

Application of Laser Spectroscopy for Detection of Actinides and Lanthanides in Solutions

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Abstract : This work is devoted to applications of the Time-resolved laser-induced luminescence (TRLIF) spectroscopy and time-resolved laser-induced chemiluminescence spectroscopy for detection of lanthanides and actinides. Results of the experiments on Eu, Sm, U, and Pu detection in solutions are presented. The limit of uranyl detection (LOD) in urine in our TRLIF experiments was up to 5 pg/ml. In blood plasma LOD was 0.1 ng/ml and after mineralization was up to 8pg/ml – 10pg/ml. In pure solution, the limit of detection of europium was 0.005ng/ml and samarium, 0.07ng/ml. After addition urine, the limit of detection of europium was 0.015 ng/ml and samarium, 0.2 ng/ml. Pu, Np, and some U compounds do not produce direct luminescence in solutions, but when excited by laser radiation, they can induce chemiluminescence of some chemiluminogen (luminol in our experiments). It is shown that multi-photon scheme of chemiluminescence excitation makes chemiluminescence not only a highly sensitive but also a highly selective tool for the detection of lanthanides/actinides in solutions.

Keywords : actinides/lanthanides detection, laser spectroscopy with time resolution, luminescence/chemiluminescence, solutions

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