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Time–resolved Laser Fluorescence Spectroscopy of Organic Ligands by Europium : Fluorescence Quenching and Lifetime Properties

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Abstract

Time–resolved Laser Fluorescence Spectroscopy (TRLFS) has proved its usefulness in the fields of biophysics, life science and geochemistry to characterize the fluorescence probe molecule with its chemical environment. The purpose of this study is to demonstrate the applicability of this powerful technique combined with Steady-State (S-S) measurements. A multi–mode factor analysis, in particular CP/PARAFAC, was used to analyze the interaction between Europium (Eu) and Humic substances (HSs) extracted from Saint Lawrence Estuary in Canada. The Saint Lawrence system is a semi–enclosed water stream with connections to the Atlantic Ocean and is an excellent natural laboratory. CP/PARAFAC applied to fluorescence S-S data allows introspecting ligands–metal interactions and the one–site 1:1 modeling gives information about the stability constants. From the spectral signatures and decay lifetimes data given by TRLFS, one can deduce the fluorescence quenching which modifies the fluorescence and discuss its mechanisms. Results indicated a relatively strong binding ability between europium and humic substances samples (Log K value varies from 3.38 to 5.08 at pH 7.00). Using the Stern-Volmer plot, it has been concluded that static and dynamic quenching takes places in the case of salicylic acid and europium interaction while for HSs interaction only a static quenching

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