

ON THE ESTIMATION OF PHOSPHORIC ACID, BY ALFRED SMETHAM,
F.C.S., &c.

A Reply by E. F. TESCHEMACHER AND J. DENHAM SMITH.

By the courtesy of Mr. Smetham we are in possession of his paper bearing the above-named title, and by the permission of the Editor of THE ANALYST, we take leave to remark upon some of the statements made therein.

The only difficulty of dealing with this pamphlet is that of knowing where to begin, as it bristles with misdescriptions, misdirections, misstatements, and mistakes. However, to follow the good rule of beginning at the beginning, the very title is a misdescription. When Mr. Square spoke of the Christian religion he was careful to define what he meant by the term. Mr. Smetham, when addressing his listeners upon one of the most widely extended subjects in analysis, omits to define what he means by "Estimation of Phosphoric Acid," which (from the paper) proves to be a very few experiments on two points only of a very limited division of his subject, together with a single experiment which has nothing to do with it. Whether this absence of, as it seems to us, requisite words in Mr. Smetham's paper is due to an absolute dislike of them, like M. Gambetta's dislike of the Jesuits, to a love of brevity, forgetful that brevity may lead to obscurity as well as to wit, or a failure to discern that, in print, at any rate, words, and also properly chosen words, are essential to an author who has a meaning to convey, and who would take pains to make that meaning clear, we cannot judge; but we fear the last must be the true reason for this failure, from his carelessness at times in their use, as we shall presently show. Our eye had not travelled down more than three or four lines of this thesis before it fell on one of these instances of carelessness and misdescription, wherein this author states that, "we issued, during the past year, a pamphlet on 'The Estimation of Phosphoric Acid.'" Now as our memory told us that this was a mistake, we looked up a copy, and there we find the title of our pamphlet to be, "On the Estimation of Phosphoric Acid, *by Magnesia, for Commercial Purposes*," &c. We had limited our researches, and had, of set purpose, been careful to describe our limits in the two clauses we have italicized, of Estimating Phosphoric Acid by "*Magnesia*," and "*for Commercial Purposes*."

In this our object is made manifest, and we deny the competence of anyone so to dock our title as to convey to a reader or hearer a meaning of the widest kind, when we had described in so many words the exact limits to which we had confined ourselves. In his very next sentence we find it stated, "By these experiments they came to the conclusion, which had been previously arrived at by other chemists, that this salt—ammonia-magnesian phosphate—is *totally insoluble* in water containing one-eighth of its bulk of '880 ammonia.'" The italics are ours.

This is too bad. We came to no such conclusion: indeed we stated that "eight filtrates yielded 0.25 grain of pyrophosphate, an average of 0.03 grains dissolved in wash-

waters;" and further, "when we maintain its insolubility, we mean its practical insolubility," not one word of *total insolubility* when discussing the absurdity of adding some 2 per cent. to the weight of pyrophosphate, which we characterized, and still characterize, as "a vamping up by ridiculous allowances," despite this author's recommendation to revert to this silly practice. As to the "other chemists, who had previously arrived at the total insolubility of this salt in ammonia-water," Mr. Smetham does not cite any one of the gentlemen who found this mare's nest, and who, if they exist in the flesh, have been wisely reticent of their discovery. He then notices the "high solubility" of this salt which was found by Fresenius, a strange and surely unfit term to apply to a salt of very slight solubility, but serving to illustrate this gentleman's vocabulary, and assures us of his belief that Dr. Fresenius "has since found occasion to modify this opinion," a belief which may or may not be well founded, as we are as little acquainted with the conclusions of Dr. Fresenius as this chemist is with ours. Nevertheless, he tells us that our "conclusions seemed to him to be at variance with what he should expect," when he could have made sure that there is no seeming nor guessing about our statements, and proceeds to say that our "experiments were conducted in a very crude manner." Why "very crude?" We have referred to our pamphlet, and finding them to be numerous, direct, and to the point, are curious to know wherein these experiments are "very crude." Mr. Smetham can employ terms in depreciation, but he cannot quote fairly.

He then tells us: "I started the following set of experiments in the hope of setting the matter at rest." This "set of experiments," we find, amounts to three. The first yields incorrect results, viz., ".0064 grammes of pyrophosphate in excess of the theoretical quantity, due, probably, to the fact that the phosphate had effloresced. This, however, is immaterial." So "probably," "immaterial," and the like, are fitting epithets for an experiment which is to "set the matter at rest." Would not "crude" in the sense of raw, rude, incomplete, apply here, especially as in describing these experiments, made to determine the solubility of the salt in question, this chemist nowhere states the quantities of the wash-water used?

The chemist is now rewarded for his pains; he finds the filtrates yield him .0020, .0060 and .0160 grm., or, as it pleases him to write, "grammes," respectively, of pyrophosphate of magnesia, and sagely remarks, "From these experiments it is evident that ammonio-magnesian phosphate is perceptibly soluble in ammonia water." Indeed! But then, who ever doubted it? Not Dr. Fresenius; not Teschemacher and Smith, as our critic calls us. So far as our memory serves us, we have heard of none, excepting the band of "chemists who had previously arrived at the conclusion that this salt is totally insoluble in water containing one-eighth of its bulk of .880 ammonia," known to and vouched for by Mr. Smetham; who then instructs us that should we rely on—we think he means Dr. Fresenius—we must add one milligramme of pyrophosphate for every 54 c.c. of solution; but should we prefer Mr. Smetham, then, for 54 c.c., we must substitute 100 c.c., 84 c.c., or 62 c.c., respectively, thus allowing us the privilege of choice as our wishes or inclinations may prompt between 62 and 100 in respect to these three experiments, which are to "set the matter at rest," when vamping up an analysis in the modern style. In the next paragraph we find "Teschemacher and Smith's statement, that no allowance should be made for the solubility is far from conclusive." May we be permitted to inform this

writer that misrepresentation is not criticism. We said nothing of the kind. What we did say, and what we say again, is, "That we should reject as worthless any process which permits of an error of 2 per cent."

In six more experiments Mr. Smetham disposes of the influences of citric acid, iron, and alumina on the solubility of the ammonia-magnesian phosphate, which may be investigated by the curious; then passes to the correction he thinks fit for the solubility of this salt, which he fixes at 0.18 per cent. of phosphoric acid; and, finally, "sketches the method he pursues," which he has "always found to give excellent results." If by "excellent" he means accurate, and he further means—which to us seems the only inference—that he is speaking of commercial samples of rock phosphate, we can but own to a disappointment somewhat akin to humiliation that a work of ours, which we maintain bears intrinsic evidence of much thoughtfulness and care, could, even in the case of a single reader, prove so utterly futile. His method is the method we published, but so altered by the omission of well-nigh every precaution we insisted on as requisite to ensure success, that it needs a parent to recognize the changeling. In page after page did we insist on the prime necessity of the most careful attention to *moisture*, showing by repeated instances the necessary fallacy of all results unless the moisture of a sample was carefully determined; and closing our reiterated caution on this point by saying that "our pains would be wasted and our chief aim thwarted unless we could set this matter of *moisture* to rights." Mr. Smetham must have had our monograph in his hand—probably he has read it, but most certainly not with the understanding; for the moisture is never once mentioned in the details of the method, of which he says "I have always found it give excellent results;" a statement which carries with it its own contradiction, as the neglect of this question of moisture necessarily vitiates the results of every analysis made by Mr. Smetham.
