

QUALITATIVE DETECTION AND SEPARATION OF POTASSIUM AND SODIUM.

F. C. MATHERS AND I. E. LEE.

The qualitative detection and separation of potassium and sodium is less satisfactory than tests for any other group. Some manuals have abandoned wet methods and use spectrum tests. This is objectionable on account of the great difficulty in testing for potassium in the presence of an excess of sodium and also because the test is so delicate that sodium is detected in almost every chemical substance.

The test for sodium with potassium pyroantimonate has been unsatisfactory in this laboratory. There are numerous excellent and satisfactory tests for potassium.

A new method which has been tried in this laboratory and which has been found satisfactory is as follows: Separate the hydrogen sulphide and ammonium sulphide groups by the ordinary methods. Then precipitate barium, strontium, and calcium with ammonium carbonate. This leaves, in the solution, magnesium, potassium, sodium, and ammonium salts and perhaps traces of barium, strontium, and calcium, which are sometimes incompletely precipitated by ammonium carbonate.

Introduce this solution into a small evaporating dish and evaporate to dryness. Heat (in the hood) over the free gas flame until the ammonium compounds are completely volatilized, i. e., until white fumes are no longer given off.

Allow the dish to cool, dissolve the residue in about one-fourth of a test tube full of distilled water (5-7 cc.) and *add 2 to 3 cc. of alcohol (not more than an equal volume of alcohol should be added)* and then add a few drops of sulphuric acid¹ and filter (I) through a small paper but do not wash. Discard the residue.

Transfer about one cubic centimeter of filtrate I to a test tube and add one drop of sodium cobaltic nitrate, $\text{Na}_3\text{Co}(\text{NO}_2)_6$.

A. No precipitate is formed. Proceed as in B, 2, for the detection of sodium.

¹ The sulphuric acid will remove any barium, strontium, or calcium which was not precipitated by the ammonium carbonate.

B. A yellow precipitate proves the presence of potassium in the solution (ammonium compounds must be absent).

1. To the remainder of filtrate I add an excess of perchloric acid². A white crystalline precipitate of potassium perchlorate is formed. Filter (II) and test a few drops of filtrate II with the sodium cobaltic nitrite. If a precipitate is formed, add to the filtrate II more perchloric acid, filter again and test as above. When the sodium cobaltic nitrite shows that all potassium has been removed by the perchloric acid, proceed as directed in B, 2, for the detection of sodium.

2. To the filtrate from B, 1, add a few drops of hydrofluosilicic acid, H^2SiF^6 . A cloudy flocculent precipitate indicates the presence of sodium in the solution. This precipitate is not very voluminous and must be looked for carefully if only a little sodium is present. Turn the test tube and examine the sides for adhering precipitate.

This method has been tried in this laboratory with excellent results. Some of the advantages are:

1. Magnesium does not interfere and need not be removed. Magnesium perchlorate is very soluble. Magnesium fluosilicate is soluble and only precipitated, even in the alcohol solution, when large amounts are present.

2. The test for sodium is delicate but traces of sodium which are present in so many reagents are not detected. This is an advantage over the spectrum test where all substances show sodium.

3. The tests are simple and easily understood and followed by the students.

4. The tests are decisive and the student has confidence in his work.

5. Only a short time is required to make a test.

²The perchloric acid must be free from sodium but the presence of potassium does no harm because potassium is detected previously, by the use of sodium cobaltic nitrite, and any potassium present is precipitated by the alcoholic perchloric acid solution.