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NOTE

A New Reagent to Detect Alkali Nitrites and Conversely Copper Ions

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Alkali nitrites react specifically with cupric ions to form cupric nitrite imparting green colouration to the solution with intensity proportional to the concentration of the reactants. The colour is quantitatively decolorized by addition of dilute mineral acid. The reaction can be employed in routine qualitative analysis of nitrites and cupric ions and to differentiate nitrites from nitrates.

Reagents such as starch-iodide, diphenylamine/diphenylbenzidine, acidified potassium permanganate, brucine or ferrous sulfate commonly employed for qualitative detection of alkali nitrites are generally non-specific with respect to either reaction phenomenon (*i.e.*, rodox reaction) or fail to differentiate alkali nitrites from nitrates.[1–4]

Copper sulfate reacts specifically with alkali nitrites in a non-acidic medium to form cupric nitrite which imparts green coloration to the solution. Nitrates being salts of strong acid and strong base fail to react with copper ions. Addition of standard dilute mineral acid quantitatively decolorizes the solution with evolution of reddish-brown fumes of nitrogen dioxide. Apparently, the reactions proceed as under,

$$CuSO_4 \cdot 5H_2O + 2NaNO_2 \longrightarrow Cu(NO_2)_2 + Na_2SO_4 + 5H_2O \quad (1)$$

$$Cu(NO_2)_2 + H_2SO_4 \xrightarrow{\frac{1}{2}O_2} CuSO_4 + H_2O + 2NO_2\uparrow \quad (2)$$

Experimentally, the ratio between cupric sulfate pentahydrate and sodium nitrite to form maximum colour intensity was found to be 2.00 ± 0.08 ($n = 6$) on mg basis; the ratio is closer to theoretical stoichiometric value of 1.81 (Reaction 1). Decolorization of colour intensity is also proportional to the quantity of dilute mineral acid added.

Proposed detection protocols for alkali nitrites, or conversely copper ions, are as follows:

Detection of alkali nitrites: To 5 mL aqueous solution of alkali nitrite add 0.3 mL of 10% (w/v) copper sulfate pentahydrate in water. Appearance of greenish coloration that disappears on addition of dilute mineral acid confirms nitrite. The

test would detect 200 to 2000 ppm nitrite producing varying intensities of greenish coloration. An extract that would fail to give this test, but reacts positively to diphenylamine or ferrous sulfate[1], would confirm nitrate. Perliminary studies indicate maximum absorption of colour in the range 380 to 510 nm (peak 420 nm).

Detection of copper ions: To 5 mL aqueous solution of a copper salt add 0.3 mL of 5% (w/v) sodium nitrite in water. Appearance of greenish coloration that disappears on addition of dilute mineral acid confirms copper ions. Addition of alkali hydroxide would cause prcipitation of copper as cupric hydroxide. The test would detect 100 to 1000 ppm copper.

The tests can be employed in routine salt analysis in students' practicals, as well as would aid in detection of toxicologically significant levels of nitrite or copper in test specimens. The reaction is being used to standardize a new specific acidimetric assay for inorganic nitrites (unpublished data).

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