

Investigation of Improved Oil Recovery Mechanisms in Smart Water Injection by Imaging Methods

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Abstract — Nowadays, the reduction of oil production from oil reservoirs is a major problem in the oil industry. There are different methods to increase the oil production in various conditions. Water injection is one of the useful methods for enhancing oil production. In recent years, the oil production increased by changes in the salinity of injected water into the reservoir smart water injection. For analyzing the results of experiments in porous media, Rock's digital image is an accurate method. The microscale (and even Nanoscale) images are taken from the porous media of rock show the most accurate information from the mechanisms of oil production in different methods of production. In this study, a review has been done on the results of experiments with smart water injection in the rock cores by imaging methods. According to the results of imaging, reducing the salinity of injected water increase the oil production from oil reservoirs by changing the wettability of rock from oil-wet to water-wet, clay migration and formation of the emulsion of water in oil. If the injected water has low salinity, the formation of water emulsions in oil and the migration of the clay in rock pores will increase and the oil production will increase too. The investigation and proving the mechanisms associated in the process of smart water injection in oil reservoirs by imaging methods are the main purpose of this study.

Keywords: Digital core analysis, Rock imaging, Low salinity water injection, Wettability alteration of rock, water emulsion formation in oil, Enhanced oil recovery

I. INTRODUCTION

Water Injection is a practical and effective method in the secondary recovery of oil reservoirs. In this method, high-pressure water enters the oil reservoir through injection wells and creates the driving force needed to sweep the oil to the production well. The main purpose of injecting water into the reservoir is to supply the energy needed to sweep the oil to the production well and maintain the reservoir pressure. Microscopic and macroscopic efficiencies, mobility ratio, injection pattern of injection and production wells, fluid injection pressure, and injection start time are important and controlling factors of oil production in the water injection method. The schematic of how this method is performed is shown in Figure (1) [1-4].

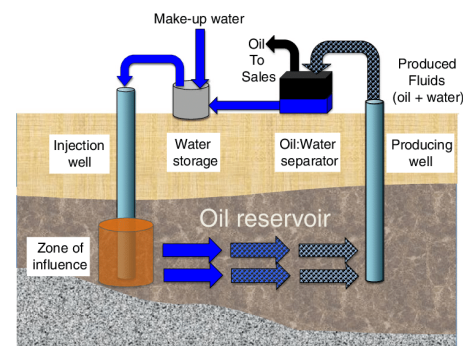


Figure (1): Schematic of how water is injected into an oil reservoir to increase oil production