شبكة المعلومات الجامعية

بسم الله الرحمن الرحيم

شبكة المعلومـــــات الجامعية

التوثيق الالكتروني والميكروفيلم

شبكة المعلومات الجامعية

جامعة عين شمس

التوثيق الالكتروني والميكروفيلم

قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها علي هذه الأفلام قد اعدت دون آية تغيرات

يجب أن

تحفظ هذه الأفلام بعيداً عن الغبار

في درجة حرارة من 15 – 20 مئوية ورطوبة نسبية من 20-40 %

To be kept away from dust in dry cool place of 15 – 25c and relative humidity 20-40 %

بعض الـوثـــائق

الأصـلية تـالفـــة

بالرسالة صفحات

لم ترد بالأصـــــل

EXPERIMENTAL AND THEORETICAL DETERMINATION OF PHYSICAL PROPERTIES OF CO_2/HYDROCARBON MIXTURES FOR ENHANCED OIL RECOVERY

A Dissertation

by

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ABSTRACT

CO_2 flooding is considered to have multi-contact miscibility displacement mechanisms. It changes the reservoir fluid in a complex manner. This type of Enhanced Oil Recovery (EOR) technique is very economically viable, readily available, and environmentally acceptable. CO_2 flooding is one of the EOR techniques in the gas processes category.

In evaluating a field for possible CO_2 flooding certain data are required that can either be measured in the laboratory or, in the absence of measurements, be estimated from fundamental and theoretical considerations. The required data include the following: a) Minimum miscibility pressure (MMP), b) Swelling of crude oil, c) Viscosity reduction.

Miscibility is defined as physical condition between two or more fluids that will permit them to mix in all proportions without the existence of an interface. The minimum pressure required to achieve a multi-contact miscibility between injected fluid and oil, specifically, is called the minimum miscibility pressure (MMP).

The CO_2 MMP is an important parameter for screening and selecting reservoirs for CO_2 injection project to simulate reservoir performance as a result of CO_2 injection.

The objectives of this study were separated into two parts. The first one was to predict the MMP using different correlations available in the literature i.e. Petroleum Recovery Inst., Yellig, Glas∅, Alston, and Orr. The thermodynamic MMP was also evaluated using an EOS (Equation Of State).The simulator (PEPPER) was used to obtain the bubble-points and dew-points, based on this data, the thermodynamic minimum miscibility pressures are determined using pseudo ternary diagram. This simulator uses Soave-Redlich-Kwong (SRK) equation of state [58]. The MMP coincides with the plait point, i.e. critical point.

The second part of the objectives is an experimental study. (1) A laboratory study for three types of synthitic oil is set up and experimental procedures were developed using

toluene in the calibration experiment and three types of Hydrocarbon/Carbon dioxide mixtures in the main experiment. (2) Determine CO_2/hydrocarbon systems viscosities at high temperatures and pressures using a high pressure rolling ball viscometer and compare these viscosities with those predicted from Lohrenz-Bray-Clark (LBC), Lansangan and Sandler models in the literature. The same types of oil were used to measure the viscosities.

Results from studies with synthetic oils show that large oil recoveries were obtained at pressures more than the minimum miscibility pressure (MMP). The average oil recoveries were about of the 90 % OOIP (1.2 PV of CO_2 injected).

We have also concluded from these studies, that (1) There was little or no effect of oil composition on the CO_2 MMP (2) A comparative investigation was performed between the experimental results of this study and six different correlations provided in the literature. The comparisons show a good agreement with each of Yellig and Orr correlations. (3) Viscosities for hydrocarbon/CO_2 mixtures were measured and compared with the published values (Cullick, Mathis, Orbey and Sandler). It has been found that the technique is sufficiently accurate for engineering measurement on crude oil systems.(4) According to the comparison between Lohrenz-Bray-Clark (LBC) correlation (which is widely used in oil industry) and the present experimental results, it was found that LBC viscosities are very much lower than the measured values specially at high concentrations of CO_2. Accordingly, such correlation is not recommended to be used.

Finally, a) according to screening pressures of several Egyptian oil reservoirs, it was found that the majority of these reservoirs are not candidates for CO_2 miscible flooding because their current pressures are less than CO_2 MMP. However, Ras Budran field was found to be suitable for such flooding (current pressure is greater than MMP). b) according to the performed theoretical calculations, if CO_2 flooding had been applied on Ramadan oil field at its initial pressure, oil viscosities would have decreased and hence the recovery factor would have increased.

DEDICATION

This dissertation is lovingly dedicated to my parents, who patiently endured its preparation, and to my wife, for her encouragement, understanding, and devotion and my lovely daughters Aisha and Fatma and my son Mohamed

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