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Short Communication

Spectrophotometric determination of vanadium(V) using gallacetophenone oxime

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Abstract

A method has been developed for the direct spectrophotometric determination of vanadium(V) using gallacetophenone oxime. The reagent forms a yellow-green complex in acid medium. The colour is stable for 20 hours. The system obeys Beer's law over the concentration range 0·5 to 6·0 μg/ml. The molar absorptivity and Sandell sensitivity are $8·6 \times 10^3$ lit. $mole^{-1}$ cm^{-1} and 0·0058 $\mu g.cm^{-2}$ respectively. The effect of foreign ions was also studied. The stoichiometry is established as 1 : 2.

Key words: Direct spectrophotometry, microamounts, gallacetophenone oxime, vanadium(V).

Gallacetophenone oxime prepared by the standard procedure[1,2] forms instantaneously an yellow-green coloured complex with vanadium(V) in the pH range of 3·5–5·0. The complex shows maximum absorbance at 390 nm. The absorbance of the solution remains stable for 20 hours.

Known aliquots of vanadium(V) solution containing 12·5–150 micrograms were taken in a series of 25 volumetric flasks and 10 ml of phthalate buffer solution (pH 4·0) were added followed by one ml. of the reagent to each flask. The contents of the flask were made up to the mark with double distilled water. The absorbance of the solution was measured at 390 nm using the reagent solution as blank.

The linear plot obtained by plotting the absorbance *vs* concentration of vanadium shows the system confirmed to Beer's law in the range 0·5–6·0 μg/ml at 390 nm. The molar absorptivity and Sandell sensitivity calculated from Beer's law plot are $8·6 \times 10^3$ lit. mol^{-1} cm^{-1} and 0·0058 $\mu g/cm^2$ respectively. The optimum concentration range calculated from Ringbom plot is 1·0–6·0 μg/ml. The stoichiometry between vanadium(V)–gallacetophenone oxime is established as 1 : 2 from Job's continuous variation and Mole ratio methods. The standard deviation calculated from ten determinations of vanadium using this method is 0·019.

The study of effect of foreign ions on the colour reaction showed that large amounts of chloride, bromide, nitrate, permanganate, phosphate, Na^+, K^+, Li^+, Cd^{2+}, Ca^{2+}, Mg^{2+}, Ba^{2+}, Zn^{2+}, Pb^{2+} and Mn^{2+} did not interfere in the determination of 4·5 μg/ml of vanadium. Fe^{3+}, Ti^{4+}, Zr^{4+}, Mo^{6+}, EDTA, oxalate, acetate interfere strongly in the determination. The other ions tolerated in the determination of vanadium(V) in micrograms are Al^{3+} (80), Cr^{6+} (12), W^{6+} (20), UO_2^{2+} (10), As^{3+} (70), Co^{2+} (10), Ni^{2+} (10). Vanadium(IV) can also be determined by this method after oxidation of it to vanadium(V) by potassium permanganate, since excess oxidant has no effect on the colour reaction.

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