DETERMINATION OF *m*-AMINOBENZOIC ACID BY POTENTIOMETRIC TITRATION

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abstract: Cerium (IV) sulfate solution in sulfuric acid was used for the determination of the *m*-aminobenzoic acid in sulfuric acid solution by potentiometric titration. The optima working conditions were set up for the quantitative determination of *m*-aminobenzoic acid. The method is simple, rapid and reliable.

Introduction

The *m*-aminobenzoic acid is a white to pale yellow crystaline powder, slightly soluble in cold water but freely soluble in boiling water. The aqueous solution turns brown on standing in air. It is used as an intermediate for production of black disazo dyes for jet printing inks and pigments as well as for perfumes and pharmaceutical products. Various methods have been used for determination of *m*-aminobenzoic acid such as: spectrometric [1] and chromatographic [2÷4] methods. There are few titrimetric methods used for direct determination of them [5]. Based on the results already published [6,7] concerning the determination of aminobenzoic acids by potentiometric titration using a Ce(IV) solution this paper reports this a simple, rapid and reliable method for assay of *m*-aminobenzoic acid by direct titration. The optima working conditions for the direct quantitative determination of *m*-aminobenzoic acid by redox potentiometric titration with Ce (IV) solution have been established.

Experimental

Reagents

All the reagents used were of analytical reagent grade. *m*-aminobenzoic acid was provided by Sigma, $1 \cdot 10^{-1}$ mol·L^{-1} cerium (IV) sulfate solution in sulfuric acid 1 mol·L^{-1} and the concentrate sulfuric acid $d = 1.84$ g·cm^{-3} were provided by Merck. Solution $1 \cdot 10^{-1}$ mol·L^{-1} of sulfuric acid has been obtained by dilution of the concentrate sulfuric acid with distilled water.

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Analele Universității din București – Chimie, Anul XII (serie nouă), vol. I-II, pag. 85–88

Apparatus

All the potentiometric measurements were made with a Consort P901 *p*H/mV-meter. A platinum redox electrode was used as indicative electrode for titration. A saturated calomel electrode was used as reference.

Procedure

The two electrodes were immersed into Berzelius beaker containing accurately measured volumes of *m*-aminobenzoic acid (MABA) solutions diluted to the 20 mL with sulfuric acid solution. The electromotive force of the system was recorded after each addition of the titrant solution (cerium (IV) sulfate solution).

Results and Discussion

The variation of the electromotive force with the volume of the solution of Ce(IV) added was used to draw the titration curve. From each curve the equivalence volume, the apparent redox standard potential of the MABA oxidized form / MABA reduced form, the apparent redox standard potential of the couple Ce^{4+} / Ce^{3+} and the number of electrons exchanged during the redox reaction have been determined. The equivalence volume was determined also by the first and the second derivative of the titration curve. In Fig. 1 a titration curve of *m*-aminobenzoic acid with Ce(IV) solution is shown.

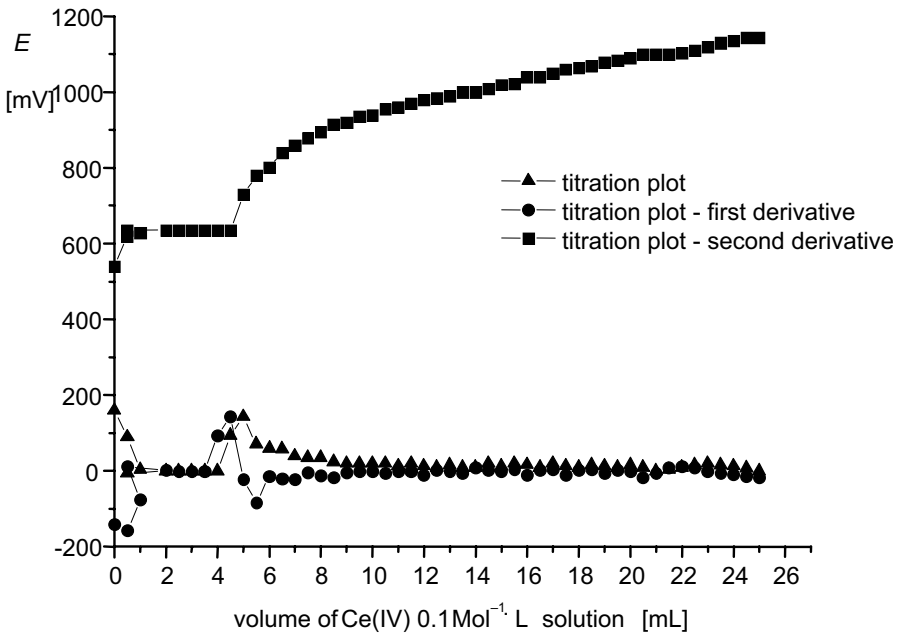

Fig. 1: *Titration curves of m-aminobenzoic acid with 10^{-1} mol·L^{-1} cerium (IV) sulfate solution.*

It was observed that the redox reaction occurs harder when the titrant concentration decreases. For this reason only the titration of MABA with a solution 10^{-1} mol·L^{-1} of cerium (IV) sulfate solution was performed. In this condition the number of electrons exchanged during the redox reaction, *n*, is equal to 5, the apparent redox standard potential of the *m*-aminobenzoic acid oxidized form/*m*-aminobenzoic acid reduced form, $\varepsilon^0_{ox/red}$ is 883±32 mV and the apparent redox standard potential of the Ce^{4+}/Ce^{3+}, $\varepsilon^0_{Ce^{4+}/Ce^{3+}}$ is 1373±32 mV.

Analytical application

The proposed method was applied for the assay of MABA in solution containing known amounts of MABA. The quantity of the MABA was determined also by a spectrometric method[1]. The results obtained by the two methods proved that the proposed method could be used for the quantitative determination of MABA.

Table3. Results of MABA assay on synthetic samples application of the method

Taken	Amount (mg) Found by*:	
	Proposed method	Spectrometric method[1]
0.30	0.31±0.01	0.30±0.03
0.62	0.61±0.02	0.59±0.01
1.29	1.33±0.01	1.30±0.02
2.12	2.14±0.03	2.13±0.02
2.51	2.48±0.02	2.54±0.01

*each value represents the mean of five determinations ± standard deviation

Conclusions

The optima working conditions for the assay of *m*-aminobenzoic acid by potentiometric titration with 10^{-1} mol·L^{-1} cerium (IV) sulfate solution in 1 mol·L^{-1} sulfuric acid have been determined. From the titration plot the apparent redox standard potential of the *m*-aminobenzoic acid oxidized form/*m*-aminobenzoic acid reduced form, $\varepsilon^0_{ox/red}$ = 883±32 mV; the number of electrons exchanged during the redox reaction, n = 5; the apparent redox standard potential of the Ce^{4+} / Ce^{3+}, $\varepsilon^0_{Ce^{4+}/Ce^{3+}}$ = 1373±32 mV have been determined. The method shows good results when it was applied on synthetic samples. The results obtained prove that the method proposed can be used for quantitative determination of *m*-aminobenzoic acid when the optima working conditions are applied.

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