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Sorption-luminescence method for determination of terbium using Transcarpathian clinoptilolite

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Abstract

Sorption-luminescent method for terbium determination based on natural Transcarpathian clinoptilolite without using of complex synthetic organic compounds and toxic solvents was proposed. Optimal luminophore preparation conditions are sorption of Tb(III) on zeolite in the borate buffer solution with pH 8.25 and further calcination of clinoptilolite-Tb(III) samples at 500 °C. For luminescence excitation the rays with wavelength of $\lambda = 220$ nm of were used. Luminescence intensity at $\lambda = 545$ nm was selected as analytical parameter for a quantitative terbium determination. Definable range of Tb(III) concentration with the detection limit of $1 \text{ ng}\cdot\text{mL}^{-1}$ is within of 3–1140 $\text{ng}\cdot\text{mL}^{-1}$. The proposed method can be used for the terbium determination in the presence of many rare earths. Sorption-luminescent method can be applied for determination of trace terbium ions in synthetic water solutions and in intermetallics. The proposed analytical method gave recoveries from 90 to 108 % and R.S.D. from 0.78 to 6.2 % determination of terbium.

Keywords

Sorption-luminescence determination, Terbium, Clinoptilolite.

1. Introduction

Due to similar chemical properties the lanthanide ions are heavily distinguishable in solutions, which make problematic their quantitative determination by chemical and physical-chemical analysis techniques. However, the lanthanides differ significantly in their optical properties, in particular they have different ability to absorption and emission of energy. The light emission occurs during the transition of electrons from certain energy levels, typical for each lanthanide ions, on different sublevels of the ground level. Therefore the lanthanides have different ability to luminescence (LM) and their specific spectra allow to develop selective LM methods for determination some of them.

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