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Title: Dissolved Hydrocarbon Stability in Produced Water
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Produced water (PW) is a wastewater stream generated by oil and gas production. It is estimated that approximately three barrels of PW are generated for every single barrel of crude oil produced (Gomes et al. 2009). Globally, this amounts to an estimated daily volume of 250 million barrels (Ahmadun et al. 2009). PW is a complex substance that is comprised of (amongst other things) production chemicals, dissolved minerals, and dissolved and dispersed oil compounds (Ahmadun et al. 2009). This project is primarily focused on the removal of dissolved organics in PW, as they are less likely to be removed by conventional oil-water separation techniques than dispersed oil. Dissolved oil thus tends to be present in higher concentrations in discharged PW (Veil et al. 2004). In Atlantic Canada, the 24-hour average oil concentration in discharged PW should not exceed 44 mg/L (NEB et al. 2010).

The objective of this research, which is a subsection of a larger thesis, is to evaluate the likelihood of dissolved organics coagulating in PW. Chemical coagulation, with salts such as ferric chloride or alum, is a common method for removing substances from water. However, little research has been done regarding coagulation in a complex solution like PW.

The first experimental task was to characterize PW. A PW sample from a platform producing natural gas off of the Atlantic coast was obtained and analyzed. The results from this analysis were compared against results found in literature. From this information, a synthetic PW formula was created consisting of sodium chloride, calcium chloride (sodium and calcium being predominant metals), and three partially water soluble hydrocarbons: naphthalene, acenaphthene, and 4-nonylphenol.

The second task, which is currently in progress, is to determine the “binding” or zeta potentials of the components of PW—separately, together, and with coagulant—under various conductivity and pH conditions. Zeta potential is an indicator of a particle’s stability in water; specifically, it is the electrostatic potential between the shear plane and the bulk solution of a particle in water (MWH, 2005, p657). Zeta potential will be determined using the Malvern Zetasizer Nano-ZS (Malvern Instruments, Worcestershire, UK).

By researching how the components of PW affect zeta potential, this project aims to understand the mechanisms behind the removal of dissolved hydrocarbons from PW, and potentially to help PW be treated in a more effective manner.