

## Determination of Critical Parameter of Fluids: Surface Tension Analysis Using Tensiometer

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**Abstract:-** Presently industries are using ring tensiometer method to find the surface tension and interfacial tension between air and liquid because, results can quickly retrieved with very less time and can be calibrated easily. Surface tension is defined as the tension of the surface film of a liquid causing by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize the surface area. The measurement value of surface tension and interfacial tension which are considered to be critical parameter for oil recovery is given by unit dynes/cm.

**Keywords:** - Ring method, Surface tension, Interfacial tension.

### I. INTRODUCTION

The Surface Tension is defined as the tension of the surface film of a liquid caused by the attraction of the particles in the surface layer by the bulk of the liquid, which tends to minimize surface area. It is due to the phenomena of surface tension that the drops of water tend to assume a spherical shape to attain minimum surface area. The du Noüy ring method is one technique by which the surface tension of a liquid can be measured. The method involves slowly lifting a ring, often made of platinum, from the surface of a liquid. This method utilizes the interaction of a platinum ring with the surface of the liquid. The ring is submerged below the inter-face by moving the stage where liquid container is placed. After immersion, the stage is gradually decreased and the ring pulls up the meniscus of the liquid. Eventually the meniscus would tear from the ring. Prior to this event, the volume (and thus the force exerted) of the meniscus passes through the maximum value and begins to drop before the actual tearing event.

#### 1.1 Surface Tension

The tendency of a fluid surface which make it occupies the least surface area is called as Surface tension. Surface tension allows lighter fluids to float on denser fluids. The surface tension force affects the shapes and the motions of the liquid that have open surfaces [1]. The surface tension will be always measure at liquids-air interfaces. Since water molecules have high attraction due to their hydrogen bonds, water has a higher surface tension (67 dynes/cm) compared to other liquids. Surface tension plays an important role in the phenomenon of capillarity.

The surface tension is always measured with respect to the unit length, the Surface tension when referring to energy per unit of area it is common to use the term surface energy.

#### 1.2 Interfacial tension

Interfacial tension is the force that holds the surface of a particular phase together and is normally measured in dynes/cm. Interfacial tension is almost similar to that of surface tension the only difference is that the interfacial tension is the tension between two different liquids whereas the surface tension is the tension between a liquid and air, The main forces involved in interfacial tension is adhesive forces or adhesive tension. The interaction occurs at the surfaces of the substances involved, that is at their interfaces. The interfacial tension is mainly caused by the tension formed between the two different fluids, in the E.O.R (Enhanced Oil Recovery) method the IFT or the interfacial tension between the crude oil and water is reduced by using alkyl salts to enhanced the production.

### II. PROCEDURE

To measure surface tension, attach the clean ring to the lever arm. Place the liquid whose surface tension is to be measured in a clean container, such as evaporating dish, watch glass, or beaker, at least 4.5 cm in diameter. Place the container on the sample table. With screw 'B' in its uppermost position, raise the entire

sample table assembly until the ring is immersed approximately 5mm into the liquid and is approximately centered with respect to the container. Lower the liquid further by means of screw 'B' until the ring is just in the surface of the liquid and the index is approximately on zero. Increase the torsion of the wire by rotating knob 'A' and , at the same time, lower the sample table means of screw 'B' to keep the index on zero. The index is to be kept on zero even though the surface of the liquid is distended. Continue adjusting the knob and the screw simultaneously until the film breaks. The scale reading at the breaking point of the film is the force of the pull exerted on the ring, or the apparent surface tension 'p' dynes/cm.

### III. OBSERVATION

Sample	Surface Tension (Dynes/Cm)
Sae-30 Oil	34
Sae-40 Oil	32
Petrol	28
Water	67

### IV. CONCLUSION

From the above experiment, we conclude that the surface tension of various fluids (water, SAE-40, petrol, SAE-30). It is found that the surface tension of water is greater than all the other fluids taken for the experiment. The surface tension is obtained as follows:

Water > SAE 30 > SAE-40 > Petrol

### REFERENCES

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