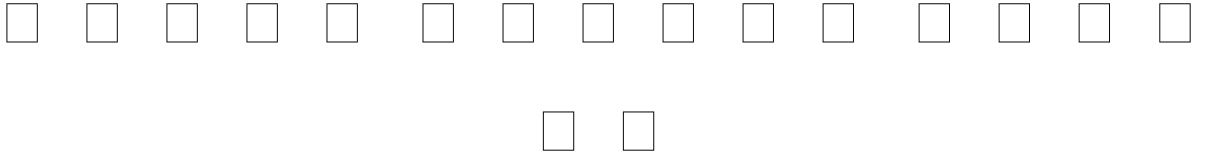


الإستهلال

قال تعالى



سورة النجم

Abstract

Steam flooding as an enhanced oil recovery method of oil from heavy oil reservoir has been of interest in recent years. Analytical models are very helpful for predict oil recovery by steam flooding for preliminary forecasting purposes and sensitivity studies. Though different models are available with different presumptions; the most common analytical technique used for prediction of steam flooding performance is Jeff Jones model which in turn does not give a satisfactory prediction of the oil production under steam flooding specially the peak oil production rate.

In this study, a production performance of 1/8 symmetry element of 5-spot pattern steamflood has been simulated and the results compared against those based on the Jeff Jones model.

Four different steam injection rates (125, 156.25, 187.5 and 250 m^3/day) each with two different steam qualities (60 and 70%) to check sensitivity of both models.

The study showed that's Jeff Jones model gives lower maximum predicted oil production rate compare with numerical model.

As steam injection rate increase Jeff Jones model gives higher oil production rate while the numerical one gives lower maximum production.

At lower steam injection rates Jeff Jones model was more sensitive to change in peak production rate accordingly to change in steam quality compare with numerical model which is more sensitive to the higher one.

التجريد

لقد أصبح استخلاص الزيت الثقيل عن طريق الغمر البخاري من اهم وسائل الاستخلاص المحسن خصوصا في السنين الاخيرة ومن ثم فإن النماذج التحليلية المستخدمة لاستقراء الانتاجيه المستقبلية للاستخلاص المحسن عن طريق الغمر البخار ذات اهمية خصوصا للتنبؤ بالانتاجية المستقبلية.

هنالك مجموعة من النماذج التحليلية المستخدمة للتنبؤ بالانتاجية المستقبلية للاستخلاص المحسن للزيت عن طريق الغمر البخاري تختلف فيما بينها بإختلاف الافتراضات التي علي ضوئها تم اشتقاقها ويعتبر النموذج الرياضي الخاص بجيف جونز اشهرها واكثرها استخداما، إلا أن هذا النموذج لايعطي تنبؤاً جيداً للانتاجية المستقبلية للإستخلاص المحسن عن طريق الغمر البخار خصوصاً عند أقصى معدل انتاج للزيت يمكن التنبؤ به.

في هذه الدراسة تم التنبؤ لأدائية الانتاج لثمن نموذج حقلي سوداني من خمس ابار (نموذج معكوس من خمس ابار) عن طريق إستخدام النماذج العددية (برامج) والتحليلية (نموذج استيف جونز).

تم استخدام اربع معدلات ضخ للبخار مختلفة (١٢٥، ١٨٧.٥، ٢٥٠، ١٥٦.٢٥ و ٢٥٠ متر مكعب في كل يوم) وبجودة بخار مختلفة لكل معدل حقن (٦٠ و ٧٠ %).

أظهرت الدراسة ان نموذج جيف جونز يعطي اقل اقصي معدل انتاج زيت متوقع مقارنة مع النموذج العددي وكذلك أظهرت الدراسة انه وبزيادة معدلات الحقن ،يذداد معدل انتاج اقصي زيت متوقع عند استخدام نموذج جيف جونز بينما تقل الكمية المتوقعة بإذدياد معدلات الحقن عند استخدام النماذج العددية .

كذلك أظهرت الدراسة ان نموذج جيف جونز أكثر تأثراً عند تغير جودة البخار المحقون عند معدلات الحقن الصغري بينما يذداد التأثير في النماذج العددية بإذدياد معدلات الحقن.

DEDICATION

This research is dedicated to my lovely mother ENSAF MOHAMED ALI AHMED and my brother ABDELMONEIM FAROUG ABDELMONEIM for their unlimited support.

Acknowledgement

Foremost, I would like to express my sincere gratitude to a great many people have contributed to this production. I owe my gratitude to all those people who have made this dissertation possible and because of whom my graduate experience has been one that I will cherish forever.

My deepest gratitude is to my supervisor, Dr. Tagwa Ahmed.

I have been amazingly fortunate to have a supervisor who gave me the freedom to explore on my own and at the same time the guidance to recover when my steps faltered.

I am also thankful to Sudapet E&P staff who maintained all facilities (Software and references).

Special thanks for my co advisor Mohamed AlmojtabaYusri for his endless support throughout the project stages.

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Nomenclature

A = effective pattern area (acres).

A_{CD} = dimensionless steam zone size.

A_s = steam zone size (acres).

C_w = specific heat of water ($\frac{btu}{lbm \text{ } ^\circ F}$).

E_{hs} = Average thermal efficiency of steam zone, dimensionless

f_s = bottom hole steam quality

F_{HD} = ratio of enthalpy of vaporization to liquid enthalpy

F_{os} = oil steam ratio

h_f = enthalpy of saturated water at steam temperature ($\frac{BTU}{lbm}$)

h_{fg} = latent heat of steam ($\frac{BTU}{lbm}$)

h_n = Net zone thickness (ft)

h_n = gross formation thickness (ft)

i_s = steam injection rate cold water equivalent ($\frac{bbl}{D}$)

K_h = Bulk thermal conductivity of cap and base rock ($\frac{BTU}{ft \cdot hr \cdot ^\circ F}$).

K = Constant for complementary error function calculation.

$M1$ = Average heat capacity of steam zone (BTU/cu ft $^\circ F$)

$M2$ = Average heat capacity of cap rock (BTU/cu ft $^\circ F$)

N = Oil originally in place (bbl.)

N_p = cumulative oil produced (bbl)

P_s = injection pressure (psi)

q_o = oil production rate ($\frac{bbl}{D}$)

q_{od} = oil displacement rate $\left(\frac{\text{bbl}}{\text{D}}\right)$

Abbreviations:

API American Petroleum Institution.

Ba Bantiu (Reservoir Formation)

BTU British Thermal Unite.

CMG Computer Modeling Group.

CSS Cyclic Steam Stimulation.

FNE Fula North East.

SAGD Steam Assisted Gravity Drainage .

SCALS Special Core Analysis Lab.

SPE Society Of Petroleum Engineers.

STB Stock Tank Barrel.

STARS Thermal and Advanced Processes Reservoir Simulator.

VAMOD Volume and area modifier (CMG keyword).