UNIVERSITY of HOUSTON

CULLEN COLLEGE of ENGINEERING

Department of Civil & Environmental Engineering

CIVE 6111 Graduate Seminar

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Confocal laser scanning microscope as an oil quantification technique

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CBB 120

Abstract: My research proposes the confocal laser scanning microscopy (CLSM) as an enabling technology for oil quantification in industrial produced water. CLSM takes advantage of the self-fluorescence properties of oil to visualize in 3D and quantify in real-time oil droplets present in water. The successful quantification of oil in water and produced water was validated by investigating known amounts of oil content in synthetic produced water. In this initial investigation different concentrations and types of oil were used and an optimum image threshold of 0.5 was identified for the accurate quantification of oil concentration in water. The results obtained with the CLSM were comparable to the EPA 1664 method, which is the current method used for oil and grease quantification in produced water. Following the initial optimization of the confocal parameters, the effects of different environmental parameters, i.e. salinity, pH, temperature, and particles, were investigated to determine their impact in the precision and accuracy of CLSM quantification of oil droplets. The different conditions investigated aimed to simulate real produced water, which typically contains a mixture of oil, salts, and different concentrations of particles. The results showed that under extreme environmental conditions, like low pH, high salinity and high temperature, larger standard deviations in the final results were observed, which indicated that these conditions affected the precision of CLSM measurements. The accuracy of the quantification, on the other hand, for all the conditions investigated were consistent with the amount of oil present in the water. These results demonstrated that increasing sampling will be necessary to obtain the desired accuracy in the results. To validate the CLSM as a potential method to quantify oil droplets in produced water, quantification experiments with real produced water samples from different treatment steps were investigated and compared with the standardized EPA1664 method. The results for both methods correlated well, which suggested that CLSM can be used as an alternative method to the EPA method for the measurement of oil in real produced water. This technique has several advantages over the EPA 1664 method since it is less labor intensive, does not require hazardous solvents for oil extraction and the results can be obtained in real time.

About the speaker:

Jingjing Fan obtained her Master's degree in Environmental Engineering at the University of Houston under the supervision of Dr. Debora F. Rodrigues in 2013. In her M.S., she investigated bioremediation of heavy metals in the environment using biotechnology, which yielded a publication in the Journal of Hazardous Materials. She is currently a Ph.D. student under Dr. Debora Rodrigues' supervision. In her Ph.D., she is involved in different projects, such as toxicity of photocatalytic nanomaterials, biodegradation of nanocomposites, and innovative technology for oil and grease quantification. In her Ph.D., she has authored two peer reviewed articles and co-authored a book chapter. During her research, she won a travel award to attend the Sustainable Nanotechnology Conference (SNO) and was also the recipient of the best elevator research pitch at the SNO conference.