



بسم الله الرحمن الرحيم

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**"A study on the inhibitory effect of some synthesized surfactants
against biofilms to mitigate microbial corrosion"**

A THESIS SUBMITTED

BY

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Dedication

***To my great parents, brothers,
My wife Rasha and my lovely children***

Hamza, Ahmed,

Rody & Obay

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LIST OF ABBREVIATIONS

Symbol	Meaning
APB	Acid-producing bacteria
API	American Petroleum Institute
ATP	Adenosine Triphosphate
CFU/ml	Colony Forming Unit per millilitre
CLSM	Confocal laser scanning microscopy
CMC	Critical Micelle Concentration
EPS	Extracellular polymeric substance
GC	Gas chromatography
FTIR	Fourier transform infrared spectroscopy
MIC	Microbially influenced corrosion
mN /m	Milinewton per meter
MPN	Most probable number
NACE	National Association of Corrosion Engineering
nm	Nanometer
NMR	Nuclear magnetic resonance spectroscopy
NR-SOB	Nitrate-reducing/sulfide-oxidizing bacteria
NUB	Nitrate-utilizing bacteria
PCR	Polymerase chain reaction
ppm	Part per milion
sp.	Species
SEM	Scanning electron microscopy
SRB	Sulfate-reducing bacteria

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بسم الله الرحمن الرحيم

" قَالُوا سُبْحَانَكَ لَا عِلْمَ لَنَا إِلَّا هَا

حَلَّمْتَنَا إِنَّكَ أَنْتَ الْعَلِيمُ الْحَكِيمُ "

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ABSTRACT

Sulfate reducing bacteria are considered as the major cause of microbial induced corrosion. It contributes to a lot of environmental and other major industrial problems in petroleum industry. In this work, three Schiff base cationic surfactants coded (Q12, Q14 and Q18) were synthesized and characterized using FT-IR and ^1H -NMR techniques. Mixed culture of SRB collected from an oil field production tank located in North Bahrya Petroleum Company (NORPETCO), Egypt. Metagenomic analysis using next generation sequencing technique was used to identify and characterize the microbial community of collected samples.

The antimicrobial effect of the new synthesized surfactants was studied against the target SRB along its different growth phases by different methods; viable cell count via most probable number method, estimation of biogenic sulfide concentrations, weight loss of iron coupons in microbial growth medium and biofilm examination on coupon surfaces using scanning electron microscope.

The results of metagenomic analysis revealed that the formation water sample has a high degree of microbial variation, where the

phylum *Proteobacteria* was most dominant with 60% of total reads in the phylum level, it was also overwhelmingly dominated by the family *Desulfovibrionaceae* and it was found to comprise about (53%) of total reads. Moreover, *Desulfovibrio alaskensis* was the most predominant species of sulfate reducing bacteria SRB in the sample.

The synthesized surfactants expressed a high inhibition effect on the bacterial growth, recording a minimum inhibitory concentration of 750 ppm for Q18 and 1000 ppm for both Q12 and Q14, with a considerable decline in the biogenic sulfide production from dose of 500 ppm until the complete suppression at a dose of 1000 ppm. Also the synthesized surfactants showed sufficient metal corrosion inhibition at a concentration of 500 ppm. These results were confirmed by the scanning electron microscope images.

Key words: : Sulfate reducing bacteria; Environmental concerns; Biocide; Corrosion inhibitor; Vanillin Schiff base; Cationic surfactants.
