UNIVERSITI TEKNOLOGI MARA

SP FLOODING EOR:
SLUG RATIO AFFECTED OIL RECOVERY

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B. Eng. (Hons) Oil & Gas

January 2019

ABSTRACT

Surfactant-Polymer (SP) Flooding is one of the chemical enhanced oil recovery (EOR) that catch the researcher and oil and gas industry's interest nowadays to reduce the amount of residual oil saturation in the pore space of the rock matrix. Literally, the oil recovered by the primary and secondary recovery was only about one-third of the OOIP, by applying SP Flooding as the tertiary recovery the other two-third of the remaining oil in the reservoir can be extracted. Surfactant will be injected to mobilize the oil by altering the reservoir's wettability from oil-wet to water-wet. Polymer on the other hand will increase the viscosity of formation water and increase the sweep efficiency during the oil recovery process. The aim of this study is to determine the effectiveness of industrial wastewater treatment surfactant, SULFOCAT BK80 as the potential materials for SP Flooding alongside with Xanthan Gum (XG) as polymer and injecting the optimum SP formulations with a different slug ratio. Selection of optimum BK80 and XG concentration is one of crucial stages that will be carry out in this study. Several experiments involving 16 SP formulations with constant salinity was carry out to determine the density, contact angle, viscosity and shear rate of the materials for the screening process purpose. Through the screening process, it was found that at a 3000 ppm BK80 and 400 ppm XG was the optimal surfactant and polymer solution for the SP Flooding process. The optimum SP solution was then injected in the sandpack after waterflooding with a slug ratio of 0.3PV BK80 + 0.3PV XG, 0.3PV BK80 + 0.4PV XG and 0.1PV BK80 + 0.6PV XG in Run 1, Run 2 and Run 3 respectively. The incremental of oil recovery for Run 1, 2 and 3 are 1.82% , 2.54 % and 2,84% respectively. It was found that with the same total volume of BK80, injecting a larger volume of polymer produced more oil by comparing between Run 1 and Run 2. The highest oil recovery of 63.47% was obtained when a ratio of 0.1PV of BK80 and 0.6PV XG was used and this somehow proved that polymer played a dominant role in SP Flooding compare to surfactant.

ACKOWLEDGEMENT

Firstly, I wish to thank God for giving me the opportunity to embark on my BEng and for completing this long and challenging journey successfully. My gratitude and thanks go to my supervisor Miss Suriatie Binti Mat Yusuf for all the guidance during this study being held.

My appreciation goes to my labmates Sarah Hanis and Farina also not to forget Danial Azim for helping me with all the hiccups throughout this project.

Finally, this thesis is dedicated to the loving memory of my mom and dad for the vision and determination to educate me. This piece of victory is dedicated to both of you. Alhamdulilah.

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CHAPTER 1

INTRODUCTION

1.1 Background of Study

Enhanced Oil Recovery (EOR) is being used in oil and gas industry as one of the tertiary recovery where additional recovery can be obtained after the primary recovery process. The EOR process can be categorized into three; Thermal Recovery, Miscible/Immiscible Recovery and Chemical Recovery. With the growing of energy demand and depleting of the petroleum resources, EOR has become one of the important options that most of the companies are interested in.

The Petroleum Management Unit in PETRONAS had stated during 'The Petroleum Policy Management (PPM) Project' in Indonesia (2006), their objective is to maximize the domestic long term value of reserves is done through the 4 main levers (Hashim & Nasir, 2006). The second lever is where additional 33% replenishment ratio of reserves recovery are through IOR/EOR. PETRONAS had made a screening study on 31 reservoirs from 16 fields in the Peninsular Malaysia and 39 reservoirs from 19 fields in East Malaysia as to identify the EOR potential in Malaysia. It was found that the amount of potential incremental recovery from these reservoirs is almost 1 billion barrels (Hashim & Nasir, 2006). Figure 1.1 below showed an infographic on each of the producing reservoirs and their respective potential EOR that can be applied.

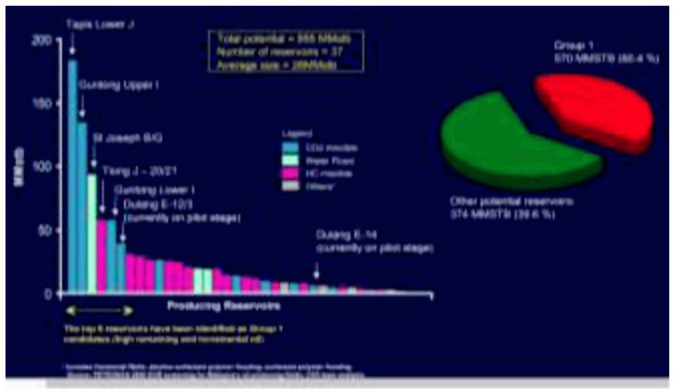

Figure 1.1: Producing Reservoirs and Their Respective Potential EOR (Hashim & Nasir, 2006)