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A TRLFS study of europium speciation with glycolic acid

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Europium is often used as a model of the fission products from the lanthanides and minor actinides group. Glycolic acid is used in modern decontamination solutions and has been also proposed as a complexing agent in the reprocessing of spent nuclear fuel.
The aim of this study was to carry out a more detailed study of europium complexation with glycolic acid using Time-Resolved Laser-Induced Fluorescence Spectroscopy (TRLFS), including determination of the stability constants of europium complexes with glycolic acid, and to compare the results with published data ¹. Furthermore, this work should also clarify the impact of sample preparation in air and under N₂ atmosphere, i.e. the role of hydroxo- and carbonato- complexes at pH > 7.
Because Eu complexes with glycolic acid show good fluorescent properties, the TRLFS method was chosen for their study. The studied parameters included the influence of the concentration of CO₃²⁻ on the formation of europium carbonato- complexes, effect of pH on the formation of hydroxo- complexes of europium (solutions prepared under N₂ atmosphere), and europium complexation in solutions with glycolic acid (comparison of the samples prepared on air and under N₂ atmosphere). The fluorescence spectra of individual samples and the time of fluorescence of prepared complexes were recorded. The results obtained were compared with those published by Stumpf et al. ¹. Based on the comparison of the results obtained for samples prepared on air and under N₂ atmosphere, it can be concluded that the transfer of atmospheric CO₂ is negligible even at relatively high pH value and that the influence of carbonate complexes in europium-glycolic acid systems is negligible. The TRLFS method was further supplemented with the extraction method, which can be also used for determining the stability constants of complexes of europium with glycolic acid. In the following step, stability constants of prepared complexes will be obtained from measured data using factor analysis.

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Reference:
1. Stumpf T., Franghänel T., Grenthe I.: J. Chem. Soc., Dalton Trans. 2002, 3799.

Primary author: Mr KRMELA, Jan (KJCH FJFI CVUT)

Presenter: Mr KRMELA, Jan (KJCH FJFI CVUT)

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