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Frequency-domain fluorescence lifetime measurements via frequency segmentation and recombination as applied to pyrene with dissolved humic materials

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Abstract
In this study, the association behavior of pyrene with different dissolved humic materials (DHM) was investigated utilizing the recently developed segmented frequency-domain fluorescence lifetime method. The humic materials involved in this study consisted of three commercially available International Humic Substances Society standards (Suwannee River fulvic acid reference, SRFAR, Leonardite humic acid standard, LHAS, and Florida peat humic acid standard, FPHAS), the peat derived Amherst humic acid (AHA), and a chemically bleached Amherst humic acid (BAHA). It was found that the three commercial humic materials displayed three lifetime components, while both Amherst samples displayed only two lifetime components. In addition, it was found that the chemical bleaching procedure preferentially removed red wavelength emitting fluorophores from AHA. In regards to pyrene association with the DHM, different behavior was found for all commercially available humics, while AHA and BAHA, which displayed strikingly similar behavior in terms of fluorescence lifetimes. It was also found that there was an enhancement of pyrene's measured lifetime (combined with a decrease in pyrene emission) in the presence of FPHAS. The implications of this long lifetime are discussed in terms of (1) quenching mechanism and (2) use of the fluorescence quenching method used to determine the binding of compounds to DHM. © 2008 Springer Science+Business Media, LLC.

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