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On the Detection of Chromium in Presence of Iron,
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It is customary, in the methods of analysis now most commonly employed in laboratories of instruction, to rely upon the solvent action which the caustic alkalis exert upon hydrated sesquioxide of chromium as a means of separating this base from the oxides closely allied to it. It is well known, however, and the experiments of Northcote and Church¹ have determined the fact quantitatively, that when a small amount of sesquioxide of chromium is accompanied by a large quantity of the oxides of manganese, cobalt, nickel, or of sesquioxide of iron, it ceases to be soluble in the alkalis. From the frequency of its occurrence, as well as from the fact that it has the power of concealing a larger amount of chromium than either of the other bases which have been mentioned, the sesquioxide of iron in particular gives rise to much inconvenience in practice. It is a constant source of annoyance to beginners, who almost invariably fail to detect the presence of chromium in solutions containing it given them for analysis, if these at the same time contain iron also. In this case it may be detected, it is true, by fusing the mixed precipitate of oxide of iron and of chromium with nitrate of potash and carbonate of soda, and examining the aqueous solution of the mass obtained for chromic acid; but the student seldom applies this test, unless specially directed to do so. The operation is troublesome, since it necessitates the employment of a special set of tools, and occupies considerable time. It is as a rule distasteful to the student, and is rarely resorted to even by experienced analysts, unless the colour of the solution, a preliminary blowpipe test, or some incidental observation, has already indicated the probable presence of chromium in the substance under examination.

It is obvious, that if the chromium in the mixed precipitate could be oxidised in the wet way by some simple and rapid method, it would not only be more readily detected in any case, but the chances of overlooking it altogether, an event now so liable to occur, would be materially lessened.

Frommherz², long ago noticed that chromic acid is formed when an aqueous solution of a salt of chromium is treated with a solution of permanganate of potash, a fact which has since been corroborated by Reynoso³, and still more recently by Cloez and Guignet.⁴ Reynoso has suggested, moreover, that this reaction may be employed for the detection of chromium, especially if the chromic acid formed be subsequently converted into Barreswil's perchromic acid.

Chancel⁵ on the other hand, has observed that chromic acid is formed when sesquioxide of chromium is heated

with solution of caustic potash in presence of peroxide of lead, as may be shown by acidifying the filtrate from this mixture with acetic acid, chromate of lead being precipitated. He has also proposed⁶ that this reaction shall be used as a test for the detection of chromium.

After a number of experiments upon the subject, I have satisfied myself that peroxide of lead is as good an agent as any at our disposal, if it is not the best, for effecting the oxidation of sesquioxide of chromium by the wet way, while the formation of perchromic acid is unquestionably the most delicate and characteristic reaction for chromic acid which we possess. This note, therefore, must be considered as being merely supplementary to the statements of Chancel and Reynoso.

Besides the observations of these chemists are those of Balard⁷ that oxide of chromium is immediately changed to chromic acid when treated with a solution of hypochlorous acid; and of Carney⁸ who has found that chromic acid is produced when a galvanic current is caused to flow through a dilute solution of caustic alkali in which sesquioxide of chromium, even that which has been ignited, is suspended.

For my own part, I have observed that sesquioxide of chromium may be converted into chromic acid in the wet way by the agency of several substances besides those already mentioned, and that the presence of free alkali, so far from being necessary, as has been implied by previous observers, with the exception perhaps of Frommherz, is not by any means essential in most instances to the success of the operation, oxidation occurring very readily in several cases in strongly acid solutions.

A dilute solution of chrome alum, which by experiment was ascertained to contain no chromic acid, was acidulated with sulphuric acid, a little peroxide of lead was added, and the whole boiled; on filtering, the solution was found to be of a yellow colour, and readily afforded the reaction of chromic acid when tested with dilute solution of peroxide of hydrogen, viz. a magnificent blue colouration due to the formation of perchromic acid.

A solution of permanganate of potash, acidulated with dilute sulphuric acid, being substituted for the peroxide of lead in the preceding experiment, produced a similar result. Peroxide of manganese also replaces perfectly the peroxide of lead in this experiment.

It is not even necessary that these mixtures should be heated. Dilute solution of chrome alum, acidulated with sulphuric acid, and mixed with a small portion of peroxide of lead, having been allowed to stand in the cold, was found to contain traces of chromic acid at the end of half an hour; after standing eighteen hours, a considerable quantity of chromic acid had formed.

A similar solution, in which peroxide of manganese was used instead of the peroxide of lead, gave a fine reaction of chromic acid at the end of eighteen hours.

¹ *Qu. J. Chem. Soc.* vi. 53.

² *Schweigger's Journ. f. Ch. u. Phys.* 1824, xli. 281.

³ *Ann. Ch. et Phys.*, 1851 (3), xxxiii. 524.

⁴ *Comptes-Rendus*, xlvii. 712.

⁵ *Ibid.* xliii. 928.

⁶ *Loc. cit.* and *Précis d'Anal. Chim. Qualit.* par Gerhardt et Chancel, (Paris, 1855) pp. 112, 289.

⁷ *Ann. Ch. et Phys.* (2) lvii. 266.

⁸ *Proceedings of Boston Soc. Nat. Hist.* vi. 409.