

Freeze Concentration: Potential Application in the Oil and Gas Industry

Mazura Jusoh^{1*}, Nurul Aini Amran² and Zaki Yamani Zakaria³

¹Centre of Lipids Engineering and Applied Research (CLEAR)/School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia

²Centre for Bio-fuel and Biochemical Research/Chemical Engineering Department, Universiti Teknologi PETRONAS, Malaysia

³School of Chemical and Energy Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, Malaysia

Freeze concentration (FC) is a process that crystallizes the water component in a solution into ice crystal which in turn produces a highly concentrated solution and pure water. This process is gaining acceptance in solution concentration process as it could offer an easy low-temperature separation with a comparable efficiency and relatively low energy. This paper reviews the freeze concentration process itself followed by its potential to be applied in the oil and gas related industry. The first application is in the handling of produced water or brine from the oil and gas exploration. The main aim is to reduce the volume of the produced water where FC is deemed to be appropriate for the task. Research shows that water can be removed from this wastewater efficiently through FC. The performance of the process has been assessed through the final concentration of the concentrated wastewater and the purity of the melted ice crystals. The research demonstrated that FC is a practical volume reduction method with high separation efficiency. In another application, FC has been introduced to separate water from ethanol-water mixture. The performance of the process was evaluated at different readings of stirring rate and coolant temperature. The highest ethanol concentration of 52.2% and 56.5% were obtained at the highest stirring rate (500 rpm) and the lowest coolant temperature (-14°C), respectively. FC has also been applied in biodiesel winterization to reduce the saturated fatty acid (SFA) content to enhance the fuel cold flow properties. The results show that the highest reduction in cloud point (2.65%), pour point (14.29%) and SFA (3.96%) were obtained at conditions of 6°C, 20 minutes and 50 rpm with 65.46% biodiesel recovery.

Biography:

Associate Professor Dr. Mazura Jusoh is an academic staff at Universiti Teknologi Malaysia, Johor, Malaysia. She graduated with Bachelor of Chemical Engineering from University of Bradford England and Universiti Teknologi Malaysia for her Master and PhD. She has vast experience in chemical engineering separation technologies including distillation, extraction, adsorption and absorption. Her specialized research interest is in freeze concentration, where she is the pioneer of this research field in Malaysia. Her freeze concentration research has covered applications in various industries including food, pharmaceutical and waste water treatment. Her aspiration is to give exposure on this research field to Malaysians specifically and further establish her research expertise globally.