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Supplementary data

**Interactions of dissolved humic substances with oppositely charged fluorescent dyes for tracer techniques**

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Fig. S1 Fluorescence intensities with increasing concentrations of rhodamine 6G and fluorescein. Fluorescence intensities of fluorescein and rhodamine 6G were monitored at 512 nm and 551 nm, respectively. The excitation wavelengths of fluorescein and rhodamine 6G were 480 nm and 520 nm, respectively.



Fig. S2 Stern-Volmer plots for rhodamine 6G (0.5 µM) with increasing DOC concentrations of humic acid. Fluorescence intensity of rhodamine 6G was plotted at 551 nm, respectively.

If dynamic and static quenching is observed simultaneously, F0/F is expressed as (Valeur, 2012):

where KSV and KS are the Stern-Volmer constant and the stability constant of the dye-DHS complex, respectively. Equation S1 can be rearranged as:

Plotting ((F0/F–1)/[DOC]) against the DHS concentration ([DOC]) revealed a linear relationship between these values with an intercept of (KSV + KS) and a slope that represents the value of (KSVKS).



Fig. S3 Plots of equation S2 using the fluorescent intensities of rhodamine 6G in the presence of humic acid. The concentration of rhodamine 6G was 1.0 μM (0.48 mg/L). Fluorescence intensities were monitored at 551 nm. The excitation wavelength was 520 nm.

References

Valeur, B., Berberan-Santos. M.N., 2012. Molecular fluorescence: principles and applications, second ed. p272, Wiley-VCH, Weinheim.