COMPARATIVE ANALYSIS OF GAS CONDENSATE RECOVERY BY CARBONDIOXIDE HUFF-N-PUFF; CARBONDIOXIDE ALTERNATING NITROGEN AND NITROGEN INJECTION: A SIMULATION STUDY

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(19PCN02069)

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A DISSERTATION SUMMITTED TO THE SCHOOL OF POSGRADUATE STUDIES IN PARTIAL FULFILMENT FOR THE AWARD OF THE DEGREE OF MASTER OF ENGINEERING DEGREE (M. Eng) IN THE DEPARTMENT OF PETROLEUM ENGINEERING, COLLEGE OF ENGINEERING, COVENANT UNIVERSITY.

SPETEMBER, 2021

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirement for the award of the degree of Master of Engineering in Petroleum Engineering in the Department of Petroleum Engineering, College of Engineering, Covenant University, Ota, Nigeria.

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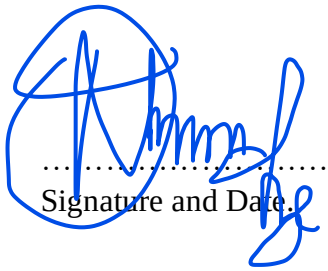
DECLARATION

I, **NCHILA, YUVEN THELMA (19PCN02069)** declares that this research was carried out my me under the supervision of Dr Fred T. Ogunkunle of the Department of Petroleum Engineering, Covenant University, Ota, Nigeria. I attest that this thesis has not been presented either wholly or partially for the award of any degree elsewhere. All sources of data and scholarly information used in this thesis are duly acknowledge.

NCHILA, YUVEN THELMA



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Signature and Date

CERTIFICATION

We certify that the dissertation "**COMPARATIVE ANALYSIS OF GAS CONDENSATE RECOVERY BY CARBONDIOXIDE HUFF-N-PUFF; CARBONDIOXIDE ALTERNATING NITROGEN AND NITROGEN INJECTION: A SIMULATION STUDY.**" is an original work carried out by **NCHILA, YUVEN THELMA (19PCN02069)** in the Department of Petroleum Engineering, College of Engineering, Covenant University, Ota, Ogun State, Nigeria, under the supervisor of Dr. Fred T. Ogunkunle. We have examined and found the work acceptable for the award of the degree of Master of Engineering in Petroleum Engineering.

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DEDICATION

I dedicate this work to God Almighty for His abundant blessings on my life, throughout the course of this work. It has been the Lords doing although and I want to glorify and thank Him for that. I would also like to dedicate this work to my parents Mr. and Mrs. Nchila and the entire Nchila's family for their relentless prayers, moral and financial support. They all made it possible for the realization of this work. May the good God continue to bless them, protect them, and guide them through their lives.

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ABBREVIATIONS

FGPT	Field gas production total.
FOPT	Field Oil production total.
RF (FOE)	Oil Recovery factor.
FWPT	Field water production total.
FWCT	Field Water Cut.
FOPR	Field Oil Production Rate.
FGPT	Field Gas Production Rate.
GIIP	Gas initially in place.
WOPR	Well Oil production rate.
WGPR	Well gas production rate.
GOR	Gas Oil ratio.
LGR	Linear grid refinement.
WGPT	Well Gas Production Total.
GAG	Gas Alternating Gas.
PVT	Pressure Volume Temperature.
FVF	Formation volume Factor.
CVD	Constant Volume Depletion.
CCE	Constant Composition Expansion.
EOS	Equation of state.
BOE	Barrels of oil equivalence.

NOMENCLATURE

Res Vol	Reservoir volume
Sur Vol	Surface Volume
Wrt	with respect to separator
Temp	temperature
T, P V	temperature, pressure, Volume
Crit	critical
Kr	relative permeability
Sw, So	water saturation, Oil saturation
O, W, G	Oil, Water, Gas
Liq	liquid

ABSTRACT

Condensates are liquid hydrocarbons that dropout of the gas during gas production and accumulate around the wellbore when the reservoir pressure drops below the dew point pressure. A phenomenon referred to as condensate banking. The continuous accumulation of condensates, block the pore spaces around the wellbore leading to decrease in gas productivity. Conventional methods to produce gas condensates are to maintain the reservoir pressure above the dew point pressure by water and/or dry gas injection. These methods, often results to late response to water and dry gas injection and low achievable drawdown pressure. In this study a new gas condensate development technique (CO_2 alternating N_2 injection) was modelled and simulated, and the performance was compared to other developmental techniques. PVTi preprocessor was used to model reservoir fluid. ECLIPSE compositional simulator was used to simulate five enhanced gas and condensate recovery scenarios for a heterogenous reservoir system using CO_2 and N_2 gas for a period of 9 years. CO_2 huff-n-puff, CO_2 cyclic injection, CO_2 and, N_2 continuous injection and the Gas Alternating Gas (CO_2 and N_2) were simulated. Parametric studies on injection rate, production rate, cyclic time and injection fluid composition investigated. PVTi modelling indicates that the reservoir is a lean gas condensate reservoir with a maximum liquid loading of 6.32%. N_2 and CO_2 continuous injection produced 3.83% and 3.81 % respectively of incremental oil. The cyclic and GAG resulted in a 2.9% and 1.85 % increment in oil volume produced respectively. CO_2 huff-n-puff achieved highest oil recovery with a 6.1% oil increment. It was observed that the huff-n-puff produced the least volume of gas. Increasing the production and injection rates showed an increase in the volume of oil and gas produced. The results also showed that the highest influencing parameter for improve gas productivity is the production rate while that for improved oil productivity is the injection rate.

Keywords: Huff-n-puff, Condensate, Recovery factor, Field oil Expected.