Comparative Analysis of Acetylation and Oxidation on Produced Water from Otakikpo Marginal Field, Niger Delta.

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Abstract

This study is aimed at comparative analysis of acetalization and oxidation on four samples defined as follows: Sample A (EAS Acetalization filtrate + produced water), Sample B (EAS oxidation filtrate + produced water), Sample C (AYB Acetalization filtrate + produced water), and Sample D (AYB oxidation filtrate + produced water) obtained from Otakikpo Marginal field in Niger Delta in terms of four parameters: Chloride, Total hardness, Total dissolved solid and Total suspended solid respectively. In terms of chloride samples, A, B and D increased chloride level in mg/l while sample C decreased in chloride level in mg/l, in terms of Total hardness samples A, C and D decreased in total hardness in mg/l while sample B increased in total hardness in mg/l, in terms of total dissolved solid samples A, B C and D all decreased in total dissolved solid level in mg/l and finally in terms of total suspended solid samples B, C and D increased in total suspended solid level in mg/l while sample A decreased in total suspended solid level in mg/l.

Keywords: Acetylation, Oxidation Sample, produces water

1 Introduction

Produced water is a complex mixture of dissolved and particulate organic and inorganic chemicals in water and usually ranges from fresh water to saline brine. It is a naturally occurring water that comes out of the ground with oil and gas. Acetylation is an organic esterification reaction with acetic acid through the introduction of acetyl functional group into a chemical compound. Chemical oxidation is a process used to treat water polluted with aromatic compounds like benzene. (Nwokoma & Dagde, 2012).

Mohammad et al., (2019), in their study opined that produced water ha large amounts of hydrocarbons, heavy metals in addition to other contaminants. As a result of increased rate in the production of oil and gas activities produced water production has been on the increase and this has necessitated the need for its treatment and possibly reuse. They also outlined some methods that can be employed in the treatment of produced water which are physical (membrane filtration, adsorption etc.), chemical (precipitation and oxidation), and biological (activated sludge, biological aerated filters and others) methods respectively.

Alfredo et al., (2020) in their thesis considered well injection as an alternative treatment method for produced water, however high operational cost is a big challenge for this method of treatment. The focus of their research was to develop low-cost technology and optimization system design and operation that will treat produced water effectively.

Angela & Robert (2010) in their work stated that produced water is a fluid trapped in the rock of oil reservoir. Their research was aimed at design a mobile station plant for efficiently treating produced water for agricultural irrigation. The result obtained from their research showed that treatment of produced water was less expensive that disposing by injection method.

2 Materials and Methods

2.1 Sample Collection and Preservation

Produced water which was used as control plus four additional samples defined as follows : Sample A (EAS Acetalization filtrate + produced water), Sample B (EAS oxidation filtrate + produced water), Sample C (AYB Acetalization filtrate + produced water), and Sample D (AYB oxidation filtrate + produced water) where collected from a Crude processing oilfield in Niger Delta region in Nigeria and stored in beakers labeled A to D plus control making a total of five samples to be analysed for Chloride ion, Total Hardness , total dissolved solid and total suspended solid respectively.

2.2 Determination of Chloride

to a 50ml of the sample add 5 drops of phenolphthalein indicator solution and neutralize with 0.1M sulphuric acid to the colourless side of phenolphthalein. 1ml of potassium chromate indicator solution was added before titration with standard silver nitrate solution to a pinkish yellow endpoint. A reagent blank titration was carried out into the sample for titration. Chloride in mg/l in the sample was calculated as

$$\left[\frac{(A-B)(N)(35.5)}{V}\right] X\ 100$$

Where A = Silver nitrate solution in ml for sample titration

B = Silver nitrate solution in ml for blank titration

N = Normality of the silver nitrate

V = sample volume in ml

2.3 Determination of Total Hardness

25ml of sample was placed in different clean flask. To this were added 3ml of ammonium chloride in concentrated ammonia buffer and 2 drops Erichrome black T indicator. This was titrated against 0.01M EDTA solution until there was colour change from violet to blue. Total Harness was then calculated from the formular

Hardness in mg/l = volume of EDTA X Molarity of EDTA

2.4 Determination of Total Dissolved Solid

A portion of water was filtered out and 10ml of the filtrate was measured into a pre-weighed evaporating dish. The sample was then dried in an oven at a temperature of 103^{O}C to 105^{O}C for two hours. The dish was transferred into a desiccator and allowed to cool room temperature and was weighed. Total dissolved solid was then calculated from the formula

$[(W_2 - W_1)]\ X\ 1000$ Per ml of sample used

Where W_1 = initial weight of evaporating dish

W_2 = Final weight of the dish

2.5 Determination of Total suspended Solid

10ml of the sample was measured and passed through a filter paper after it has been weighed. The residue was dried and reweighed. Total suspended solid was then calculated from the formular

$$\frac{[Weight\ of\ Dry\ Residue + Filter\ paper - weight\ of\ Dry\ paper]\ x\ 1000}{Volume\ of\ sample}$$

3 RESULTS AND DISCUSSION

Table 1 shows the result obtain from all four samples plus control sample in terms of chloride, total hardness, TDS and TSS respectively.

Table 1: Analysis of produced water with four other samples

Samples	Cl (mg/l)	Hardness(mg/l)	TDS(mg/l)	TSS (mg/l)
Sample A	26.2	1.3	21.54	0.03
Sample B	20.45	4.7	21.56	0.05
Sample C	15.15	2.05	21.76	0.06
Sample D	23.25	3.1	21.53	0.05
Control	15.5	4.5	22.01	0.04

Table 1 shows the analysis of produced water which is used as control in addition to four samples labelled A to D which are defined as follows : Sample A (EAS Acetalization filtrate + produced water), Sample B (EAS oxidation filtrate + produced water), Sample C (AYB Acetalization filtrate + produced water), and Sample D (AYB oxidation filtrate + produced water).

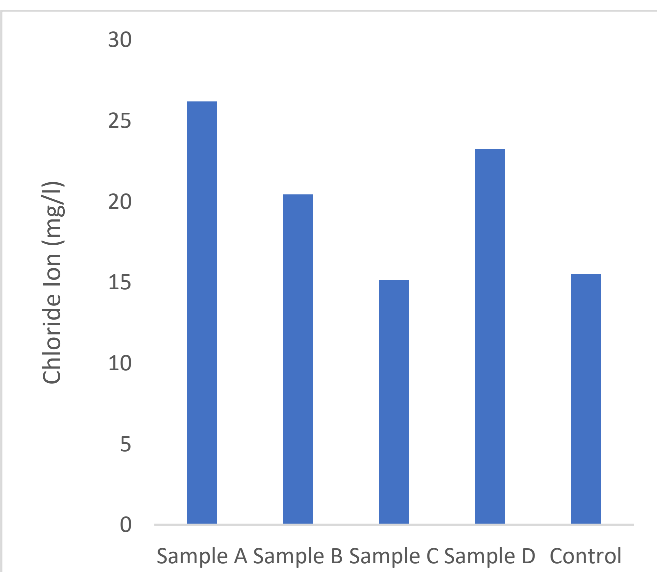

Figure 1: Chloride Ion for samples

Figure 1 shows the effect of acetalization and oxidation on produced water in terms of chloride ion. Sample A increased the chloride of produced water from 15.50 mg/l to 26.20mg/l , sample B increased the chloride level of produced water from 15.50 mg/l to 20.45mg/l, sample C decreased the chloride level of produced water from 15.50 mg/l to 15.15mg/l, sample D increased the chloride level of produced water from 15.50 mg/l to 23.25mg/l,

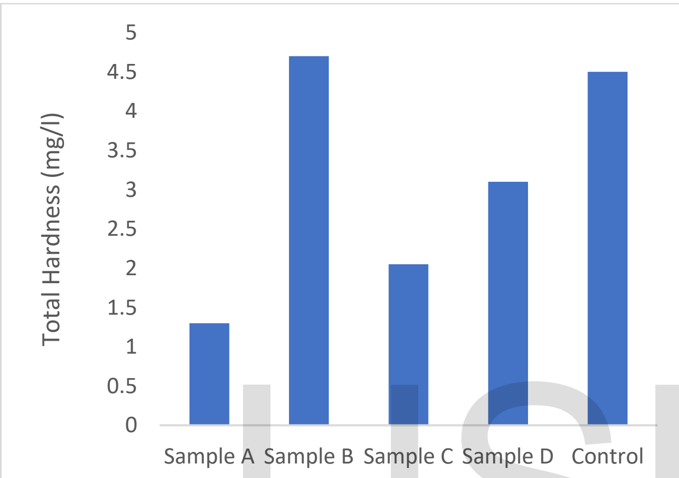

Figure 2: Total Hardness for samples

Figure 2 shows the effect of acetalization and oxidation on produced water in terms of total hardness. Sample A decreased the total hardness of produced water from 4.5 mg/l to 1.3mg/l , sample B increased the total hardness level of produced water from 4.5 mg/l to 4.7mg/l, sample C decreased the total hardness level of produced water from 4.5 mg/l to 2.05mg/l, sample D decreased the total hardness level of produced water from 4.5 mg/l to 3.1mg/l,

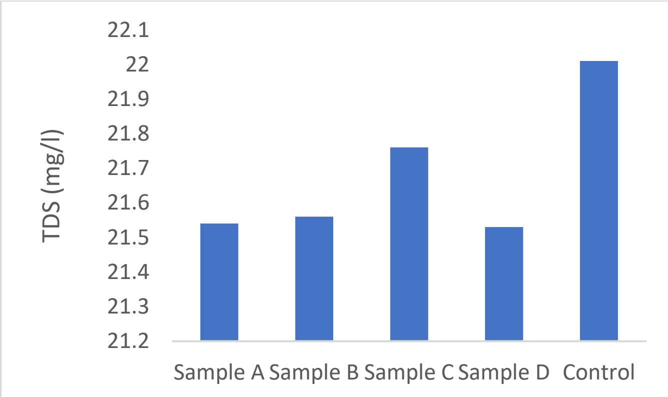

Figure 3: Total Dissolved Solid for samples

Figure 3 shows the effect of acetalization and oxidation on produced water in terms of total dissolved solid. Sample A decreased the total dissolved solid level of produced water from 22.01 mg/l to 21.54mg/l , sample B decreased the total dissolved solid level of produced water from 22.01 mg/l to 21.56mg/l, sample C decreased the total dissolved solid level of produced water from 22.01mg/l to 21.76mg/l, sample D decreased the total dissolved level of produced water from 22.01 mg/l to 21.53mg/l.

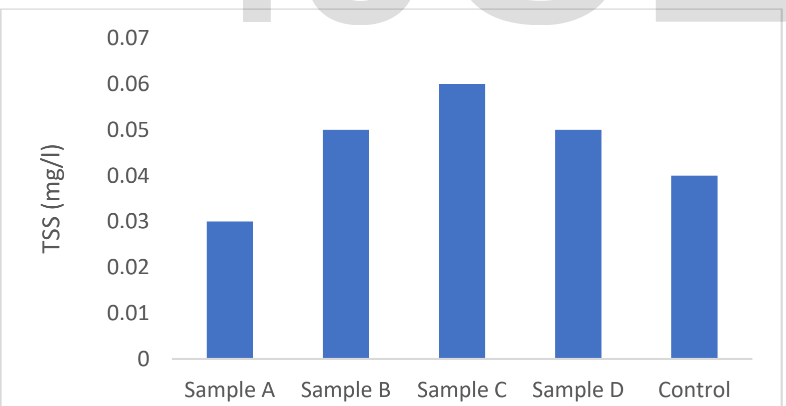

Figure 3: Total Suspended Solid for samples

Figure 3 shows the effect of acetalization and oxidation on produced water in terms of total suspended solid. Sample A decreased the total suspended solid level of produced water from 0.04 mg/l to 0.03 mg/l, sample B increased the total suspended solid level of produced water from 0.04 mg/l to 0.05mg/l, sample C increased the total suspended solid level of produced water from mg/l to 0.06mg/l, sample D increased the total suspended level of produced water from 0.04 mg/l to 0.05mg/l.

4 Conclusion

This study has been able to establish the effect of acetalization and oxidation on four samples defined as follows: Sample A (EAS Acetalization filtrate + produced water), Sample B (EAS oxidation filtrate + produced water), Sample C (AYB Acetalization filtrate + produced water), and Sample D (AYB oxidation filtrate + produced water) in terms of four parameters: Chloride, Total hardness, Total dissolved solid and Total suspended solid respectively. In terms of chloride samples A, B and D increased while sample C decreased, in terms of Total hardness samples A, C and D decreased while sample B increased, in terms of total dissolved solid samples A, B C and D all decreased and finally in terms of total suspended solid samples B, C and D increased while sample A decreased.

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