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Determination of Trace Elements in Iron Minerals by Atomic Absorption Spectrometry

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Abstract: A method for the determination of lead, cobalt, nickel, chromium, zinc and manganese in iron minerals siderite (FeCO_3), hematite (Fe_2O_3), pyrite and marcasite (FeS_2) by flame and Zeeman electrothermal atomic absorption spectrometry (ETAAS) was developed. Interferences were investigated by measuring the absorbance of the elements investigated in series of samples with varying mass ratios of the elements investigated and iron as the potential interfering element. It was found that there was no interference in the determined mass ratios of iron on the absorbance of Mn and Zn and that they could be directly analyzed by flame and electrothermal atomic absorption spectrometry. However, iron tends to decrease the absorbance of Co, Cr, and Pb and to increase the absorbance of Ni. Therefore, to avoid the interference of iron, a method for extraction of iron and determination of investigated elements in the inorganic phase was proposed. Iron was extracted by isoamyl acetate in hydrochloride acid solution. Optimization of the extraction procedure was performed. The procedure was verified by the method of standard additions and by its application to reference standard samples. The minerals investigated originate from different mines in the Republic of Macedonia. It was found that the detection limits of the method (calculated as 3 SDs of the blank) are $10 \text{ ng} \cdot \text{g}^{-1}$ for Ni and Cr and $30 \text{ ng} \cdot \text{g}^{-1}$ for Pb and Co, determined by Zeeman ETAAS, and $0.10 \mu \text{g} \cdot \text{g}^{-1}$ for Zn and $0.25 \mu \text{g} \cdot \text{g}^{-1}$ for Mn, determined by flame AAS.

Key Words: iron minerals, trace elements, lead, cobalt, nickel, chromium, zinc, manganese, determination, atomic absorption spectrometry

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