

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

Sudan University of Science and Technology

College of Science department of chemistry

*Wax Treatment Chemicals Compared with Diluents and Their Impact on
Improving the Flow Properties of Sudanese Crude Oil*

المواد الكيميائية المستخدمة في معالجة الشمع ومقارنته مع المذيبات وأثرها في تحسين
خواص الإنسياب لخام النفط السوداني

A thesis Submitted in Fulfillment for the Requirements of Master Degree in Chemistry

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April 2016

بِسْمِ اللَّهِ الرَّحْمَنِ الرَّحِيمِ

يَرْفَعُ اللَّهُ الَّذِينَ آمَنُوا مِنْكُمْ وَالَّذِينَ أُوتُوا الْعِلْمَ دَرَجَاتٍ وَاللَّهُ بِمَا
تَعْمَلُونَ خَبِيرٌ

اللَّهُ الْعَظِيمُ

Dedication

To my mother and father

To my husband and kids

To my brothers, sister and friends

Without their help, support and encouragement this work

Could not be accomplished

Acknowledgments

I would like to express my sincere gratitude to Dr.Gurashi Abdalla Gasmelseed for his supervision and guide.

I want to thanks also my mother, son and daughters for their love, support and prayers

Many thanks to my father ,husband for their continuous help and support during this study

And special thanks to my brothers and sisters

I would also like to express my sincere gratitude to central petroleum laboratories CPL Staff

and final thanks to neimat , amani, hala, hazim and ahmed for their help in laboratory work ,data collection and comments

Abstract

The aim of this Study is to characterizing the Pour Point Depressant (PPDs) by GC and FTIR, Evaluating their Impact on Flow Properties in Sudanese Crude Oil (Neem Filed) and Comparing their Effect with Kerosene and Diesel.

Five commercial pour point depressant have been tested for their structure and effectiveness in remediating paraffin (wax) depositions from neem crude oil. All PPDS were characterized by FTIR the results showed that all sample contain aromatic compound, aliphatic compound but some of them contain ester and olfien .The samples were also surveyed by GC ,The results show follows all PPDS Contain mainly different type of solvents such as ethyl benzene ,O-xylene,p-xylene,toluene in high concentration ,naphthalene ,cyclopentylcyclopentene,1,2,3,4tetramethyl benzene,1,2,3trimethyl benzene and eicosadiene in small concentration

PPDS evaluated as pour point depressant and flow improver on neem crude oil. the pour point and viscosity at different temperature for different doses (500,750,1000,1250ppm) were studied by measuring viscosity and pour point, result showed that the best viscosity was improved when adding epr2 at doses1250 ppm then epr1 then china PPDS but epr25j1 did not have any effect in these type of crude oil . the result of pour point showed that the best results were epr2 PPDS giving a reduction in pour point of 9 C^0 ,followed by epr1 PPDS , china PPDS ,but epr25j1 did not have any effect

Also kerosene and diesel have been tested for their effectiveness in remediating paraffin wax depositions from neem crude oil and compare it with PPDS ,it is found that need high doses of solvent(5%,10%,15%,20%,25%,30%,35%) to make change in the pour point and viscosity this compares with PPDS .

But in term of cost, it is found that these large doses are not a problem because they are retrieved when distilling crude oil into product.

When comparing kerosene with diesel, it is found that the rate of reduction in pour point and viscosity of neem crude oil in kerosene bigger than diesel

GC and FTIR were used to study the chemical composition of wax extracted from two type of Sudanese crude oil (neem,hadida),the result showed that it consists of only normal paraffins ,the carbon number distribution in neem crude oil fromC11-C29 and the critical carbon numberC17,For hadida crude oil the carbon number distribution C11-C30 and the critical carbon number C15.

Also the DSC-1 was used to measure melting point and crystallization point of wax the results showed that the melting point from wax extracted from neem 52C^0 and crystallization is 46C^0 ,and for hadida crude oil the melting point is 68C^0 and the crystallization point is 63C^0 .

المستخلص

الهدف منة هذه الدراسة هو دراسة وتحليل المواد الكيميائية المستخدمة في تخفيض نقطة الإنسكاب بواسطة جهازي (الغاز كروماتوغرافي والاف تي أي ار) بالإضافة الي تقييم أثر هذه الكيماويات في تحسين إنسيابية خامات النفط السوداني وقد تمت الدراسة تحديداً في حقل نيم . وكذلك تمت مقارنة هذا الأثر بعد معالجة الخام بالكيروسين والديزل . تم اختبار خمسة انواع من المواد الكيميائية التجارية المستخدمة لتخفيض درجة حراره الانسكاب للخامات البترولية من ناحية التركيب ومن ناحية فعاليتها في علاج ترسيب البرافين المتكون في النفط الخام .ولقد تم دراسة التركيب بواسطة جهاز الاف تي أي ار واطهرت النتائج ان هذه المواد الكيميائية تحتوي على مركبات اروماتيه ومركبات اليفاتيه ولكن بعض منها يحتوي ايضا على استرات واليفينات .وايضا تم دراسته التركيب لهذه المواد بواسطة جهاز الغاز كروماتوغرافي والنتائج اوضحت ان كل هذه الانواع تحتوي بصوره رئيسيه على انواع مختلفه من المذيبات مثال لها الايثايل بنزين والاورثو زابيلين والتولوين بنسب عاليه وايضا تحتوي على النافثينات والسيكلوبنتايل والسايكلوبنتين وايكوسارين بنسب بسيطه .وايضا تم تقييم فعاليتها في علاج البرافين المترسب علي خطوط الانابيب وتمت دراسته على خام حقل نيم حيث تم اخذ العينات في الربع الاول من 2014 وذلك عن طريققياس نقطة الانسكاب وقياس اللزوجه وتم اضافتها بنسب مختلفه هي 500 ، 750 ، 1000 ، 1250 واطهرت النتائج ان افضل هذه الانواع هو ابري تو عند اضافته بنسبة 1250ويليه ابري وان ويليه جاينا ولكن ابري خمس وعشرون جي وان ليس له اي تأثير على هذا النوع من الخامات .واوضحت نتائج نقطة الانسكاب ان افضل نوع هو ايضا ابري تو حيث خفض نقطة الانسكاب بحوالي تسع درجات ثم يليه في الترتيب ابري وان ثم يليه جاينا واخيرا ابري خمس وعشرون جي وان حيث لم يحدث اي تغير في درجة الانسكاب .وايضا تم دراسة الكيروسين والديزل من ناحية فعاليتهم في منع ترسيب الشمع البرافيني المتكون في خام نيم ومقارنتهم مع هذه المواد الكيميائية ووجد انه لا بد من اضافة كميات كبيره من هذه المذيبات لتخفيض درجة حرارة الانسكاب واللزوجه وذلك بالمقارنه مع هذه المواد الكيميائية.ووجد انه من ناحية تكلفه ان هذه النسب الكبيره غير مؤثره لانها تسترجع عند تقطير الخام الي منتجات

وتم ايضا دراسة الشمع المستخلص من نوعين من الخامات السودانيه(خام حقل نيم ,خام حقل حديد)من ناحية التركيب وذلك عن طريق جهازين الافتي اي ار والغاز كروماتوغرافي واطهرت النتائج ان النوعين من الشمع يحتويان على سلاسل برفاينيه فقط وان خام نيم يحتوي C11-C29 واكبر نسبه وزنيه هي C17 اما خام حديده يحتوي من C11-C30 واكبر نسبه وزنيه هي C15 .

وتم قياس درجة الانصهار ودرجه التجمد لهذا الشمع ووجد ان درجة الانصهار لنيم هي 52درجه مئوية اما درجة التجمد

هي46اما بالنسبه لخام حديده وجد اندرجة الانصهار هي 68درجه مئوية اما درجة التجمد هي63

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List of Abbreviations

PPD	Pour Point Depressant
FTIR	Fourier Transform Infrared Spectroscopy
DSC	Differential scanning calorimeter
UOP	Procedure used to measure wax content in crude oil