



**EXPERIMENTAL STUDY OF ENHANCED OIL RECOVERY USING SILICA
NANOPARTICLES AND GUM ARABIC ON MEDIUM CRUDE OIL AND CORES OF
THE NIGER DELTA**

BY

JOHN MAZI FELIX

15PCN01224

JUNE, 2017

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**IN PARTIAL FULFILLMENT OF THE REQUIREMENT FOR THE AWARD OF
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COLLEGE OF ENGINEERING
COVENANT UNIVERSITY, OTA

JUNE, 2017
SUPERVISOR: DR OYINKEPREYE D. ORODU

ACCEPTANCE

This is to attest that this dissertation is accepted in partial fulfillment of the requirement for the award of Masters of Engineering Degree in Petroleum Engineering in the Department of Petroleum Engineering, College of Engineering, Covenant University, Ota, Ogun State.

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Dean, School of Postgraduate Studies

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CERTIFICATION

I, JOHN MAZI FELIX hereby certified that this research work was carried out by me in the Department of Petroleum Engineering, Covenant University, Ota, Nigeria in partial fulfillment of the award of Master’s degree in Engineering, Petroleum Engineering (Reservoir Engineering) and therein supervised by Dr. Oyinkepreye D. Orodu. Moreso, this thesis, “**EXPERIMENTAL STUDY OF ENHANCED OIL RECOVERY USING SILICA NANOPARTICLES AND GUM ARABIC ON MEDIUM CRUDE OIL AND CORES OF THE NIGER DELTA**” is certified as my true work.

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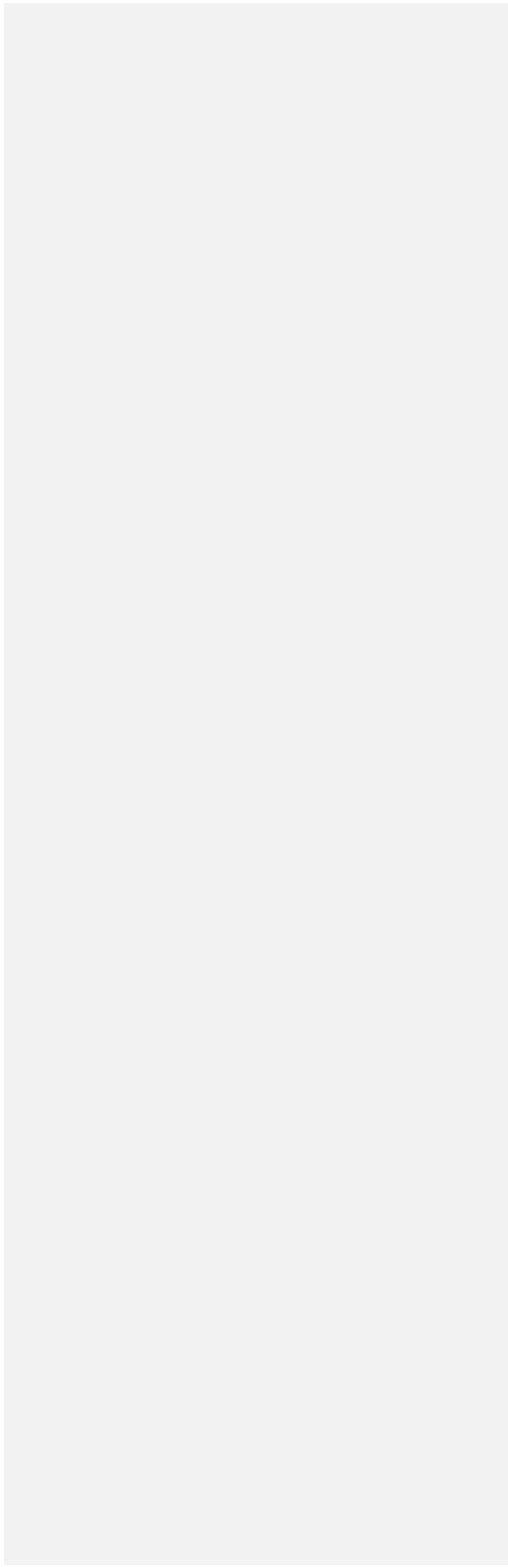


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Date



DEDICATION

This thesis is first and foremost dedicated to the Almighty God for His enablement and His grace towards the completion of this research work and finally to my beautiful wife, Mrs. Felix Ununotovo Joy as well as my two lovely children Prince David Chiagoziem Felix & Princess Deborah Chimamanda Felix.

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ABSTRACT

New methods of improving recoveries have been investigated since they provide lower risks, costs and proven as compared to exploring for new reserves. Most reservoirs around the world are declining into their final phase of production; new techniques are essential in maintaining production and improve hydrocarbon recoveries. Thermal enhanced oil recovery methods for heavy crude is faced with major issues such as high cost, heat energy loss to unwanted zone, low thermal conductivity of rock and corrosion to wells have placed a burden to find new cost effective, more desirable and less disadvantageous methods for improving oil recoveries in such reservoirs. Among these enhanced recovery techniques (EOR) are chemical injection, which has focus on improving the effectiveness of water floods. The aim of enhanced oil recovery (EOR) is to manipulate the fluid-fluid properties and fluid-rock properties between the injected fluid and the residual oil phase to improve recovery efficiency. Water enhanced with nanoparticles (nanofluid) has recently gained research interest for enhanced oil recovery because of the possible physical and chemical properties imparted by the nanoparticles (NP).

The only challenge in the use of this technique from studies are substantial adsorption to rock formation, log jamming and mechanical entrapment due agglomeration of nanoparticles. Therefore, reservoir evaluation process should be carried out before NPs are injected into the reservoir to ensure the feasibility and prospect of enhancing oil recovery.

In recent years, nanofluid (suspended nanoparticles in brine) has been launched as a cheap, efficient and environmentally friendly alternative to other chemicals. The purpose of this project was to investigate and improve oil recovery after water flooding by nanofluid flooding. Nanoparticle used was silica nanoparticles (SiO_2) suspended in deionized water at 0.05 wt%. Flooding experiments were conducted on four core samples. Nanofluid flooding was performed on three cores while polymer flooding was applied for the last core sample and the experiments were performed at ambient conditions. SEM analysis was conducted to observe the possibility of adsorption of the NP and polymer to the sand grains of the core samples.

The results from the core samples show an additional oil recovery of 4.29 %, 2.022 % and 1.86 % respectively from three cores at nano-flooding rate of 0.5 cc/min. Another core gave a recovery of 33 % during water flooding and 38.2 % during polymer flooding thus giving an incremental recovery of 5.2 %.

These results have validated the effectiveness of chemical flooding, especially nanoparticles to successfully recover crude oil from reservoirs after water flooding usefulness has declined.

TABLE OF CONTENT

ACCEPTANCE	iii
CERTIFICATION	iv
DEDICATION	v
ACKNOWLEDGEMENT	vi
ABSTRACT.....	vii
LIST OF FIGURES	x
LIST OF TABLES.....	xii
CHAPTER ONE	1
1.0 INTRODUCTION.....	1
1.1 BACKGROUND AND RESEARCH FOCUS.....	1
1.2 STATEMENT OF PROBLEM	18
1.3 RESEARCH AIM AND OBJECTIVES.....	19
1.4 SIGNIFICANCE OF RESEARCH.....	19
1.5 SCOPE OF RESEARCH.....	20
1.6 LIMITATIONS OF RESEARCH	20
CHAPTER TWO	21
2.0 LITERATURE REVIEW.....	21
2.1 ISSUES TO BE ADDRESSED.....	31
2.1.1 Adsorption.....	32
2.1.2 Plugging	33
2.2 SEM ANALYSIS.....	34
CHAPTER THREE.....	37
3.0 METHODOLOGY.....	37
3.1 MATERIALS.....	37
3.2 EQUIPMENT.....	37
3.2.1 Reservoir Permeability Tester	37
3.2.2 Soxhlet Extractor.....	39
3.2.3 Manual Saturator	41
3.2.4 Pycnometer.....	42
3.2.5 Glass Capillary Viscometer.....	42
3.2.6 Desiccator.....	44
3.3 PROCEDURE.....	44
3.3.1 Core Cleaning.....	44

3.3.2 Preparation of Brine	45
3.3.3 Porosity	45
3.3.3 Permeability	46
3.3.4 Density	47
3.3.5 Viscosity.....	47
3.3.6 Preparation of Nanoparticles and Polymer (Gum Arabic)	48
3.3.7 Core Flood Setup.....	50
3.3.8 Core Flood Scheme	51
3.4 SEM AND XRD ANALYSIS	52
CHAPTER FOUR.....	53
4.0 RESULTS AND DISCUSSION.....	53
4.1 CORE POROSITY AND PERMEABILITY	53
4.2 VISCOSITY AND DENSITY MEASUREMENTS	54
4.3 CORE FLOODING.....	55
4.3.1 Core-2 Flooding	56
4.3.2 Core-5 Flooding	59
4.3.3 Core-6 Flooding	63
4.3.4 Core-7 Flooding	67
4.3.5 Permeability Impairment.....	71
4.4 SEM and XRD ANALYSIS.....	73
CHAPTER FIVE	79
5.0 CONCLUSIONS AND RECOMMENDATION.....	79
5.1 CONCLUSIONS.....	79
5.2 RECOMENDATIONS.....	79
REFERENCES	81

LIST OF FIGURES

Figure 1: Primary drive (water drive and gas cap drive mechanism).....	1
Figure 2: The categories of obtainable EOR technologies.....	4
Figure 3: in-situ combustion process.....	6
Figure 4: schematic diagram showing polymer augmented water flooding.....	7
Figure 5: FESEM images of some commonly used NPs: (a) TiO ₂ (b) Al ₂ O ₃ ; (c) NiO; (d) SiO ₂ (Alomair, Matar, & Alsaeed, Nanofluids application for heavy oil recovery, 2014).....	8
Figure 6: A schematic diagram of NPs with high surface to volume ratio.....	9
Figure 7: Influence parameters of viscosities for SiO ₂ Nano fluids (Al-Anssari, Barifcani, Wang, Maxim, & Iglauer, 2016).	11
Figure 9: Relative permeability curves. The symbols are experimental data. The notation AT and BT indicates that measurements were carried out after or before nanofluid treatment (Juliana, Pedro, Sergio, Farid, & Marco, 2013).....	14
Figure 10: SEM images of the measured calcite surface: (A) before; (B) after nano-modification; (C) high resolution; and (D) maximum resolution; (E) EDX analysis of carbonate rocks aged in fluids (Al-Anssari, Barifcani, Wang, Maxim, & Iglauer, 2016).	15
Figure 11: Atomic force microscopy (AFM) images of the measured calcite surface: (a) before; (b) after nano-modification. (Al-Anssari, Barifcani, Wang, Maxim, & Iglauer, 2016).	16
Figure 12: Schematic for the application of PNPs in EOR through mobility control and wettability alteration.	30
Figure 13: Schematic of EOR mechanism of nanofluids.....	32
Figure 14: Jamming is plugging of pore channels that are larger than each NP. When a nanofluid flows entrapment; (b) log-jamming.....	34
Figure 15: CT-scan of the cross section of a core flooded with CO ₂ and (a) 2% NaBr brine and (b) 2% NaBr brine and 5% PEG-coated silica nanoparticles; pure brine and CO ₂ are illustrated with red and blue, respectively. The scan is taken after 0.25 pore volume of.....	36
Figure 16: Reservoir permeability tester (Reservoir Permeability Tester, 2015, department of petroleum engineering, Covenant University, Ota, Nigeria).	39
Figure 17: Soxhlet extractor (SciLabware, 2017).....	Error! Bookmark not defined.
Figure 18: Manual saturator	42
Figure 19: Pycnometer	42
Figure 20: Viscometer (1) Venting tube, (2) Suction tube, (3) Filling tube, (4) Storage bulb, (6) Leveling bulb, (7) Capillary, (8) Measuring sphere, (9). Pre-run sphere, (10) Min-Max filling marks, M1 and M2. M1 and M2 Measurement marks.....	43
Figure 21: Desiccator	44
Figure 22: Core samples used	Error! Bookmark not defined.
Figure 23: Experimental setup of the core flooding apparatus. (1) pump fluid, (2) pump, (3) valves, (4) displacing reservoir fluid, (5) piston to separate the oils, (6) crude oil, (7) NSB, (8) Nanofluid, (9) pressure gauge, (10) bypass valve, (11) Hassler core holder (12) sleeve pressure, (13) effluent into test tubes (Aurang et al., 2014).....	50
Figure 24: Scanning electron microscope (SEM) and Kontron Image Analyzer.....	Error! Bookmark not defined.
Figure 25: Permeability and Porosity	54
Figure 26: Increased Oil recovery using 0.05 %wt SiO ₂ (Core 2).....	59
Figure 27: Increased Oil recovery using 0.05 %wt SiO ₂ (Core 5).....	63
Figure 28: Increased Oil recovery using 0.05 %wt SiO ₂ (Core 6).....	67

Figure 29: Increased Oil recovery using 0.05 %wt SiO₂ (Core 7).....68

Figure 30: Oil recovery against pore volume for core 7 (polymer flooding)..... 70

Figure 31: Oil recovery against pore volume for core 7 (water flooding)..... 70

Figure 32: Oil recoveries of water and polymer flooding against pore volume for core 7....**Error!**

Bookmark not defined.

Figure 33: A bar chart showing Permeability Impairment..... 72

Figure 34: Effect of Permeability to Incremental oil recovery and displacement efficiency of nanofluid..... 73

Figure 35: SEM at 100× magnification of Core 2 after nanoflooding 74

Figure 36: SEM at 100× magnification of Core 5 after nanoflooding 75

Figure 37: SEM at 100× magnification of Core 6 after nanoflooding 76

Figure 38: SEM at 100 × (2mm)) magnification of Core-Polymer after polymer flooding 77

Figure 39: Typical Clay constituents of Core samples (Quartz 72 % - Si₃O₆, scale fac- 0.763; Kaolinite 6 % - Al₂Si₂O₉ sale fac -0.024; Microcline 22 % - K1.9Na0.1Al₂, scale fac: 0.048)... 78

LIST OF TABLES

Table 1: Summary on experimental studies about wettability alteration by nanofluids. (Source: Xiaofei, Yanyu, Guanpeng, & Zhiyong, 2017)	16
Table 2: Determination of porosity for all the cores.....	53
Table 3: Density and Viscosity	55
Table 4: Properties of SiO ₂	55
Table 5: Oil injection to determine the Residual Oil Saturation	56
Table 6: Waterflooding to determine the Residual Oil Saturation.....	56
Table 7: Nano-fluid Flooding to determine the Residual Oil saturation	56
Table 8: Incremental Recovery after Waterflooding using Nanofluids against time	57
Table 9: Incremental Recovery after Waterflooding using Nanofluids against Pore Volumes	58
Table 10: Oil injection to determine the Residual Oil Saturation	59
Table 11: Waterflooding to determine the Residual Oil Saturation.....	60
Table 12: Nanofluid Flooding to determine the Residual Oil saturation	60
Table 13: Incremental Recovery after WaterFlooding using Nanofluids against time.....	61
Table 14: Incremental Recovery after WaterFlooding using Nanofluids against Pore Volumes	62
Table 15: Oil injection to determine the Residual Oil Saturation	63
Table 16: WaterFlooding to determine the Residual Oil Saturation	64
Table 17: Nanofluid Flooding to determine the Residual Oil Saturation.....	64
Table 18: Incremental Recovery after Waterflooding using Nanofluids against time	65
Table 19: Incremental Recovery after WaterFlooding using Nanofluids against Pore Volumes	66
Table 20: Shows a plot of Oil Recovery during Polymer Flooding against the Pore Volume injected and the graph underneath it shows a graphical representation of the result.....	69
Table 21: Permeability Impairment.....	72