

**EFFECT OF VARIOUS REDUCTANTS ON SPECTRAL CHARACTERISTICS
OF REDUCED
PHOSPHOPOLYOXOMOLYBDATE ANION AND ITS APPLICATION TO
ORTHOPHOSPHATE ANION QUANTIFICATION IN SELECTED WATERS
OF UGANDA**

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ABSTRACT

The effect of various reductants on spectral characteristics of reduced phosphopolyoxomolybdate anion both in presence and absence of potassium antimonyl tartrate catalyst is described. Based on the formation of phosphopolyoxomolybdate on addition of the orthophosphate anion (PO_4^{3-}) to the molybdate and followed by its reduction with a given reductant in aqueous sulphuric acid medium, an intense blue coloured product, molybdenum blue, is formed, whose intensity is proportional to concentration of PO_4^{3-} .

Ascorbic acid, tin(II) chloride and hydrazine sulphate as the hitherto used reductants form molybdenum blues that are intense but as time goes on, the colour fades. The reason for the fading may probably be due to oxidation of the reduced phosphopolyoxomolybdic acid (PPMA). Whereas with sodium dithionite ($\text{Na}_2\text{S}_2\text{O}_4$) and sodium thiosulphate ($\text{Na}_2\text{S}_2\text{O}_3$) as reductants, the intensity kept on increasing. This could probably be due to the increasing number of reduced Mo centres.

This work identified the effect of potassium antimonyl tartrate catalyst on the rate of reduction of PPMA in respect of using $\text{Na}_2\text{S}_2\text{O}_4$ and $\text{Na}_2\text{S}_2\text{O}_3$ as reductants. For $\text{Na}_2\text{S}_2\text{O}_3$ as the reductant, in the absence of a catalyst, a stable spectrum was attained after 60 minutes, compared to 40 minutes when it was added.

A sodium dithionite method for determination of PO_4^{3-} spectrophotometrically in water is described. The reduced PPMA (RPPMA) obeyed Lambert-Beer's law at λ_{max}

880 nm and 825 nm in the concentration range 0.0027-0.8000 mg P L⁻¹ with detection limits of 0.54 µg mL⁻¹ and 0.76 µg mL⁻¹ in presence and absence of a catalyst respectively. The results obtained were reproducible with relative standard deviation 8.0% for a 0.006 mg P L⁻¹ and 7.6% for a 0.005 mg P L⁻¹ in presence and absence of a catalyst, respectively.

A sodium thiosulphate method for determination of PO₄³⁻ spectrophotometrically in water is also described. The resultant RPPMA containing sulphur and phosphorus as heteroatoms obeyed Lambert-Beer's law at λ_{max} 735 nm and 725 nm in the presence and absence of a catalyst, respectively. However, with formation of the presumed RPPMA, [PS₂Mo_xO_y]ⁿ⁻, the method could not be used to quantify PO₄³⁻.

Based on formation of RPPMA, the sodium dithionite method not used before was successfully applied to the quantification of PO₄³⁻ in selected waters of Uganda: water from a well and borehole in Katooke (Wakiso District) and Bwaise channel (Kampala District).