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DETERMINATION OF BISMUTH IN COPPER CONSENTRATE BY ATOMIC ABSORPTION SPECTROMETRY

Trajče Stafilov[1], Borka Ristova[2] and Milan Ristov[2]

ABSTRACT

A method for bismuth determination in copper concentrate by atomic absorption spectrometry is presented. Investigations of the matrix interferences showed that iron increasing the bismuth absorbance. For this reason, a mathematical relation for correction of the obtained value for bismuth in dependence of iron content, is proposed.

INTRODUCTION

It is very important to follow the presence of bismuth in copper concentrate because in the copper production, bismuth passes into a metal phase, and it contaminates the obtained copper. The bismuth determination in geological materials is performed by different methods, but atomic absorption spectrometry (AAS) is one of the most applied one. In addition, different technique of atomic absorption spectrometry (AAS) are used: flame (ENDO et al., 1969; TARASEVICH et al., 1975; CLARK and VIETS, 1981; GUSKINSKII et al., 1982), electrothermal (LANGMYHR et al., 1974; KANE, 1979; HEINRICHS, 1979; SCHROEN et al., 1983), and lately, hydride generation technique (DEKERSABIEC, 1980; TERASHIMA, 1984; CROCK, 1989; ZHANG, 1990).

In this work a method for direct bismuth determination in copper concentrate by flame AAS is presented.

[1]Institute of Chemistry, Faculty of Science, St. Cyril and Methodius University, POB 162, 91000 Skopje, Macedonia and [2]Mining and Metallurgy of Copper „Bučim", 92420 Radoviš, Macedonia.

EXPERIMENTAL

Instrumentation

A Perkin-Elmer M 5000 atomic absorption spectrophotometer was applied. A bismuth hollow cathode lamp was used as a source, while deuterium lamp was used as a background corrector. The instrumental parameter are given in Table 1.

TABLE 1. Instrumental parameters for bismuth determination by AAS

Wavelength	223.1
Slit	0.2 nm
Lamp current	10 mA
Gas mixture	Air-Acetylene

Procedure

5 g of copper concentrate were taken into a beaker of 400 cm^3 and 45 cm^3 concentrated HCl and 15 cm^3 concentrated HNO_3 were added. This solution was heated 30-40 minutes on a hot plate. Then, 25 cm^3 destiled water were added and the solution was heated for another 15 minutes. The solution was cooled and filterred off. The viltrate was collected in a volumetricf flask of 100 cm^3, and filled with destiled water; from this solution the determination of bismuth by AAS was performed.

RESULTS AND DISCUSSION

In the application of AAS it is necessary to cheque the possible interferences on the determination of the investigated element, especially when the sample is of a complex composition. To avoid this interferences in the bismuth determination by flame AAS in defferent geological samples a matrix modification (Endo et al., 1969) or extraction of bismuth (TARASEVICH et al., 1975; CLARK and VIETS, 1981; GUSKINSKII et al., 1982; LANGMYHR et al., 1974) were applied. It was necessary to see the eventual influence of the elements with higher concentration in copper concentrates (copper, iron, calcium and lead) and in the obtained sample solution, on the bismuth determination. For this purpose a series of solution with constant concentration of bismuth (10 mg. cm-3) and different concentration of the potential intereferent elements, were prepared. The investigations show that the presence of calcium and lead (from 0 to 250 mg. cm-3, corresponding to 0.1 to

0.5 % in the solid sample) and copper (up to 16 mg. cm-3, corresponding to the concentration of 32%) don't interfere on the absorption of bismuth.

However, the presence of iron in the solution (from 7-16 mg. cm^{-3}, corresponding to the iron concentration of 24-32%) increase the absorption of bismuth. It was found that there is a linear dependency on the increasing of the obtained bismuth concentration from the iron concentration, Fig. 1. Applying the linear regression analysis, the relation for the calculation of the correct value of the bismuth concentration was obtained from the found concentration of bismuth and the concentration of iron:

$$C_{Bi} = C_{Bi}\ (found) - 0.06212.\ C_{Fe} - 0.3126$$

were the corresponding concentrations are given in μg. cm^{-3} for C_{Bi}, and in mg. cm^{-3} for C_{Fe}.

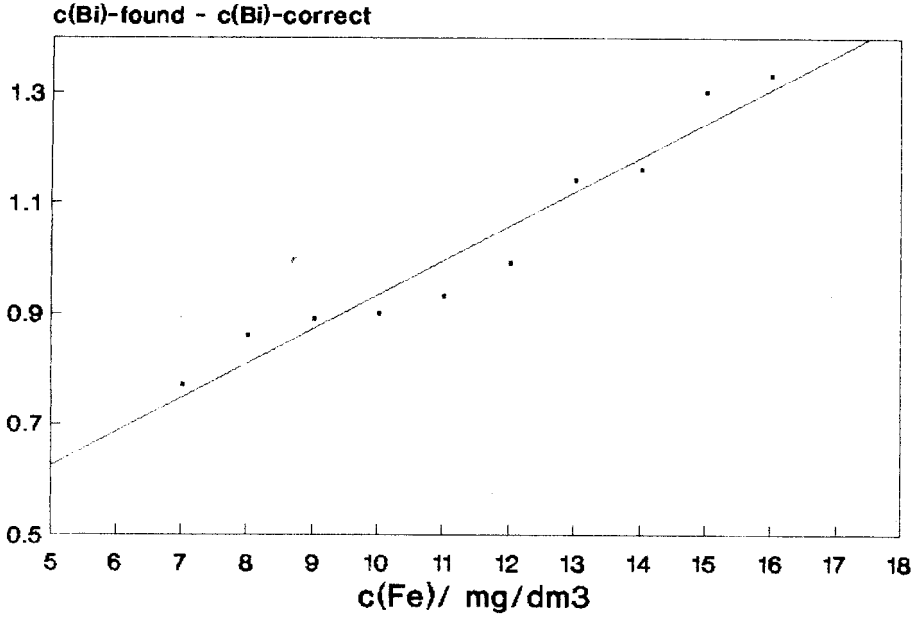

Fig. 1. The dependence of difference between C_{Bi} (found) and C_{Bi} (correct) from the iron concentration

To cheque this relation, three samples of copper concentrate were analyzed and the correct values of bismuth were calculated, and than these values were

compared with the values obtained by the spectrographic method, as shown in Table 2. One can notice that the corrected values of bismuth are similar to those obtained by spectrographic method.

TABLE 2. Results from the bismuth determination in copper concentrate samples by proposed method and by spectrographic method

Sample No	w_{Fe} (%)	Proposed method (%) w_{Bi} (found)	Spectrographic method (%) w_{Bi} (corrected)	
L-1	31.81	0.089	0.079	0.077
L-3	29.75	0.165	0.147	0.140
L-11	30.05	0.160	0.142	0.140

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РЕЗИМЕ

ОПРЕДЕЛУВАЊЕ НА БИЗМУТ ВО БАКАРЕН КОНЦЕНТРАТ СО ПОМОШ НА АТОМСКА АПСОРПЦИОНА СПЕКТРОМЕТРИЈА

Трајче Стафилов[1], Борка Руистова[2] и Милан Ристов[2]
Институт за хемија, Природно-математички факултет,

Во трудот е прикажана постапка за определување на бизумот во бакарни концентрати со помош на атомска апсорпциона спектрометрија. Испитувањата на влијанието на присутниот матрикс покажа дека железото влијае врз определувањето на бизмутот со тоа што ја зголемува вредноста на апсорбанцата. Предложена е математичка корекција на добиената вредност на концентрацијата на бизмут во зависност од концентрацијата на железо во добиениот раствор.

[2] Претпријатие за рударство и металургија на бакар „Бучим", Македонија

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