Chinese Chemical Letters Vol. 10, No. 2, pp. 155–156, 1999

Study on New Spectrophotometric Determination of Arsenic (V) with Chlorpromazine

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Abstract: It was shown that a new sensitive spectrophotometric method for the determination of trace arsenic with chlorpromazine by the formation of heteropoly arsenomolybdic chlorpromazine complex in aqueous phase.

Keywords: Chlorpromazine, spectrophotometry, arsenic .

Introduction

Chlorpromazine as a new chromogenic reagent has been employed for the determination of vanadium (V) in this laboratory[1]. It was found that this reagent also gave a sensitive reaction with heteropoly acid of As,P,Ge,and Si in strongly acidic medium.

In this paper, a new method for spectrophotometric determination of arsenic (V) with chlorpromazine is reported. The optimum conditions for color development of the complex and the effects of foreign ions were studied. It is possible to establish a sensitive and selective spectrophotometric method for the determination of arsenic (V) by using chlorpromazine, as the reagent is easy to obtain.

Experimental

Apparatus Model 751-GW spectrophotometer with 1.0-cm cells.

General procedure Transfer a solution containing not more than 10 μg of arsenic into a 25 mL calibrated flask. Add 6.0 μg of arsenic, 3.5 mL of 6 mol/L hydrochloric acid and 2.5 mL of 5% sodium molybdate. Place the flask in a boiling-water bath for 5 sec, cool, add 2 mL of 6 mol/L hydrochloric acid, 1.5 mL of 2% PVA, and 2.5 ml of 0.2% chlorpromazine hydrochloride, dilute to mark with water and mix well. Place the flask in a boiling-water bath for 15 min, cool. Measure the absorbance at 350 nm on a 751-GW spectrophotometer with 1.0 cm cell against a reagent blank.

Results and Discusion

The maximum absorption wavelength In the absence of PVA, chlorpromazine hydrochloride and heteropoly arsenomolybdic chlorpromazine complex exhibit maximum absorption at 320 and 350 nm,respectively.

Effect of amount of chlorpromazine In 25 mL of solution, 2.0~3.0 mL of 0.2% chlorpromazine solution gave maximum and constant absorbance for 6.0 μg of arsenic, thus an addition of 2.5 mL chlorpromazine solution was recommended.

Effect of acidity The suitable hydrochloric acid acidity for producing heteropoly arsenomolybdic acid was in the range of 0.72~0.96 mol/L and 0.84 mol/L of acidity was selected. For producing heteropoly arsenomolybdic chlorpromazine complex, the presence of 1.2-1.7 mol/L hydrochloric acid gave a maximum and constant absorbance . Thus, 1.3 mol/L of acidity in the final solution was recommended.

Effect of amount of PVA Since a surfactant should be used as a solubilizing agent, various surfactants were tried for this purpose. . Nonionic surfactants such as Tween-40, Triton X-100, Triton X-305 and PVA gave a remarkable increase in sensitivity of the complex and the latter was found to be the best . The optimum amount of PVA ranged from 1.0 to 2.0 mL. Therefore 1.5 mL of 2% PVA was recommended

Effect of time of reaction The color complex was formed in a boiling-water bath for 15 min and exhibit maximum absorption, the absorbance was stable for at least 4hr.

Calibration graph, sensitivity and precision A calibration graph was constructed in the usual way according to the general procedure. Beer' Law was obeyed for 0~10 μg of arsenic in 25 mL solution. The molar absorptivity was calculated from the slope of the calibration graph to be $1.13*10^5$ L mol^{-1} cm^{-1}. Ten replicate analyses of a test solution contaning 6.0 μg of arsenic by the general procedure gave a relative standard deviation of 1.6%.

Effect of foreign ions The effects of various cations and anions on the determination of 8.0 μg of arsenic were examined. When a change of 5% in absorbance was set as the tolerance limit, the following ions do not interfere (amounts given in μg): Na^+, K^+, NH_4^+, Li^+ (10000), Ba^{2+}, Mg^{2+}, Co^{2+}, Mn^{2+}, Cr^{3+}, Al^{3+}, Ag^+, $Cr_2O_7^{2-}$ (8500), Pb^{2+}, Sr^{2+}, Hg^{2+}, ClO_3^- (7000), V (V), Ce (IV) (2500), Fe^{3+} (100), F^-, $HCOO^-$, $S_2O_8^{2-}$ (6000), SO_4^{2-} (12000), Cl^- (14000), PO_4^{3-} (20), SiO_3^{2-} (50), Ge (IV) (60). Most of ions did not interfere with the determination, but Fe^{3+}, PO_4^{3-}, SiO_3^{2-} and Ge (IV) interfered.

Recovery test The recoveries of arsenic found by standard addition of 6 μg of arsenic to each determination averaged 99.3%, with ranges of 98.4~102%.

References

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Received 17 September 1998