

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

**NCHILA, YUVEN THELMA
(19PCN02069)**

SEPTEMBER, 2021

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**A DISSERTATION SUBMITTED TO THE SCHOOL OF
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(M. Eng) IN THE DEPARTMENT OF PETROLEUM ENGINEERING,
COLLEGE OF ENGINEERING, COVENANT UNIVERSITY.**

SEPTEMBER, 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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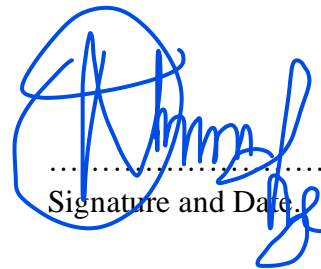
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DECLARATION

I, **NCHILA, YUVEN THELMA (19PCN02069)** declares that this research was carried out by 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 acknowledged.

NCHILA, YUVEN THELMA


.....
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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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TABLE OF CONTENT

CONTENT	Page
COVER PAGE.....	i
TITLE PAGE.....	ii
ACCEPTANCE.....	iii
DECLARATION.....	iv
CERTIFICATION.....	v
DEDICATION.....	vi
ACKNOWLEDGEMENT.....	vii
TABLE OF CONTENT.....	viii
LIST OF TABLES.....	xii
LIST OF FIGURES.....	xiii
ABBREVIATIONS.....	xvi
NOMENCLATURE.....	xvii
ABSTRACT.....	xviii
CHAPTER ONE: INTRODUCTION.....	1
1.1 BACKGROUND OF STUDY.....	1
1.2 DEFINITION OF KEY TERMS.....	2
1.2.1 Dew point pressure.....	2
1.2.2 Critical temperature.....	2
1.2.3 Cricondentherm.....	2
1.2.4 Condensate blocking.....	2
1.2 TYPES OF RESERVOIR FLUIDS.....	3
1.2.1 Black oil.....	3
1.2.2 Volatile Oil.....	3
1.2.3 Gas Condensate.....	3
1.2.4 Wet Gas.....	4
1.2.5 Dry Gas.....	4
1.3 RECOVERY FLUIDS FOR CONDENSATE RESERVOIRS.....	4
1.3.1 Carbon dioxide.....	5
1.3.2 Natural gas.....	6
1.3.3 Nitrogen gas.....	6
1.4 RETROGRADE BEHAVIOR OF GAS CONDENSATES.....	7

1.5	STATEMENT OF PROBLEM.	8
1.6	AIM AND OBJECTIVES.....	9
1.7	JUSTIFICATION OF STUDIES.....	10
CHAPTER TWO: REVIEW OF LITERATURE.....		11
2.1	GAS CONDENSATE RESERVOIRS.	11
2.2	PHASE BEHAVIOR OF CONDENSATE RESERVOIRS	14
2.3	CONDENSATE RESERVOIR PROPERTIES.....	16
2.3.1	Dew point pressure.....	16
2.3.2	Condensate gas ratio.	16
2.3.3	Condensate yield.....	16
2.3.4	Gas condensate specific gravity.....	17
2.3.5	Condensate composition.....	17
2.4	CONDENSATE FORMATION ZONES	17
2.4.1	An outer region.	18
2.4.2	An intermediate region.....	18
2.4.3	An Inner region.....	19
2.5	DEVELOPMENT OPTIONS FOR GAS CONDENSATRE RESERVOIRS.	19
2.5.1	Pressure Maintenance.....	19
2.5.1.1	Gas Cycling.....	21
2.5.1.2	Nitrogen Injection	22
2.5.1.3	Carbon dioxide injection.	25
2.5.1.4	Huff-N-Puff	27
2.5.2	Production improvement.	30
2.5.2.1	Drilling Horizontal Wells.	30
2.5.2.2	Hydraulic fracturing.	32
2.5.3	Chemical method	33
2.5.3.1	Wettability alteration method.	33
2.5.3.2	Application of Solvents.	35
CHAPTER THREE: METHODOLOGY		37
3.1	INTRODUCTION.....	37
3.1	Reservoir and Fluid Properties use for simulation.....	37
3.2	SIMULATION MODEL SET UP.....	38
3.2.1	Reservoir Model	38
3.2.2	Reservoir grid description.	39
3.2.3	Formation core Analysis.	40

3.2.4 PVT Modelling (Fluid characterization)	42
3.2.5 Reservoir Initialization.....	46
3.2.6 Well events Schedule.	46
3.2.7 Simulation run.	47
3.3 SIMULATION CASES.	47
3.3.1 Case 1. Natural Depletion.	47
3.3.2 Case 2. Continuous injection of Carbon dioxide gas	48
3.3.3 Case 3. Continuous injection of Nitrogen gas.	48
3.3.4 Case 4. Carbon dioxide Huff-n-Puff.	48
3.3.5 Case 5. Gas Alternating Gas injection (GAG)).	48
3. 4 PURPOSE OF GAS INJECTION IN EACH CASE.	49
3.5 OPERATIONAL PRODEDURES FOR EACH SIMULATION CASE.....	50
CHAPTER FOUR: RESULTS AND DISCUSSION.....	51
4.1 OVERVIEW.	51
4.2 PVTi MODELLING RESULTS.	51
4.2 .1 Saturation Pressure and Constant Composition Expansion Test (CCE).	51
4.2.2 Constant Volume depletion Test.....	55
4.3 INITIAL RESERVOIR CONDITIONS.	59
4.4 RESULTS FROM THE SIMULATION MODELS.....	60
4.4.1 RESULTS OF THE BASE CASE.	60
4.4.2 RESULTS FROM DEVELOPMENT OPTIONS.....	63
4.4.2.1 RESULTS OF NITROGEN INJECTION.	63
4.4.2.2 RESULTS OF CONTINOUS INJECTION OF CARBONDIOXIDE.....	68
4.4.2.3 RESULTS OF CYCLIC INJECTION OF CARBONDIOXIDE.....	72
4.4.2.4 RESULTS FROMCARBONDIOXIDE HUFF-n-PUFF.....	76
4.4.2.5 RESULTS OF THE GAS ALTERNATING GAS INJECTION (GAG).	80
4.4.3 SENSITIVITY ANALYSIS.....	85
4.4.3.1 Effect of production rate.....	85
4.4.3.2 Effect Carbon dioxide injection rates.....	88
4.4.3.3 Effect Nitrogen injection rates.	91
4.4.3.4 Effect of injection gas composition.....	92
4.4.3.5 Effect of cyclic time.	95
CHAPTER FIVE:CONCLUSION AND RECOMMENDATIONS	105
5.1 CONCLCUSION.....	105
5.2 RECOMMENDATION FOR FURTHER RESEARCH	107

5.3 CONTRIBUTION TO KNOWLEDGE.....	108
REFERENCES.....	109

LIST OF TABLES

TABLES	Page
Table 3. 1: Reservoir and fluid properties.....	37
Table 3. 2: Binary Interaction coefficient for Equation of states.....	43
Table 3. 3: Critical values of Fluid components.....	43
Table 3. 4: Composition of initial reservoir fluid	45
Table 4. 1: Saturation pressure determination at 212.7 F.....	54
Table 4. 2: Constant Volume Depletion (CVD) Test	55
Table 4. 3: Initial reservoir fluid in place.....	59
Table 4. 4: Base case Field oil and gas production volumes.	60
Table 4. 5: Nitrogen injection Field oil and gas production volumes.	64
Table 4. 6: Field oil and gas production volumes for continuous injection of carbon dioxide.	68
Table 4. 7: Cyclic injection Field oil and gas production volumes	72
Table 4. 8: Huff-n-puff injection Field oil and gas production volumes.	76
Table 4. 9: Gas Alternating Gas Field oil and gas production volumes.....	81
Table 4. 10: Comparison of different production rates.	85
Table 4. 11: Comparison of Carbon dioxide production rates.....	88
Table 4. 12: Comparison of different Nitrogen injection rates.	92
Table 4. 13: Comparison of different injection gas composition rates.	92
Table 4. 14: Comparison of two cyclic time for injection.	95
Table 4. 15: Results for all development options.	97

LIST OF FIGURES

FIGURES	page
Figure 1. 1: Phase envelop of a typical gas condensate reservoir.	7
Figure 2. 1: Schematic of Reduction in PI due to Condensate Blocking.....	12
Figure 2. 2: A typical gas condensate P-T phase diagram.....	15
Figure 2. 3: Regions of condensate and gas flow behavior in a typical gas condensate reservoir.....	18
Figure 2. 4: Condensate reservoir development Techniques.....	20
Figure 2. 5: Nitrogen Injection Workflow for EOR.....	24
Figure 2. 6: Huff and puff technique for enhanced oil recovery	28
Figure 3. 1: Reservoir grid model.....	38
Figure 3. 2: Porosity distribution in model.	39
Figure 3. 3: Permeability distribution in model.....	40
Figure 3. 4: Well locations.....	40
Figure 3. 5: Water/Oil saturation functions vs Water saturation.....	41
Figure 3. 6: Gas/Oil saturation function.....	41
Figure 3. 7: Phase Envelop of the gas condensate fluid.....	44
Figure 3. 8: Fingerprint plot.....	46
Figure 4. 1: Retrograde Liquid Volume Versus pressure at 212.7 F.....	52
Figure 4. 2: Plot of relative volume Versus pressure at 212.7 F.....	52
Figure 4. 3: Plot of Gas density Versus pressure at 212.7 F.....	53
Figure 4. 4: Plot of Z-factor Versus pressure at 212.7 F.....	53
Figure 4. 5: Plot of Gas FVF Versus pressure at 212.7 F.	54
Figure 4. 6: Retrograde liquid deposit from CVD at 212.7 F.....	56
Figure 4. 7: Plot of Cumulative volume produced from CVD at 212.7 F.....	56
Figure 4. 8: Plot of Gas density from CVD at 212.7 F.....	57

Figure 4. 9: Plot of Z-factor from CVD at 212.7 F	57
Figure 4. 10: Plot of Gas FVF at 212.7 F.....	58
Figure 4. 11: Plot of Gas Viscosity from CVD at 212.7 F.....	58
Figure 4. 12: Initial gas saturation	59
Figure 4. 13: Field gas production total for base.....	60
Figure 4. 14: Field Oil production total for base case.....	61
Figure 4. 15: Recovery Factor for base case.....	61
Figure 4. 16: Field gas production rate for base case.....	62
Figure 4. 17: Field Oil production rate for base.	62
Figure 4. 18: Field water cut for base.....	63
Figure 4. 19: Field gas production total for nitrogen injection.....	64
Figure 4. 20: Field Oil production total for nitrogen injection.....	65
Figure 4. 21: Recovery Factor for nitrogen injection.....	65
Figure 4. 22: Field gas production rate for nitrogen injection.....	66
Figure 4. 23: Field Oil production rate for nitrogen injection.	66
Figure 4. 24: Field water cut for nitrogen injection.	67
Figure 4. 25: Field Gas injection total for nitrogen injection.	67
Figure 4. 26: Field gas production total for carbon dioxide continuous injection.	68
Figure 4. 27: Field Oil production total for carbon dioxide continuous injection.....	69
Figure 4. 28: Recovery Factor for carbon dioxide continuous injection.	69
Figure 4. 29: Field gas production rate for carbon dioxide continuous injection.....	70
Figure 4. 30: Field Oil production rate for carbon dioxide continuous injection.....	70
Figure 4. 31: Field water cut for carbon dioxide continuous injection	71
Figure 4. 32: Field gas injection total for carbon dioxide continuous injection.....	71
Figure 4. 33: Field gas production total for cyclic injection.....	72
Figure 4. 34: Field Oil production total for cyclic injection.	73
Figure 4. 35: Recovery Factor for cyclic injection.....	73

Figure 4. 36: Field gas production rate for cyclic injection.....	74
Figure 4. 37: Field Oil production rate for cyclic injection.....	74
Figure 4. 38: Field water cut for cyclic injection.	75
Figure 4. 39: Field Gas injection total for cyclic injection.	75
Figure 4. 40: Field gas production total for cyclic injection.....	77
Figure 4. 41: Field Oil production total for cyclic injection.....	77
Figure 4. 42: Recovery Factor for cyclic injection.....	78
Figure 4. 43: Field gas production rate for cyclic injection.....	78
Figure 4. 44: Field Oil production rate for cyclic injection.	79
Figure 4. 45: Field water cut for cyclic injection.	79
Figure 4. 46: Field Gas injection total for cyclic injection.	80
Figure 4. 47: Field gas production total for GAG injection.....	81
Figure 4. 48: Field Oil production total for GAG injection.....	82
Figure 4. 49: Recovery Factor for GAG injection.....	82
Figure 4. 50: Field gas production rate for GAG injection.....	83
Figure 4. 51: Field Oil production rate for GAG injection.....	83
Figure 4. 52: Field water cut for GAG injection.	84
Figure 4. 53: Field Gas injection total for GAG injection.	84
Figure 4. 54: Field production profile for base case.....	87
Figure 4. 55: Production profile results for CO2 continuous injection.....	90
Figure 4. 56: Nitrogen injection field production profile.....	91
Figure 4. 57: Injection gas composition profile.....	94
Figure 4. 58: Carbon dioxide cyclic time production profile	97
Figure 4. 59: Results comparison of various development options.	103
Figure 4. 60: Tornado for FGPT versus high influencing parameter.....	117
Figure 4. 61: Tornado for FOPT versus high influencing parameter.....	117

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 (CO₂ alternating N₂ 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 CO₂ and N₂ gas for a period of 9 years. CO₂ huff-n-puff, CO₂ cyclic injection, CO₂ and, N₂ continuous injection and the Gas Alternating Gas (CO₂ and N₂) 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%. N₂ and CO₂ 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. CO₂ 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.