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Determination of levels of production chemicals in water phase using capillary electrophoresis

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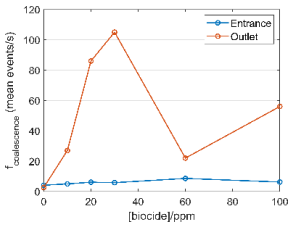
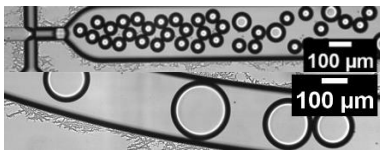
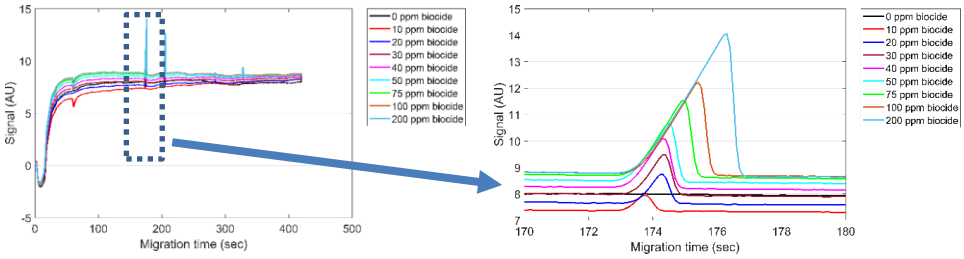
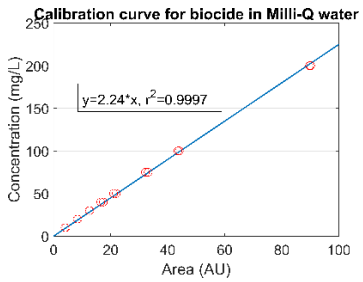
Oil production is accompanied with produced water at a rough volumetric ratio of 1:3 on average globally. In the recent decades, great attention has been devoted to filter hydrocarbon species in produced water stemming from traces of production chemicals such as corrosion/scale inhibitors, biocides, demulsifiers and H_2S scavengers. The produced water is ultimately discharged to surface waters and it poses a serious environmental risk if a certain level of hydrocarbon species is discharged in conjunction.
The production chemicals are usually blends of many individual constituents and each of them and their combinations can partition in either the water phase or oil phase depending on their preference.
In this study, we use capillary electrophoresis (CE) to quantify concentrations of production chemicals in the water phase as a measure to evaluate the environmental factor.
The results show that a commercial biocide can be detected down to 10 ppm in Milli-Q water and detectable in diluted synthetic sea water as well. The partitioning tendency of the biocide was assessed by quantification of the chemical in the water phase after reaching equilibrium with interfaces of water/heptane and water/crude oil.
The results were acquired with only 0.5 mL of solution with no pre-treatment in the course of 5 min per sample. The technology is fast, very low-cost, user-friendly and detection limit down to ppm-regime. Moreover, it enables on-site measurements of production chemicals in the oil & gas industry. The CE data is assisted with microfluidic data to evaluate oil droplet coalescence rate which helps to determine how hard it is to filter oil droplets in water.









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