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ORIGINAL PAPER - EXPLORATION GEOLOGY

Determining the effect of mineral scaling formation under different injection water sources on the performance of Mishrif carbonate reservoir in Halfaya oilfield, Southern Iraq

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Abstract

The chief source of the oilfield scale is the mixing of incompatible waters. This study demonstrated that mixing the reservoir of Mishrif formation (Halfaya oilfield) with six types of injection water sources, including Tigris River water, producing water formation, Gulf seawater, Marshes water, Middle Kirkuk formation water, and Main Outfall Drain water (AL-Masab AL-Aam Channel), leads to the formation of salt crusts that cause the reduction of reservoir rock permeability. According to the Piper diagram, the Mishrif formation water of all extant water samples was of the sodium chloride type (NaCl), except for HF-81, which was between (NaCl) and mix (CaMgCl) type. A geochemical simulation model of water alignment (PHREEQC) was used to simulate this problem, and it revealed the mineral scaling from mixing processes. These minerals precipitate in rock pores and clog them, which then cause damage to the petrophysical properties of the reservoir and prevent the passage of liquids. Results showed that the best water types used for injection are Middle Kirkuk formation water, followed by the general downstream, then Gulf seawater, but treatment before injection is needed. The study of geochemical modeling method can help to better understand scaling issues by efficiently identifying the best injection water from various selected types with the lowest possible cost, which in turn improves oil production.

Keywords Mineral scaling · Water injection · Mishrif formation · Halfaya oilfield · Iraq

Abbreviations

ARN:	A family of tetrameric acids
GSW:	Gulf seawater
HF:	Halfaya oilfield
IAP:	Product of the ionic activity in dissolution reaction
Ksp:	Equilibrium constant of the mineral dissolution at a specific temperature
MFW:	Mishrif formation water
MKFW:	Middle Kirkuk formation water
MODW:	Main outfall drain water
MW:	Marshes water
PWF:	Producing water formation
TRW:	Tigris river water
SI:	Saturation index

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Introduction

Scale deposition is one of the most critical oilfield issues that water injection systems face, especially when two incompatible fluids are present. Scales form when two incompatible waters are mixed and supersaturation occurs (Merdhah and Yassin 2008). Supersaturation with scale-forming salts caused by changes in physical conditions in which water

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