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Study of Corrosion in Crude Oil Storage Tanks of Marsa Bashayer II -Sudan

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ABSTRACT

The aim of this study is to determine the impact of corrosion on the crude oil storage units used by Petrodar Company and to investigate the causes of internal and external corrosion of low carbon steel which used in above-ground crude oil storage tanks that may lead to leakages, pollution, disasters and potential impacts.

The Low carbon steel was tested in liquid medium crude oil, crude oil and seawater mixture 1:1. The results were found that corrosion on low carbon steel but slowly at an annual rate (0.3125 mm / y) and (0.3250 mm / y) respectively.

The weight loss for low carbon steel in crude oil, crude oil and seawater mixture were tested, the average weight loss of the low carbon steel was found to be (3.0 mg) in 456 hours.

The tests also included the measurement of the pH value in the presence of low carbon steel in both crude oil and mixture of crude oil and seawater the results were found (6.10 - 6.85) and (5.27 - 6.36) respectively.

The Chemical Analysis result of crude oil sample show 4.20 mg /g total acid content (TAN) which conceder to be very high content

ملخص الدراسة

هدفت هذه الدراسة لتحديد آثر التآكل على وحدات تخزين النفط الخام التي تستخدمها شركة بترودار. ونسبه لمخاطر التآكل الداخلي والخارجي للصلب منخفض الكربون المستخدم في خزانات النفط الخام فوق الأرض مما يؤدي إلى كوارث محتملة من تسرب وتلوثات بالنفط ,حيث تم إجراء تجارب التأكل على معدن الصلب منخفض الكربون في وسط سائل من النفط الخام ومزيج من النفط الخام ومياه البحر ودلت النتائج على وجود تآكل على الصلب منخفض الكربون لكن ببطء ، أي بمعدل سنوي مقداره (0.3250mm/y) و (0.3125mm/y) لكل منهما على التوالي.

كما اجريت تجارب قياس فقدان الوزن للصلب منخفض الكربون في كلا الوسطين النفط الخام ومزيج النفط الخام ومياه البحر حيث وجد إن متوسط الوزن المفقود للصلب الكربوني(3.0 mg) في كل منهما خلال (456 ساعة).

كما شملت التجارب قياس الرقم الهيدروجيني للوسط أثناء وجود الصلب منخفض الكربون في كل من النفط الخام ومزيج النفط الخام ومياه البحر حيث وجد ان النتائج (6.10 -6.85) و(5.27- 6.36) لكل منهما على التوالي. كما تم التحليل الكيميائي لعينه من النفط الخام حيث وجد أن نسبة الأحماض الكلية عاليه جدا (4.2 ملج/جم) .

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5.1 Conclusion

To conclude, the low carbon steel corroded at a very low and acceptable rate in crude oil and composite of Crude oil and Sea Water due to the noncorrosive nature of the organic hydrocarbons in crude oil and composite of Crude oil and Sea Water. The behavior of the steel based on its microstructure experienced corrosion first at selective regions which were at areas having the ferrite phase due to its susceptibility to corrosion. A form of reaction between carboxylic acid in the crude oil and composite of Crude oil and Sea Water with the metal contributed to the corrosion of the low carbon steel. When the metals corroded, they experienced weight loss. The dissolution of metallic ions contributed to the corrosion reactions, thus, reducing the pH of the two by evolution of hydrogen ions. After the samples were removed, the pH started to increase due to the introduction of oxygen and neutralization reaction occurring forming water. From these results a simple and cheap method of inspection for corrosion can be designed.

5.2 Recommendations

I recommend that this experiment be carried out for hours more 456 hours and temperature included as a variable to examine the effect of temperature. Additional analysis should be done, such as analysis of the surface using EDS. In addition to pH, crude oil and tank drain water composition should be analyzed as the experiment goes on. The pilling Bed worth ratio can also be used in addition to corrosion rate to tell us more about the ratio between the scales formed and the corroded metal for further knowledge on the scales formed.