

**QUALITATIVE ANALYSIS
OF INORGANIC
SUBSTANCES; PP. 2-59**

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HEINRICH ROSE

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BY

HEINRICH ROSE

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SHOULD the substance presented for analysis be in the solid state, it must be reduced to a fine powder in a mortar and then treated with distilled water. The aqueous solution having been concentrated by evaporation is to be acidified with muriatic, and treated as at page 5. The insoluble remainder is to be dissolved in muriatic, nitric or nitro-muriatic acids, and the solution having been filtered is to be treated as the aqueous solution had been. The insoluble substances generally are chromic acid, vanadic acid, selenic acid, permanganic acid, manganic acid, oxide of cerium, oxide of manganese and peroxide of manganese, peroxide of cobalt, peroxide of nickel, red and brown peroxide of lead, and other peroxides which seldom occur. The substances which remain insoluble in water and acids are to be fused; some with carbonate of potash or soda, and some with sulphate of potash, after which, being soluble in muriatic acid, they are treated as before.

Should the substance to be examined be a mineral or spa water, it will be found generally to contain potash, soda, ammonia, lithia, strontia, lime, magnesia, alumina, protoxide of manganese, protoxide of iron, oxide of zinc, oxide of copper. Acids,—sulphuric, sulphurous, nitric, carbonic, boracic, phosphoric, silica, besides chlorine, fluorine, bromine, iodine and sulphur united to a metal of the foregoing, together with some gases in solution, which are to be removed from the solution by boiling, and tested as at page 36.

If there be alkaline bicarbonates in solution without free carbonic acid, litmus paper is not reddened; but if it be reddened and be unaffected after boiling, free carbonic acid has been present.

A few drops of the mineral water is to be added to lime-water in a test-glass; a precipitate redissolving in an excess of the mineral water is a proof of free carbonic acid, and consequently it must contain alkaline bicarbonates, or the bicarbonates of lime and magnesia. If there be present the earthy bicarbonates (lime and magnesia), but no alkaline bicarbonates, or free carbonic acid, the precipitate does not redissolve in the mineral water.

If the mineral water has been taken from the vicinity of a town, a portion is to be evaporated, dissolved in water, and tested for nitrates by sulphate of protoxide of iron and concentrated sulphuric acid, which cause the solution to become dark brown; the colour disappears however after some time; but if a precipitate appears during the evaporation, there are no nitrates present.

To determine the presence of iodine and bromine, a portion of the solution must be evaporated nearly to dryness, and then treated with sp. wine. The spirituous solution having been evaporated cautiously to dryness is to be treated with a small quantity of water, and the aqueous solution tested for iodine or bromine.

If organic matter be present in the solution the water becomes yellow at the close of the evaporation, and the salt deposited becomes blackish on heating.

Colour of
the Sul-
phurets.

Note.—In the following pages the course of the analysis occupies the pages on the right-hand side, while the actions of the different substances towards reagents are contained in the left.

- Brown.** Platinum.—In the concentrated solution, a concentrated solution of chloride of potassium or muriate of ammonia gives a yellow. In the solution acidified with muriatic, potash-ammonia and their carbonates produce a yellow.
- Brown.** Iridium.—The above reagents give a black, but when both iridium and platinum are present, a reddish precipitate.
- Brown.** Molybdenum.—Sulphuret by blowpipe. Potash and ammonia produce a dark brown voluminous precipitate, insoluble in excess of the precipitant; carb. potash produces a yellow-brown, soluble in excess.
- Blackish.** Tellurium.—Often milky on dilution. Chloride of barium produces in the neutral solution a voluminous white precipitate, soluble in nitric and muriatic; potash-ammonia and their carbonates produce in tellurous acid a white precipitate, soluble in excess.
- Yellow.** Selenium.—Selenic acid produces a precipitate with a salt of barytes similar to sulphuric acid, from which it is distinguished by evolving chlorine when heated with muriatic. Selenious acid known by the red precipitate of selenium when it is heated with sulphurous acid. Heated with soda on charcoal in the inner flame or with salt of phosphorus, it is known by the smell of radish.
- Yellow.** Arsenic.—When heated with soda in the inner flame gives the odour of garlic; mixed with charcoal and boracic acid, and heated in a glass tube closed at one end, a metallic mirror of arsenic is deposited in the cold part of the tube. Arsenites distinguished from arseniates by nitrate of silver, producing in the one a brown, in the other a yellow precipitate; this latter distinguished from the precipitate produced in solutions of the phosphates by being easily soluble in weak acids.
- Black.** Gold.—Purple-red with proto-chlo.-tin, insoluble in mu-

BASES.—A.

Muriatic acid added to the solution of the salt concentrated.

There are precipitated—

Smell of chlorine when warmed,

Oxide of manganese, oxide of cerium, manganic acid, vanadic acid, chromic acid, selenic acid (these are partly deoxidated); also muriates, subchlorides, with metallic chlorides; also bromides and iodides; also

Tantallic acid, tungstic acid and titan acid.

The precipitate by muriatic acid is not dissolved by nitric acid in these. Tungsten distinguished by being easily soluble.

Sulphuretted hydrogen added to the acidified solution,

There are precipitated—

Some of these fall as oxides, depositing, after heating, a difficultly filtered sulphur, as oxide and acid manganic, chromic acid.

Oxides of cadmium, lead, bismuth, copper, silver, mercury, protoxide of mercury, oxide of gold, proto and peroxides of tin, oxide of antimony; also oxides of rhodium, iridium, osmium, osmic acid, protoxide of palladium, oxide of platinum, antimonious and antimonic acids, oxide of molybdenum, molybdic acid, tellurous, arsenious, arsenic and selenious acids.

Also subsulphurous, sulphurous, chlorine, bromine and iodine acids.

The above precipitates treated with ammonia + hydro-sulphuret of ammonia and warmed.

There dissolve—

These can be re-precipitated by muriatic acid as sulphurets. The sulphurets when dissolved in acid are tested as on the other page.

Platinum, iridium, gold, tin, antimony, molybdenum, tellurium, selenium, arsenic, tungstic acid, vanadious and vanadic acids.

- Colour of the Sulphurets.** riatic; proto-sulphate-iron produces a blue colour with a brown precipitate. Oxalic acid produces a dark green colour; soon the metallic gold subsides.
- Dark brown.** Tin (proto).—Solution milky; v. dilute solution + solution of gold gives purple-red.
- Yellow.** Tin. (ox.) and Antimony distinguished by the colour of their sulphurets after reducing tin to the protoxide.
- Orange-red.** Antimony.—If antimony, tin and arsenic be present, the sulphurets are heated in a glass tube, by which sulphur and sulphuret of arsenic are sublimed. The sulphurets of tin and antimony are dissolved in concentrated muriatic and tested.
- Vanadious and vanadic acids.
- Yellow.** Tungsten.—Blowpipe. Zinc produces a blue colour in the acid solution; distinguished from titan acid by the solubility of its alkaline compounds with water and their behaviour towards acids.
- Dark brown.** Vanadium.—Its compounds have a great resemblance to those of uranium, molybdenum, tungsten and chrome. Distinguished from chrome by the blowpipe; the green pearl with borax or salt of phosphorus in the inner flame, changes into yellow in the outer, and becomes colourless on addition of vanadium. The alkaline vanadic solutions lose their colour when heated, while those of chrome retain it. Vanadic acid does not lose oxygen by heat, while chromic is changed thereby into oxide of chrome. Oxide of vanadium is green, soluble in water and alkalies, and is oxidated by heat; oxide of chrome is green, insoluble in water and alkalies, and is not oxidated by heat. The acid solution of the yellow oxide of uranium is precipitated yellow by ammonia; the precipitate changes not its colour by warming the solution, while the solution of vanadium becomes colourless by heat, and with muriate of ammonia gives a white powder. Prussiate of potash produces in solution of uranium a reddish-brown, in solution of vanadium a green precipitate. Solutions of molybdenum lose their blue colour when boiled with potash, and a dark brown oxide subsides; but in the blue solution of vanadium alkalies produce a grey-white precipitate, and by addition of alkali in excess the solution becomes brown. Tungsten also has a blue solution, but is easily distinguished by the blowpipe.

OBSERVATIONS.