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Sorption-luminescence method for determination of europium using acid-modified Transcarpathian clinoptilolite

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Lanthanides reveal almost identical chemical properties. However, lanthanides essentially differ in their optical properties, in particular, the ability for absorption and emission of excitation energy. This luminescence (LM) is specific for each lanthanide. This fact is the basis for selective luminescent methods of lanthanides determination.

Sorption of determined elements on the solid matrix is one of the efficient methods to increase the sensitivity and selectivity of LM determination. In this case the intermolecular energy transfer is suppressed, which provides the increase of LM intensity; the selective concentration effect is also gained. Promising materials for solid phase spectrofluorometry are natural zeolites activated by REE ions. These inorganic nanomaterials have ability to include lanthanides ions in the grid using exchanged reactions. These ions retain their ability to react with organic ligands. The sorbates that have been created on the zeolite surface have the ability to absorb UV-radiation and intensive LM. The possibility for LM determination of Eu using acid-modified Transcarpathian clinoptilolite as a sorbent was studied. The Eu(III) – H – clinoptilolite samples were obtained via lanthanide ions sorption from aqueous solutions at pH 9,5 on the previously pre-calcined acid-modified zeolite at 400 ºC in a solid phase extraction mode. The Eu(III) – H – clinoptilolite samples were dried at 50 ºC treated by the mixture of atophan and phenanthroline solutions at pH 7 in a static mode. Obtained samples of the H – clinoptilolite – Eu(III) – phenanthroline – atophan luminophore were dried at room temperature. For the excitation of LM samples rays with the wavelength of 276 nm were used. The intensity of the LM at 615 nm was chosen as an analytical parameter for the quantitative determination of Eu. It was found that there is a linear dependence of the LM intensity on the Eu content and therefore on the concentration of Eu(III) in investigated samples. The linear range of determined concentrations of Eu(III) using the proposed sorption-luminescence method remains within 10–900 ng/mL. The limit of detection of Eu(III) is equal to 3 ng/mL.