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Role of a Binary Metallic Modifier in the Determination of Cadmium in Graphite Furnace Atomic Absorption Spectrometry

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In order to discuss the matrix modifier effect of palladium, iron, and a mixture of palladium and iron for the determination of cadmium in graphite-furnace atomic absorption spectrometry (GF-AAS), we measured the absorption profiles of a cadmium line at various compositions of these elements. Variations in the gas temperature were also estimated with the progress of atomization, by using a two-line method under the assumption of a Boltzmann distribution. The atomic absorption of cadmium appeared on the way of heating from the charring temperature to the atomizing temperature while the gas temperature was still low; it was thus considered that cadmium was atomized through direct conductive heating from the wall of the graphite furnace. Therefore, the effectiveness of modifiers for cadmium would be determined through any reactions on the furnace wall at the programmed charring and atomizing temperatures. The addition of iron, palladium, and an iron-palladium mixture all enhanced the absorption signal of cadmium compared to a pure cadmium sample; however, their effects were different from one another. Each addition of iron or palladium to the sample solution led to an enhancement of the cadmium absorbance, indicating that iron or palladium individually became an effective matrix modifier for the determination of cadmium. However, the addition of palladium was ineffective for the matrix modification in the coexistence of large amounts of iron. Although these phenomena are very complicated, and thus cannot be understood completely, any metallurgical reaction between the constituent elements during heating of the furnace wall, such as the formation of solid solutions and intermetallic compounds, would cause the effect of a matrix modifier in GF-

AAS.

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