxide in the particular lot used for standardization purposes. In actual practice for the standardization of the acid alkali solutions used in the determination of alkaloids, about 0.2 Gm. of yellow mercuric oxide is accurately weighed and transferred to a beaker. Ten mils of a 60 percent solution of potassium iodide are added and the whole stirred until none of the mercuric oxide remains. When this has occurred, 50 mils of the sulphuric acid, approximately $N/20$, are added and a few drops of methyl red test solution. Sufficient of the potassium hydroxide test solution is run into this from a burette to destroy the last trace of pink color and the amount consumed noted. Similarly, a blank is run against 50 mils of the acid and from the amounts of potassium hydroxide solution used in the blank and the above determination, the strength of the two solutions is calculated as follows:

Let x equal the strength of potassium hydroxide solution in terms of $N/50$.

Let y equal the strength of the sulphuric acid solution in terms of $N/20$.

Let A equal the number of mils of potassium hydroxide consumed in the titration.

Let B equal the number of mils of potassium hydroxide consumed in the blank.

Let C equal the weight of mercuric oxide.

$$\text{Then } x = \frac{0.5181C}{(B-A)\ 0.0011222} \qquad y = \frac{B\ x}{125}$$

Of course, if preferred the liberated potassium hydroxide may be directly titrated by the sulphuric acid and calculations made accordingly.

We have tested numerous alkaloidal salts with solutions standardized by the above methods, and in all cases we have found the results to be correct. We recommend the yellow mercuric oxide as an accurate substance for the standardization of the solutions used in the determination of alkaloids, particularly, as it is adapted for use with methyl red as indicator.

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OLEORESIN OF PINUS PONDEROSA.*

BY E. R. MILLER AND E. V. LYNN.

Inasmuch as Schorger had found the oil of western yellow pine to be an excellent source for beta-pinene or nopinene, a barrel of oleoresin was obtained through the coöperation of the Forest Products Laboratory from the U. S. District Forester of California. The steam fractionation resulted in a larger amount of volatile oil of this species than had heretofore been prepared. Hence, use was made of the opportunity to re-examine the oil for its constituents as well as to isolate the nopinene for the special work for which the material had been obtained. The results of the special work on nopinene will be reported elsewhere.

As pointed out by Schorger, the bulk of the oil consists of beta-pinene, however, the presence of alpha-pinene was definitely established by its crystalline derivatives. Attempts to identify other well known constituents of coniferous oils failed, though their presence seemed indicated. In spite of the care exercised in the fractionation, the large amount of beta-pinene present in the oil appears to render their purification by fractional distillation difficult, hence the negative results may be accounted for at least in part.

OZONIDES AND PEROXIDES OF THE TERPENES AS THERAPEUTIC AGENTS.*

BY A. V. LYNN.

For a long time the oxygenated constituents of the volatile oils have been looked upon as the bearers of the therapeutic properties of these products, whereas the terpenes were regarded as mere diluents, hence of little or no value. Thus, *e. g.*, the therapeutic, hence the commercial value of eucalyptus oil was determined, according to the U. S. Pharmacopoeia, by a cineol assay. The faith in this doctrine has, of late, been thoroughly shattered by the clearer recognition of the

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