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EFFECT OF MAGNETIC GRAPHENE OXIDE ON THE DEMULSIFICATION PROCESS OF HEAVY OIL EMULSION

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ABSTRACT

Crude oil emulsions cause several difficulties to Oil and Gas industry whether in production phase and processing phase. Due to the problems arises, the researchers had started to investigate the effective method to treat and separate the emulsions for many years. Interfacial film form around the liquid droplets at oil/water interface prevent the emulsions to coalesce and aggregate. Surfactant is one of the component that stabilized the interfacial film surrounding the dispersed phase droplets. The most efficient demulsification method is chemical demulsification process which able to obtain the desired separation efficiency while abide with the environmental regulations and imposing the least economic burden on the petroleum industry. A magnetic graphene oxide (MGO) was produced from graphene oxide (GO) by one-step co-precipitation method. The properties of the MGO were characterized by XRD analysis and supported by FTIR analysis. Different concentrations of MGO used to demulsify the heavy oil emulsions of different water cut (80:20, 70:30, 60:40, 50:50, and 40:60 v/v%) were studied. The magnetic graphene oxide (MGO) was successfully synthesized and used for separating diluted heavy oil emulsions. Demulsification tests which is bottle test indicated that MGO can separate the emulsions within a few minutes. UV-Visible spectrophotometer was used to analyze the residual oil content in the separated water. The residual oil concentration was as low as 20 mg/mL equivalent to a demulsification efficiency of 99.99% which at an optimal dosage of MGO demulsifier. The changes in the interfacial tension of the emulsions during demulsification process were also analyzed. The interfacial tension decreased when the concentration of MGO demulsifier increased.

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CHAPTER ONE
INTRODUCTION

1.1 Research Background

In oilfield industry, emulsification of crude oil with brine always occur during production phase. Extraction of crude oil commingled with water cause the emulsions to form. The emulsions that are always encountered are Oil-in-Water (O/W) emulsions and Water-in-Oil (W/O) emulsions. Wen et al. (2010) stated that these emulsions can be classified based on the disperse phase and continuous phase. It is essential to separate these two immiscible materials before processing the produced crude oil. Failure to separate these emulsions could results in problems such as damage in surface separation equipment and pipeline corrosions (Salam, Alade, Arinkoola, & Opawale, 2013). Due to these problems, chemical demulsifier additives are mostly used in treating the emulsions.

Emulsion is a dispersion of one liquid throughout another immiscible liquid in a form of small droplets which then stabilized by emulsifying agent. Natural emulsifier such as surface-active agents or surfactants consists of hydrophilic and hydrophobic parts that each only attracted to water and oil, respectively. This molecular structure cause the surfactants to form interfacial films at the oil/water interface of the emulsions. The interfacial rheological properties, solubility, and adsorption–desorption kinetics of the surfactants determine the stability of the interfacial films (Alsabagh et al., 2016).

Interfacial films acts as a barrier against coalescence and flocculation of the droplets. Chemical demulsifier reduced the kinetic stability of the interfacial films during demulsification process. Chemical demulsifier reduce the stability of the emulsion films by changing the interfacial rheological properties of the emulsion. One of the emulsifying material in the crude oil is asphaltene. Interfacial layer with a great mechanical strength formed by asphaltene which have a sufficient number of functional groups. Demulsification process occurs when the demulsifying materials break the interfacial layer of the asphaltene.

Nowadays, graphene-based material have been discovered as a potential adsorbents. One of it is Graphene Oxide (GO) which rich with surface-active agents,