

## Supplementary information

### Direct analysis of naphthenic acids in produced water and crude oil by NH<sub>2</sub>-surface-modified wooden-tip electrospray ionization mass spectrometry

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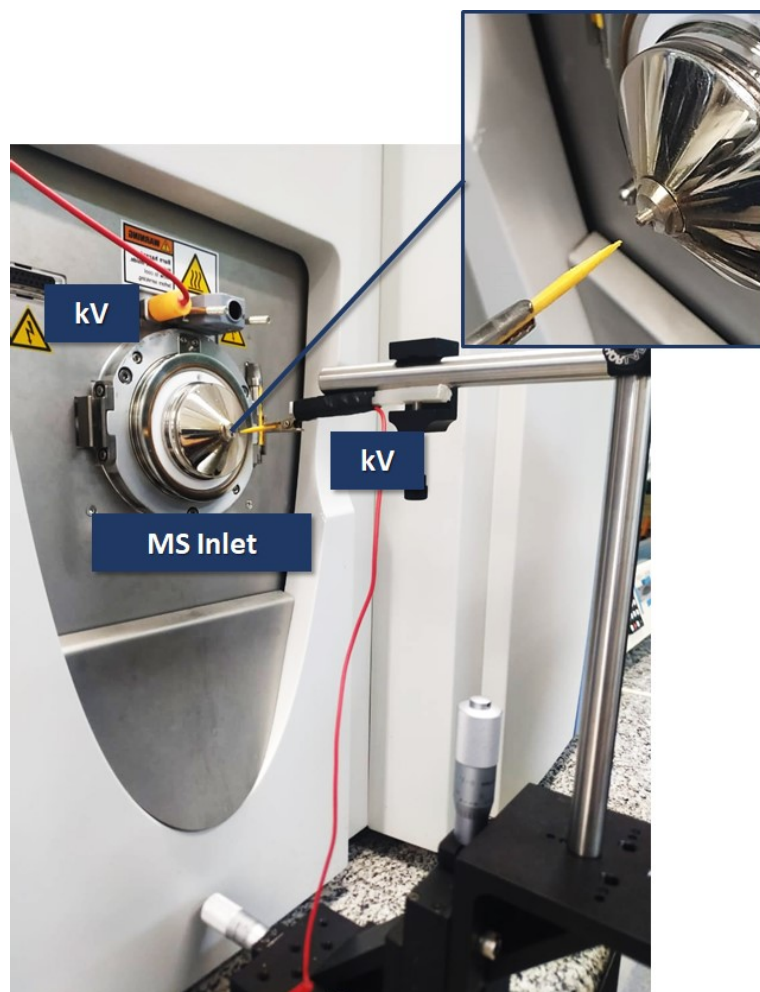
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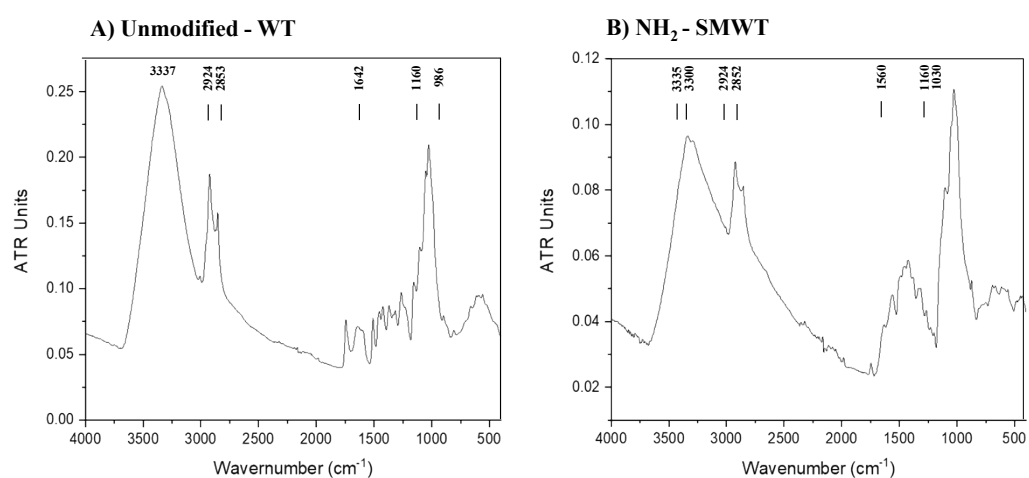
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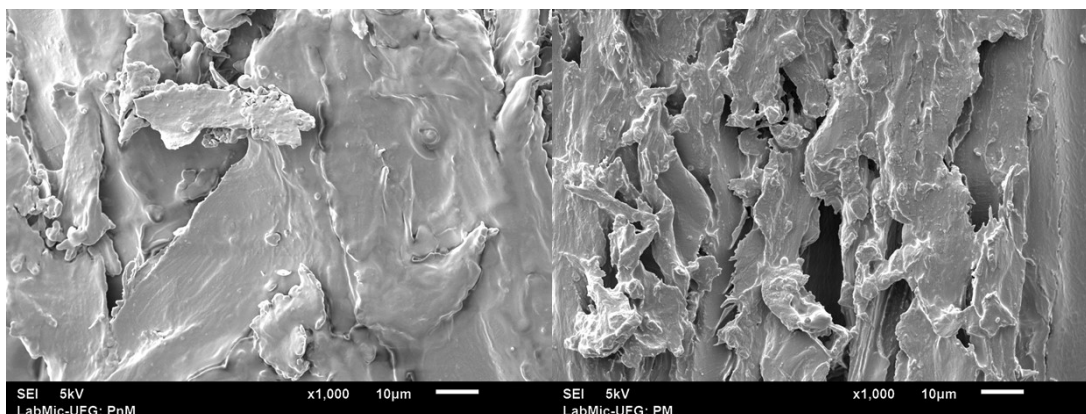
**Fig. S1.** WT-ESI system: a metal clip holds the modified wooden toothpick and applies a high voltage to it, causing droplets from the sample to be electro sprayed from the tip of the toothpick into a mass spectrometer.



**Fig. S2.** FT-IR spectra of A) unmodified and B) modified wooden toothpick.

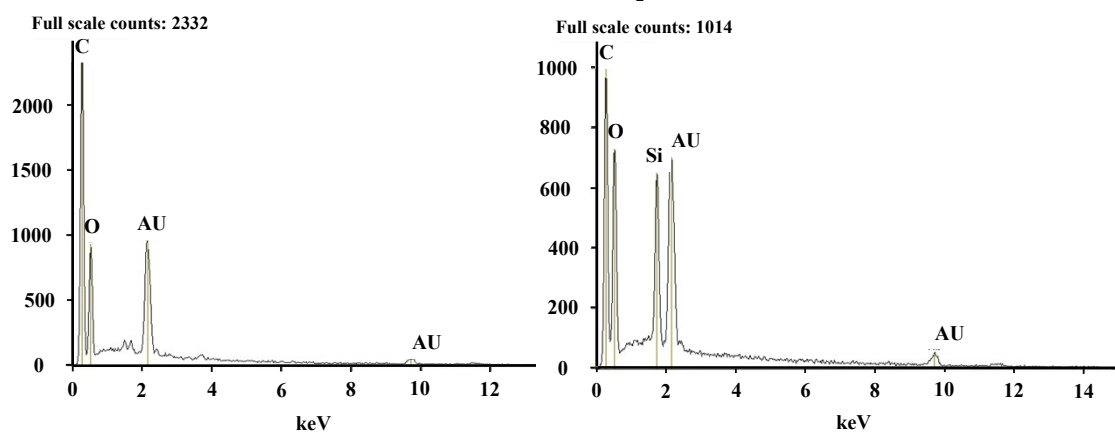
A) Unmodified WT

B) NH<sub>2</sub>-WT

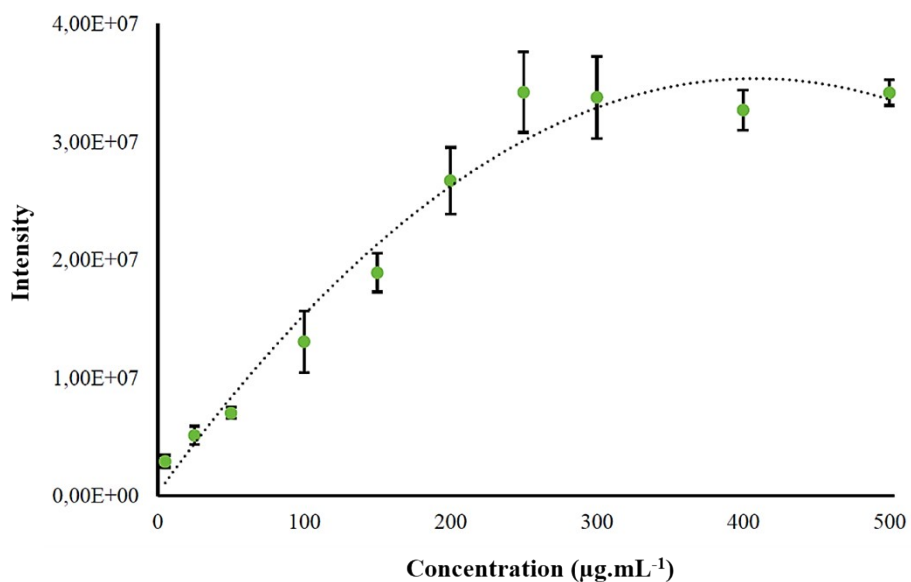


B) Unmodified WT

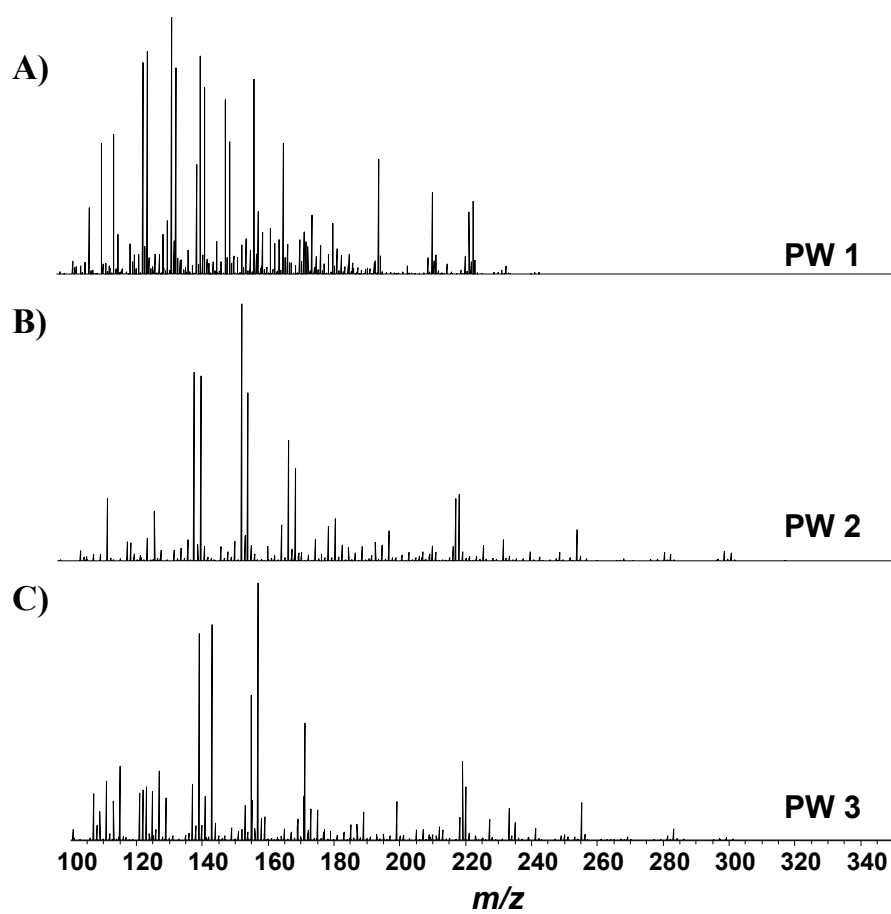
D) NH<sub>2</sub>-WT



**Fig. S3.** SEM-EDS analyses of uncoated and coated wooden toothpicks: SEM images of A) unmodified and B) modified substrates; EDS spectra of C) unmodified and D) modified substrates.



**Fig. S4.** NH<sub>2</sub>-SMWT-ESI analysis of decanoic acid in seawater at concentrations ranging from 5 to 500 µg.mL<sup>-1</sup>. Error bars show the standard deviation of triplicate measurements.



**Fig. S5.** Negative ion mode mass spectra obtained from the  $\text{NH}_2$ -SMWT-ESI analysis of produced water (PW) samples.