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Time-resolved laser-induced fluorescence for lanthanides and actinides analysis

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Time-Resolved Laser-Induced Fluorescence (TRLIF) is a very powerful technique for actinides (U, Cm) and lanthanides (Eu, Dy, Tb, Sm) analysis. The principle of this technique is based on pulsed laser excitation followed by temporal resolution of the fluorescence signal. Advantages of this technique aside sensitivity are its rapidity and its triple selectivity (*i.e.* $\lambda_{\text{excitation}}$, $\lambda_{\text{emission}}$ and lifetime).

The experimental set-up consists in a tripled Nd-YAG laser or a nitrogen laser. The laser beam is focused into the cell of the spectrofluorometer by a quartz lens. The radiation coming from the cell is focused on the entrance slit of the monochromator. The detection is performed by an intensified photodiodes array positioned at the monochromator exit. Recording of spectra is performed by integration of the pulsed light signal given by the intensifier. Time-resolution is obtained by the control unit that assures pulsed running of the intensifier and the photodiodes array.

This technique has been largely used for ultratrace analysis in various fields (nuclear, environmental and medical) since limits of detection for uranium, curium, and europium are lower than 1 ng/l. New developments are towards on-line analysis with fiber optics and complexation constants determination at low level. Hence, in the framework of the effects of humic substances on the migration of radionuclides in the geosphere, TRLIF is used as a fluorescence titration method for the determination of complexing capacities and interaction constants at low level between humic substances and actinides. Results obtained in these fields (ultratrace, on-line, complexation) will be presented.