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Determine The Surface Tension of Alkaline Solutions (Naoh,Koh,Nahco3)

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Abstract:- The idea behind the current work is to Find Surface Tension of Different Fluids like Alkaline solutions to know the Difference between them. And to know the Efficiency of each Alkaline solutions in Enhance Oil Recovery. After the conventional water flood processes a substantial amount of remaining oil resides in the reservoir due to poor sweep efficiency. However, technically it is possible to improve the recovery efficiency by applying Enhanced Oil Recovery (EOR) processes. Chemical flooding methods such as NAOH, KOH, NAHCO3.

Keywords :- Alkaline Solutions, KOH, NAOH, NAHCO3, Surface Tension.

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I. INTRODUCTION

Surface tension is a measure of the free energy of the surface per unit area. It can be thought of as the work required to expand the surface by unit area. Surface tension of pure liquids, which is a constant value, is measured by techniques now classified as static surface measurement. Surfactants are substances which alter the surface properties of liquids, even when present in small quantities. Composed of two fractions, a lyophilic group and a lyophobic group, surfactants migrate to the surface, resulting in the lyophilic portion lying within the solution and the lyophobic group orienting itself away from the solution. This orientation of the surfactant reduces the free energy of the surface, thus decreasing surface tension and increasing surface viscosity. Diffusion of surfactants to the surface continues until equilibrium is established. The transient period when surfactants diffuse to the surface is the basis for dynamic surface tension Measurements techniques, differing primarily in the time element [2].

A consequence of surface tension reduction, especially in aerated waste measurement techniques is similar to staticProduction of foam. Although foams often incur no additional treatment costs, they have an unsightly appearance and can result in nuisance residues. Not all surfactants, when used in the same concentrations, produce the same level of foam or have the same persistence to foam. The mechanisms for foam stability are currently under investigation. Another effect of surfactants in wastewater treatment plants is on oxygen transfer. There is no general consensus as to the actual effect surface techtension has on oxygen transfer some researchers indicate a decrease; others observe an increase, while others see no change. This discrepancy in part results because of differences in aeration devices, but may also be due to the relationship between dynamic surface tension and bubble hydrodynamics. It is the purpose of this paper to begin preliminary investigation into the relationship between oxygen transfer and dynamic surface tension. The first section of this paper discusses the various surface tension measuring methods, both static and dynamic. The second section addresses the topic of surfactants and surface tension measurements. A related topic also discussed here is foam stability. The last section discusses the relationship between dynamic surface tension and oxygen transfer[2].

1. Surface Tension

Surface tension is the elastic tendency of a fluid surface which makes it acquire the least surface area possible. Surface tension allows insects (e.g. water striders), usually denser than water, to float and stride on a water surface. At liquid-air interfaces, surface tension results from the greater attraction of liquid molecules to each other (due to cohesion) than to the molecules in the air (due to adhesion). The net effect is an inward force at its surface that causes the liquid to behave as if its surface were covered with a stretched elastic membrane. Thus, the surface becomes under tension from the imbalanced forces, which is probably where the term "surface tension" came from. Because of the relatively high attraction of water molecules for each other through a web of hydrogen bonds, water has a higher surface tension compared to that of most other liquids. Surface tension is an important factor in the phenomenon of capillarity. Surface tension has the dimension of force per unit length, or of energy per unit area. The two are equivalent, but when referring to energy per unit of area, it is common to use the term surface energy, which is a more general term in the sense that it applies also to solids. In materials science, surface tension is used for either surface stress or surface free energy.

2. NAOH (Sodium Hydroxide)

Sodium hydroxide, also known as caustic soda or lye, is a highly corrosive compound that is used in many oil and gas applications. It is used to control alkalinity and pH in aqueous solutions and is effective in breaking down organic matter. It is a strong base, and very soluble in water, alcohol, and glycerin. In oil and gas applications, sodium hydroxide is an important chemical to maintain the integrity of water-based drilling fluids. The drilling fluids are responsible for optimizing and improving drilling efficiency and well stability. Maintaining the proper viscosity and pH is an important step in the drilling process. In well drilling sodium hydroxide neutralizes gases in rock formations, increases viscosity of the drilling fluids, and is a source of hydroxyl ions for control of pH. The increased viscosity prevents heavy material from settling in the borehole. In water based muds or drilling fluids it increases and maintains alkalinity and pH levels. Sodium hydroxide is also used in petroleum production and refining. It is used to remove impurities such as sulfur compounds and carbon dioxide. Removing these impurities is part of the sweetening process of refining and a necessary requirement to meet regulatory specifications. The oil and gas industry utilizes sodium hydroxide for its alkalizing properties to maintain proper and effective drilling fluid performance as well as refining the final products.

3. KOH (Potassium Hydroxide)

Potassium hydroxide, commonly called caustic potash, has many industrial uses and is found in many chemicals that contain potassium. The oil and gas industry uses potassium hydroxide to improve drilling and well efficiency as well as in the refining process. In drilling hard, brittle, water-sensitive shales such as clay, potassium hydroxide is often used in injection fluids and drilling muds because it improves the stability of the shale as the well is drilled. The potassium ions attach to the clay's surface and minimize dispersion of the cuttings into finer particles which could impede drilling. It increases mud pH and helps to make lignite soluble and easy to remove. Once oil and gas are recovered, they must be refined into useable forms. Potassium hydroxide is a chemical that is widely used in the petroleum refining process to remove contaminants. Potassium hydroxide is a strong base that is reactive toward acids. The oil and gas industry takes advantage of this reactivity to acids and uses potassium hydroxide to remove unwanted organic acids and sulfur compounds from raw petroleum. Removing impurities improves the end-product and is necessary to meet regulated specifications. Known as sweetening, this major refinery treatment improves odor, color, oxidation stability, and reduces concentrations of carbon dioxide. A caustic solution treatment of potassium hydroxide removes organic acids such as naphthenic acids and phenols, and sulfur compounds such as mercaptans and H_2S, improving the odor and color of the refined products.

4.Ring Tensiometer Method

The ring method, more formally known as the Lecomte du Nouy ring method (du Nouy, 1918, 1919), is the technique most often used by researchers for static surface tension measurement. The advantage of this method is that the surface tension can be determined directly from the force required to pull the ring from a liquid . There is no need to calibrate the method with other methods or known solutions (Freud 5 Freud, 1930) . Surface tension for the du Nouy method is the mechanical force necessary to lift a platinum ring of known wire radius (Rs) and ring radius (RR) from the solution surface[1] . The equation describing this process is

$$\gamma = pf/4\pi R_r$$

γ = surface tension
P=force or pull necessary to detach ring from solution surface
V=volume of solution displaced by the pull of the ring
F=Harkins-Jordan correction factor = f(RR/Rw,RR/V)

II. PROCEDURE

Surface tension is measured in Tensiometer with the help of platinum ring of 1cm diameter attach the ring to the hook available and place the sample below the ring so that the ring touches the upper surface of the sample and slowly increase the pressure of the hook so that the ring pulls up wards And tension creates apply the pressure on the ring until the ring gets separate from the above surface of the sample and note the readings[4].

(Fig 1) Tensiometer

(Fig 2 KOH Solution)

Take 2 gm of KOH in 100ml of distilled water and mix it well so that it dissolves well in the water and now place it on ring tension meter. Repeat the same procedure for NAOH ns $NAHCO_3$.

III. TABLE

Alkaline Fluids	Temperature In ˚C	Quantity In 100ml Of Distilled Water	Readings Dyne/Cm
Koh	37	2gm	67
	38	3gm	54
Naoh	34	2gm	46
	35	3gm	50
Nahco3	33	2gm	72
	33	3gm	66
Naoh+Koh	36	1+1=2gm	54
	42	2+2=4gm	49
Koh+Nahco3	34	1+1=2gm	60
	35	2+2=4gm	58
Naoh+Nahco3	34	1+1=2gm	58
	35	2+2=4gm	51

IV. Result

The Difference between various Fluids is known That single mixed Alkaline Chemicals are more Efficient For EOR and the various mixture of Fluids are less efficient and harmful for the Reservoir properties and Bore Hole Environment Since they are highly corrosive.

V. Conclusion

1. Based on the experimental results which were conducted to examine the effect of Alkaline Solutions on the Ring Tensiometer and Surface tension the following conclusions can be drawn.
2. Variation of surface tension with different alkali concentrations are shown in above table it has been observed that Lowest Surface tension of alkali was 46Dyne/cm that is NAOH and it is more efficient for EOR[3].
3. Early alkaline flooding evolved into a three-part system consisting of an alkali source, surfactant and polymer. It was found that a dilute silicate / surfactant/ polymer solution produced superior results compared to surfactants or polymers alone. The alkali portion helps reduce interfacial tension for increased oil mobility and reduces the concentration requirements for polymers and surfactants[3].

1. Properties

1. Lowers interfacial tension at the crude/water interface.
2. Reduces levels of divalent metal ions.
3. Reduces surfactant adsorption/retention.
4. Increased water-wetness.

2. Benefits

1. Earlier recovery.
2. Higher total recovery.
3. Lower chemical costs.
4. Better sweep efficiency.

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