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RESEARCH ARTICLE

Simultaneous determination of Ru (III) and W(VI) using Second order derivative spectrophotometry

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ABSTRACT

A simple, selective and sensitive spectrophotometric method has been developed for the simultaneous determination of Ruthenium (III) and tungsten (VI) using 3,4-dihydroxybenzaldehyde isonicotinoyl hydrazine (3,4-DHBINH) without any prior separation. Beer's law is obeyed between 2.304 to 12.204 $\mu\text{g/ml}$ of Ruthenium (III) at 359 nm and 3.3676 to 22.056 $\mu\text{g/ml}$ of tungsten (VI) at 374 nm. The metal ion interferes with the determination of each other in zero order as well as in first order spectrophotometry. Zero crossing wavelengths are 363 and 373 nm. The optimum condition for maximum colour development and other analytical parameters were evaluated.

Keywords: di hydroxy benzaldehyde, isonicotinoyl hydrazine, Beer's law & Wavelength etc.

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1. Introduction

Simultaneous determination of metal ions using derivative spectrophotometry decreases the interference of foreign ions. This method is particularly advantageous in the case of metal ions having overlapping spectra. Number of reports¹⁻¹⁸ is available in recent years on derivative spectrophotometry for the simultaneous determination of metal ions. 2,4-dihydroxybenzaldehyde isonicotinoyl

hydrazone¹⁹ and Salicylaldehyde p-hydroxy benzoyl hydrazone²⁰ in the presence of Triton X-100 are used for the simultaneous determination of Mo(VI) and Ti(IV). Methods for the simultaneous determination of metal ions on derivative spectrophotometry using 3,4-DHBINH are not available. A second order derivative spectrophotometric method has been developed for the simultaneous

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determination of Ruthenium (III) and tungsten (VI) using 3,4-DHBINH and results are presented in this paper.

Interferences

The tolerance limits of different cations and anions that interfere in the present method are studied the amount of foreign ion that cause an error of $\pm 2\%$ in the derivative amplitude is taken as its tolerance limit.

Simultaneous determination of Ru(III) and W(VI)

The second order derivative spectra of Ru(III) DHBINH and W(VI) DHBINH at pH 6.0 are taken. Ruthenium shows considerable derivative amplitude at 359 nm where tungsten has zero amplitude (zero cross). At 374 nm tungsten shows a peak. However, at 363 nm ruthenium (III) has zero amplitude. Thus Ru(III) and W(VI) are determined simultaneously by measuring the derivative amplitude at 359 nm and 374 nm respectively without using simultaneous equations. It can be seen from the results in Table 1 that Beer's law is obeyed between 2.304 to 12.204 $\mu\text{g/ml}$ of Ru (III) and 3.3676 to 22.056 $\mu\text{g/ml}$ of W(VI).

Simultaneous determination of Ru(III) and W(VI)

Different aliquots of sample solutions were treated as mentioned in procedure (*loc. Cit.*). The amounts of Ru(III) and W(VI) present in these samples were computed from the pre-determined calibration plots and given in Table 1.

2. Materials and Methods

Apparatus

U.V visible recording spectrophotometer (UV – 160A)

A Shimadzu UV-Visible Spectrophotometer, UV-160A and ELICO LI 160 digital pH meter were used for the absorbance and pH measurements respectively.

Reagents

3,4- dihydroxy benzaldehyde isonicotinoyl hydrazone

This was prepared by taking equimolar solutions of 3,4-dihydroxybenzaldehyde and isonicotinic acid hydrazide in methanol and refluxing for 3 hrs. It was allowed to stand at room temperature until the yellow colour crystals were formed. A 0.01M solution of the reagent in DMF was used in the studies.

Buffer solutions

They were prepared by mixing 1M HCl and 1M sodium acetate (pH 1.0 – 3.0) and 0.2M acetic acid and 0.2M sodium acetate (pH 3.5 – 7.0) in various proportions. The pH of this solution was adjusted to their appropriate values using pH meter.

Ruthenium (III) and tungsten (VI) solution

Stock solutions of 0.01M of Ru(III) and W(VI) were prepared by dissolving requisite amounts of analytical grade RuCl_3 and Na_2WO_4 in distilled water and standardized. Lower concentrations were prepared by appropriate dilution of the stock solutions. All other chemicals used were of analytical grade.

Procedure

Simultaneous determination of Ru(III) and W(VI)

2 ml of reagent ($2 \times 10^{-2}\text{M}$), 10 ml of buffer solution of pH 6.0, were taken in 25 ml volumetric flask, known aliquots of Ru(III) and W(VI) were added and made upto the mark with distilled water. Second derivative spectra of these solutions were recorded against reagent blank solution in the wavelength range 350 to 500 nm with scan speed of the

derivative peak height were measured by peak zero method at 359 nm and 374 nm for Ru(III) and W(VI). Calibration plots were drawn for the experimental data and they are shown in figures 3 and 4.

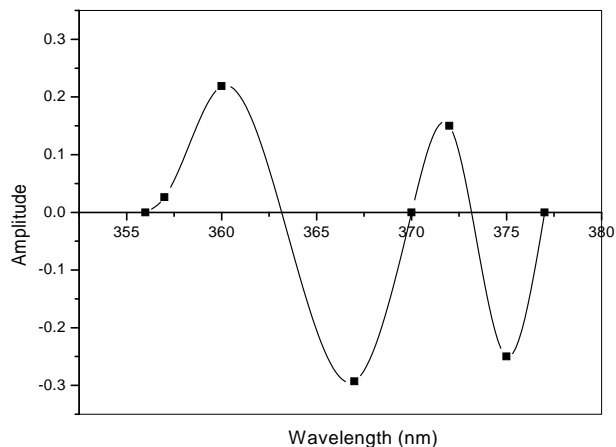


Fig. 1. Typical second order derivative spectrum of Mo (VI) + W (VI) in presence of 3,4-DHBINH [3,4-DHBINH] = $2 \times 10^{-4}\text{M}$; [Mo (VI)] = [W (VI)] = $1 \times 10^{-5}\text{M}$; pH = 6.0

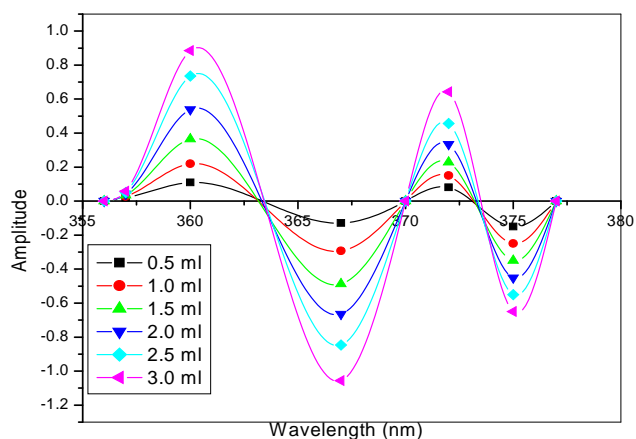


Fig. 2. Second order spectra of Mo (VI) + W (VI) in presence of 3,4-DHBINH [3,4-DHBINH] = $2 \times 10^{-4}\text{M}$; [Mo (VI)] = [W (VI)] = $1 \times 10^{-5}\text{M}$; pH = 6.0

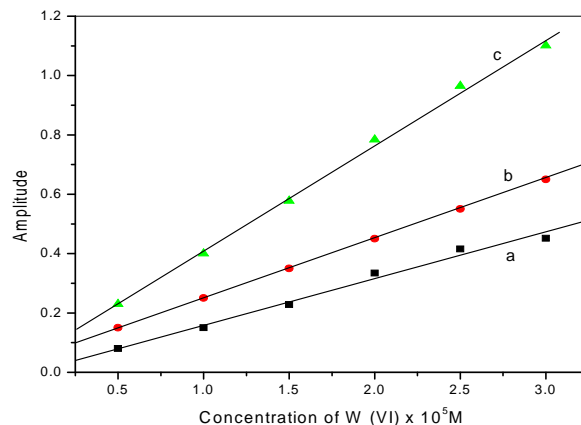


Fig. 3. Second derivative amplitude Vs Concentration of W (VI) Wavelength = 372; pH = 6.0 a = Peak; b = Valley; c = Peak + Valley

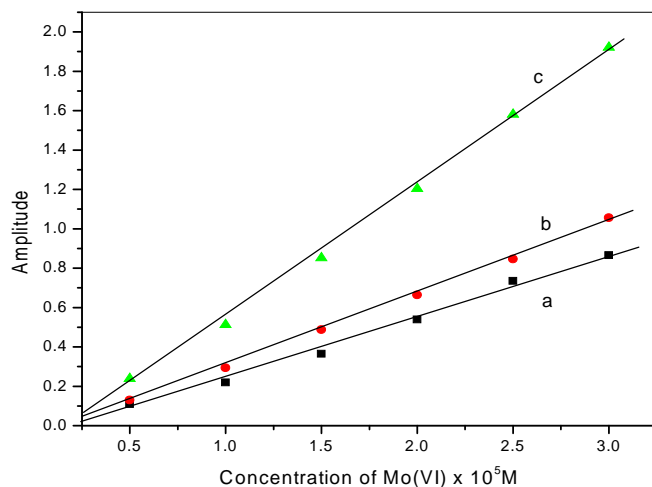


Fig. 4. Second derivative amplitude Vs Concentration of Mo (VI) Wavelength = 360 ; pH = 6.0 a = Peak ; b = Valley ; c = Peak + Valley

3. Results and discussion

Zero order spectra of W(VI) and Ru(III) are recorded in a solution of pH 6.0 at 395 and 360 nm respectively. When a simultaneous zero order spectrum is recorded only a single peak is noticed at 390 nm. Hence, zero order is not useful for simultaneous determination of metal ions. The first order derivative spectra are not useful because they are broader in shape and resolution is not possible. The second order spectrum recorded for experimental solution against the respective blank solution is presented in fig. 1. An examination of figure reveals that there are two peaks. The peak at 359 nm corresponds to Ruthenium (III) and the other at 374 nm corresponds to tungsten(VI). The peak at 359 nm and the valley at 365 nm corresponds to Ru(III). Similarly the peak at 374 nm and the valley at 378 nm corresponds to W(VI). Typical second order derivative spectrum is shown in fig. 2. To know the sensitivity of the method for simultaneous determination graphs are drawn between the concentration of metal ion and peak amplitude, valley amplitude and sum of peak and valley amplitudes are shown in Fig 3 and 4 for Ru(III) and W(VI) respectively.

4. Conclusions

Several reagents are used as photometric reagents for the simultaneous determination of Ru(III) and W(VI). But very few methods are available for simultaneous determination of both the metal ions using isonicotinoyl hydrazone derivatives. The present method does not need solving of simultaneous equations. The present method is rapid sensitive and highly selective. Hence, it can be applied successfully to their analysis in steel samples.

5. References

- [1] E.Y. Hashem,, *Spectrochim. Acta Part A*, **58**, 1404 (2002).
- [2] E.Y. Hashem, S.A. Bakr, and S.M. Hussain, *Spectrochem, Acta Part A*, **59**, 761 (2003).
- [3] M.I. Toral, P. Richter, A.E. Tapia and J. Hernandez, *Talanta*, **50**, 183 (2003).

- [4] V.K. Singh, N.K. Agnihotri and H.B. Singh, *Talanta*, **55**, 799 (2001).
- [5] V.K. Reddy, S.M. Reddy, A. Chennaiah, P.R. Reddy and T.S. Reddy, *J. Anal. Chem.*, **58**, 442 (2003).
- [6] Hasan Sedaira, *Talanta*, **51**, 39 - 48 (2000).
A. Bhalotra and B.K. Puri, *Mikro chim. Acta.*, **134**, 139 (2000).
- [7] M.N. Abbsa, A.M. Homoda and G.A.E. Mostafa, *Anal. Chim. Acta*, **436**, 223 (2001).
- [8] L.L. Martinez, J.L.G. Mar and P.L.L. Alba, *J. Radioanal. Nucl. Chem.*, **247**, 413 (2001).
- [9] J. Karpinska and M.KULIKOWSKA, *j. Pharm. Biomed. Anal.*, **29**, 153 (2002).
- [10] Birsen Demirata Ozturk, Hayati Filik, Esma Tutem, Resat Apak, *Talanta*, **53**, 263 - 269 (2000).
- [11] Krishna Reddy, V., Mutta Reddy, S., Raveendra Reddy, P. and Sreenivasulu Reddy, T. *Chem. Anal.*, (Warsaw) **46**, 687 (2001).
- [12] Kevser Sozgen and Esma Tutem, *Analytical Science.*, **17**, 1861 - 1864 (2001).
- [13] Krishna Reddy, V., Mutta Redy, S., Raveendra Redy, P. and Sreenivasulu Reddy, T., *J. Indian Chem. Soc.*, **79**, 71 - 74 (2004).
- [14] Abdolkarim Abbaspour and Leila Baramkeh, *Analytical Sciences*, **18**, 1127 - 1130 (2002).
- [15] Agnihotri, N.K., Ratnani, S., Singh, V.K., Singh, H.B., *Analytical Scinces*, **19**, 1297 - 1301 (2003).
- [16] Eskandari, H. and Saghseloo, A.G., *Analytical Scinces*, **19**, 1513 - 1518 (2003).
- [17] Abdel-Aziz Y.El-Sayed and Najeb A. El-Salem., *Analytical Sciences*, **21**, 595 - 614 (2005).
- [18] O.Babaiah, P.Raveendra Reddy, *J. Indian Chem. Soc.*, Vol. 81, 670 - 673 (2004).
- [19] Anitha Varghese, A.M.A. Khadar, *Ind. J. Chem. Tech.*, Vol 12, 701 -707 (2005).