

## Electronic Supporting Information

### Surface Adsorption of Nordic Aquatic Fulvic Acid on Amine-Functionalized and Non-Functionalized Mesoporous Silica Nanoparticles

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*Adsorption of aromatic organic acids on MSN.* Adsorption of three small aromatic organic acids, benzoic, phthalic and salicylic, were also studied to facilitate the interpretation of the adsorbed NAFA spectra. These mono and poly protic aromatic acids can be considered as smaller sub units, which contains single and multiple carboxylic groups, of the NAFA structure that play key roles in the NAFA adsorption. A titration and modelling study by Vaz et al showed that the speciation of fulvic acid in the environment is mainly controlled by the structural components analogous to the above mentioned acid molecules.<sup>1</sup> Because of this analogy we investigate the adsorption of benzoic acid, phthalic acid and salicylic acid at pH 3.0 on MSN@APTES. Figure SI1.a shows the spectra of 0.410 mM benzoic acid, phthalic acid and salicylic acid, adsorbed on the MSN@APTES and surface at pH 3.0 along with the corresponding solution phase spectra obtained at a higher concentration (8.20 mM) (Figure SI1.b). A Higher concentration was used for the solution phase to obtain spectra with clearly resolved peaks. Narrower peaks appear in the adsorbed spectra of these molecules compared to the adsorbed NAFA and their simple structure make the peak interpretation less complicated. By comparing the adsorbed phase spectra with the solution phase spectra of these acids at pH 3.0, peaks present in the range of 1385–1402 cm<sup>-1</sup> were assigned to the symmetric stretch of COO<sup>-</sup> groups. Peaks found in the range of 1443–1489 cm<sup>-1</sup> and 1594–

1603  $\text{cm}^{-1}$  were assigned to the ring stretch vibrations of aromatic groups. Peaks present in the range of 1542–1581  $\text{cm}^{-1}$  were assigned to the asymmetric stretch of  $\text{COO}^-$  groups. According to the spectra, small acid molecules also undergo surface induced deprotonation at  $\text{MSN@APTES}$  surface; however, they do not exhibit multilayer adsorption at pH 3.0 in contrast to NAFA. At pH 3.0 none of the acids studied showed a significant adsorption on MSN surface.

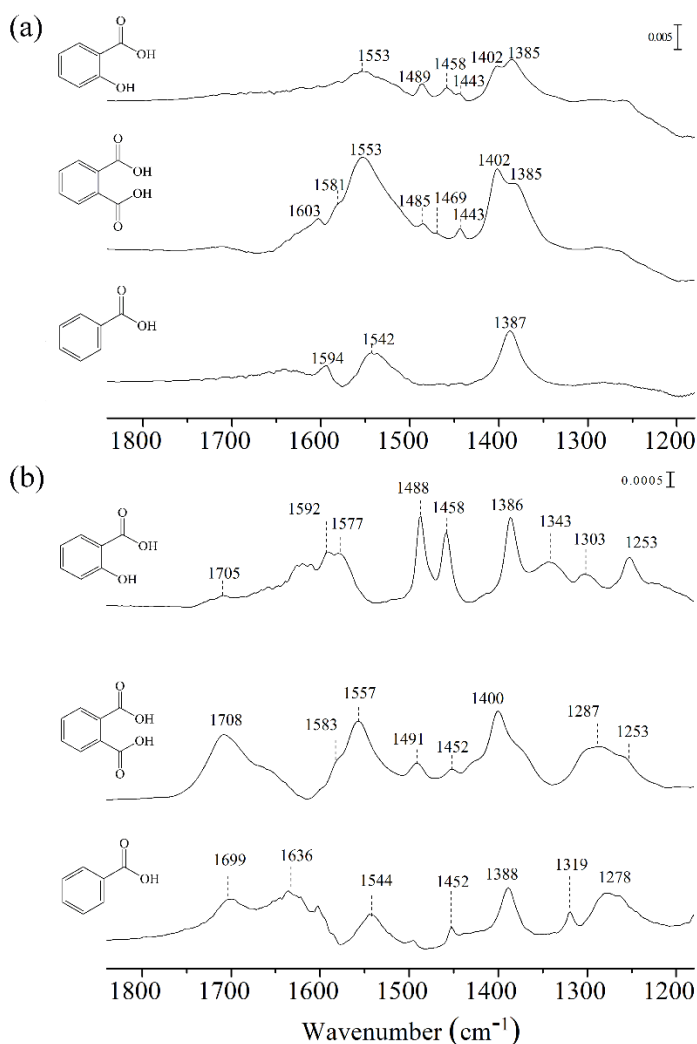


Figure S11: a. ATR-FTIR spectra showing 0.410 M benzoic (bottom), phthalic (middle) and salicylic (top) acid adsorbed on  $\text{NH}_2\text{@MSNs}$ . Solution phase spectra are subtracted from the relevant adsorbed spectra to remove the effect of solution phase on the adsorbed spectra. b. solution phase spectra of 8.20 mM benzoic, (bottom) phthalic (middle) and salicylic (top) acid.

## References

1. Vaz, D. d. O.; Fernandes, A. N.; Szpoganicz, B.; Sierra, M. M. D., Potentiometric quantification and speciation of oxygenated groups in humic substances using BEST7 software. *Eclética Química* **2010**, 35 (4), 147-152.