International Refereed Journal of Engineering and Science (IRJES)
ISSN (Online) 2319-183X, (Print) 2319-1821
Volume 6, Issue 2 (February 2017), PP. 30-31

Determination of Contact Angle for Various fluids Used in Industries

Abiya James[1], V. M Jomy[1], Tomin Kurian[1], C. M Vishnu[1], A. Rajesh Kanna[2,*]
[1]*Students, Department of Petroleum Engineering, LORDS Institute of Engineering & Technology, Hyderabad, India*
[2]*Professor & HOD, Department of Petroleum Engineering, LORDS Institute of Engineering & Technology, Hyderabad, India*
** Corresponding author email: rajeshkanna@lords.ac.in*

Abstract :- An attempt is made to measure the contact angle of different fluids in water, gear oil, multi stoke engine oil, using imaging method. It give the wettability of rock or the formation in this study we used metal plates that is silver .if the angle formed is above 90° than it is non-wet fluid than it is immiscible if it is below 90 deg then it is wettable than it is miscible.

Keywords: - contact angle, petroleum samples, immiscible, water, gear oil

I INTRODUCTION

The term contact angle is the angle, conventionally measured through the liquid, where a liquid–vapour interface meets a solid surface. It quantifies the wettability of a solid surface by a liquid via the Young equation. A given system of solid, liquid and vapour at a given temperature and pressure has a unique equilibrium contact angle. However, in practice contact angle hysteresis is observed, ranging from the so-called advancing (maximal) contact angle to the receding (minimal) contact angle. The equilibrium contact is within those values, and can be calculated from them. The equilibrium contact angle reflects the relative strength of the liquid, solid, and vapours molecular interaction.

The Young–Laplace equation for a three-dimensional drop is highly non-linear. This is due to the mean curvature term which includes products of first- and second-order derivatives of the drop shape function Solving this elliptic partial differential equation that governs the shape of a three-dimensional drop, in conjunction with appropriate boundary conditions, is extremely complicated, and an alternate energy minimization approach to this is generally adopted [1]. The open-source software, Surface Evolver, which solves for the drop shape by minimizing the sum of potential and surface energies, has been used by many for this purpose. The shapes of three-dimensional sessile and pendant drops have been successfully predicted using this energy minimization method [2].

1.1 Typical Contact Angles

Contact angles are extremely sensitive to contamination; values reproducible to better than a few degrees are generally only obtained under laboratory conditions with purified liquids and very clean solid surfaces. If the liquid molecules are strongly attracted to the solid molecules then the liquid drop will completely spread out on the solid surface, corresponding to a contact angle of 0°. This is often the case for water on bare metallic or ceramic surfaces, although the presence of an oxide layer or contaminants on the solid surface can significantly increase the contact angle. Generally, if the water contact angle is smaller than 90°, the solid surface is considered hydrophilic and if the water contact angle is larger than 90°, the solid surface is considered hydrophobic. Many polymers exhibit hydrophobic surfaces. Highly hydrophobic surfaces made of low surface energy (e.g. fluorinated) materials may have water contact angles as high as ~120°.Some materials with highly rough surfaces may have a water contact angle even greater than 150°, due to the presence of air pockets under the liquid drop.

These are called super hydrophobic surfaces. If the contact angle is measured through the gas instead of through the liquid, then it should be replaced by 180° minus their given value. Contact angles are equally applicable to the interface of two liquids, though they are more commonly measured in solid products such as non-stick pans and waterproof fabrics.

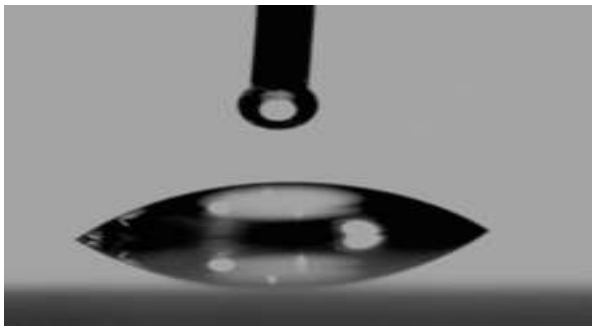

Figure 1: Image of water drop on glass with reflection below

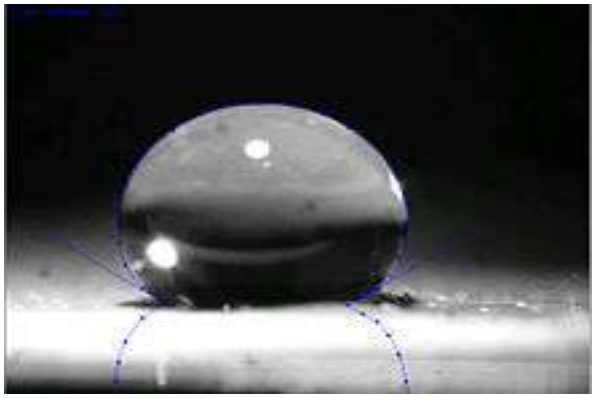

Figure 2: Water drop on a lotus leaf surface at angle approximately 147°

II. MATERIAL & METHODS

Normal tap water, Gear oil: Spirax EW SAE 80W-140, Engine oil: SAE OW - 20 Multi grade viscosity motor oil are able to perform at a wide range of temperature.

III. EXPERIMENTAL PROCEDURE

Fill the syringe with water and fix it to the stand carefully inject droplet of the water on the glass cell or metal cell. Adjust the imaging system until a drop is in focus that is a clean outline of the image appears on the screen. Take image picture and measure the dimension of the drop image. Repeat the same procedure for different samples.

IV. RESULT

The left contact angle of water is 71.323 deg and right contact angle is 80.34 deg. The left contact angle of engine oil is 29.31 deg and right contact angle is 30.6 deg. The left contact angle of gear oil is 29.31 deg and right contact angle is 30.69 deg.

V. CONCLUSION

The contact angle of water is more when compared to other fluid samples and it is more wettability than other fluids. The water present in petroleum reservoirs are much solid wet than other fluids. This is mainly due to change in their density.

REFERENCES

[1]. R. Kidambi, P. N. Shankar. The effects of the contact angle on sloshing in containers, Proceedings of the Royal Society A: Mathematical, Physical and Engineering Sciences, 2251-2267, 2004.

[2]. J. J Magada, J. Y. Lee., TAPPI J, 82(3) : 139, 1999.