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On a Simple and Expeditious Method of Estimating Phosphoric Acid and its Compounds, by E. W. DAVY *M.B. M.R.I.A. Professor of Agriculture, Agricultural Chemistry, to the Royal Dublin Society.*[1]

THE want of a simple and expeditious method of estimating phosphoric acid and its compounds, has long been felt, most of the means devised being tedious and complicated. After much investigation, the author has devised a method founded on the fact that phosphoric acid possesses a great attraction for peroxide of iron. When a persalt of iron is added to a solution containing phosphoric acid an insoluble phosphate is produced. This fact has long been known, and different methods founded on it have been devised by Berthier, Kobell, Raewsky and others, for the estimation of phosphoric acid and its compounds. But as each of those methods requires a considerable time for the collecting, washing, drying, igniting, and weighing of the precipitated phosphate of iron, the author proposes to dispense altogether with those operations by simply adding a solution of iron of known strength to the phosphate, and ascertaining the point when enough has been added to combine with all the phosphoric acid present.

The standard iron solution is made by dissolving clean pianoforte wire in pure hydrochloric acid, and sufficient nitric acid is added to convert the proto- into per- chloride of iron. Any free hydrocloric acid is then carefully neutralised with caustic ammonia, which is added until a little peroxide remains undissolved on shaking the mixture. Acetic acid is now added to dissolve the precipitated oxide, and when the solution is effected the mixture is largely diluted with distilled water and graduated in the ordinary way, so that the amount of iron in a given quantity may be known.

This solution may be kept a considerable time without undergoing change, and is therefore preferable to the acetate and other salts of iron which have hitherto been employed.

The next step is to prepare the phosphate. If insoluble (as is generally the case) it is dissolved in an acid. Ammonia is added until the solution is decidedly alkaline, but not in large excess, and then enough acetic acid to completely redissolve the precipitated phosphate, and leave a slight excess. The standard solution of iron is then carefully added from Mohr's alkalimeter, or any other convenient form of volumetric apparatus, till the iron begins to be in slight excess, which is ascertained by taking a drop of the mixture (after it has remained a few minutes with occasional stirring) on a glass rod, and touching with it a piece of thick filtering paper, placed over another piece of paper which has been soaked in a solution of gallic acid and dried. The insoluble phosphate of iron is retained on the filtering paper and the

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solution which passes down to the lower shows at once by the purple stain when sufficient iron has been added and a minute excess exists in the mixture. If this excess is very minute, the stain will become more visible when the gallic acid paper is dried. The results should be controlled by repeating this experiment a second and third time, having the phosphate dissolved in a given quantity of solution, and taking a certain amount of it for each determination.

The author's experiments have clearly shown him that under the conditions in which the iron and phosphoric acid are placed, a compound having the uniform composition ($Fe_2O_3.PO_5$) is produced, and therefore the objections hitherto made to the volumetric method of estimating phosphoric acid are obviated. Experiments made with pyrophosphate of magnesia, tribasic phosphate of lime, and anhydrous pyrophosphate of soda, all gave results agreeing closely with the calculated composition, as will be seen by the following table:

Amount of iron required to combine with the PO_5 contained in one grain of

	By calculation, parts of a grain,			By experiment.
Pyrophosphate of Magnesia	0·5000	1st experiment		0·5000.
	„	2nd	„	„
	„	3rd	„	„
	„	4th	„	„
Tribasic phosphate of lime	0·3589	1st experiment		0·3600.
	„	2nd	„	„
	„	3rd	„	„
	„	4th	„	„
Anhydrous pyrophosphate of soda	0·4179	1st experiment		0·4200.
	„	2nd	„	„
	„	3rd	„	„
	„	4th	„	„

In all cases, however, bibasic salts must be converted into tribasic before the addition of the iron solution, which may be done by heating them with a little hydrochloric acid; and then the solution must be allowed to cool before the estimation is made, as heat alters the conditions and gives rise to a different compound of iron and phosphoric acid.

The method appears particularly useful for estimating the quantity of soluble and insoluble phosphates in superphosphate of lime as well as other manures, in the ashes of plants, and in all cases in which an expeditious determination of the phosphates is required.

Solubility of Mercury Precipitates in Alkaline Salts, by J. ATTFIELD, *Demonstrator of Chemistry at St. Bartholomew's Hospital.*

THE precipitates that are obtained on adding an alkali to the solution of a mercuric or a mercurous salt, are described in the ordinary text-books as being insoluble in an excess of the reagent. Practically, however, this is far from being the fact; the acid with which the mercury was combined forming an alkaline salt in which in nearly all cases the mercury precipitate is more or less