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STUDY OF LIQUID CONTACT ANGLE IN DIFFERENT SOLID SURFACES

AZWAN BIN AIRUDDIN

Report submitted in partial fulfillment of the requirements
for the award of the degree of
Bachelor of Engineering in Manufacturing Engineering

Faculty of Manufacturing Engineering

UNIVERSITI MALAYSIA PAHANG

June 2016

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ABSTRACT

The purpose of this study is to analyse the contact angle on different material of solid surfaces and to analyse the liquid drop shape on different material. The materials used include aluminium, Perspex, mild steel and wood. There are many methods have done to find contact angle. In this study, sessile drop is used to find contact angle as it is easy to apply. Then adobe Photoshop software is used to process the image and measure the contact angle and diameter of spreading liquid on different solid materials. From this study shown that Perspex has higher contact angle then aluminium and mild steel and wood has low contact angle reading. For the wettability wood state the highest result compare to other solid materials used. The low contact angle result the high wettability and high reading of contact angle has low surface free energy.

ABSTRAK

Tujuan kajian ini adalah untuk menganalisis sudut sentuh cecair pada bahan yang berbeza daripada permukaan pepejal dan untuk menganalisis bentuk titikan cecair pada bahan yang berbeza. Bahan-bahan yang digunakan termasuk aluminium, perspek, keluli lembut dan kayu. Terdapat banyak kaedah telah dilakukan untuk mencari sudut sentuh cecair. Dalam kajian ini, kaedah sessile drop digunakan untuk mencari sudut kenalan kerana ia adalah mudah untuk memohon. Maka perisian adobe Photoshop digunakan untuk memproses imej dan mengukur sudut sentuh cecair dan diameter menyebarkan cecair pada bahan-bahan pepejal yang berbeza. Daripada kajian ini menunjukkan bahawa perspek mempunyai sudut sentuh cecair lebih tinggi maka aluminium dan keluli lembut dan kayu mempunyai bacaan sudut sentuh yang rendah. Bagi kayu mempunyai kebolehbasahan yang paling tinggi berbanding dengan bahan-bahan pepejal lain yang digunakan. sudut sentuh yang rendah menyebabkan kebolehbasahan yang tinggi dan bacaan tinggi sudut kenalan mempunyai tenaga bebas permukaan rendah.

CHAPTER 1

PROJECT BACKGROUND

1.1 Introduction

In nature, rain drop on surfaces is the clear example to discuss the significant of liquid's contact angle. The application are also present in our lungs, we can see the flow of liquid that covered with membranes and also the film of tears of the cornea in our eyes. The term of contact angle is defined as a droplet of liquid that is in contact with the surface of material as shown in figure 1.1. Then, the angles will be measured between the surface and the liquid form on the material surfaces. Nowadays, the contact angle measurement is significantly applied in various industrial fields, such as microfluidics, spraying, printing, and coating.

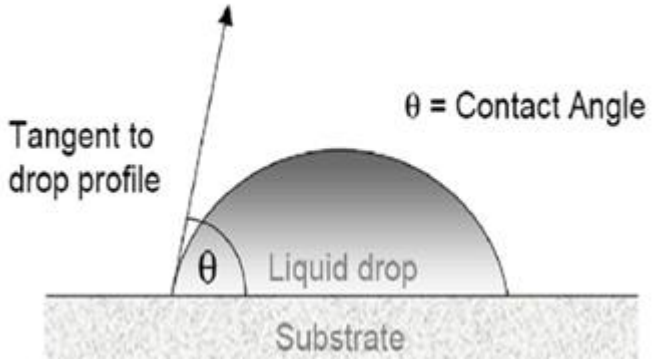

Figure 1.1: Definition of contact angle

Source: (Rudawska et al. 2009; Zhao et al, 2004).

Until now it is increasingly hard to ignore the role of contact angle measurement. Therefore, many studies and researches associate with the contact angle. The first approach has been done on the measurement of contact angle is done between 13 June 1773 to10 May 1829 by Thomas Young. His research was focused on treating the contact angle of a liquid with a surface as the mechanical equilibrium of a drop resting on a plane solid surface under the control of three surface tensions. The research leads to the equation of Young's equation as shown in Eq. (1.0)

$$\text{Cos } \Theta e = \frac{\gamma sv - \gamma sl}{\gamma lv} \qquad (1.0)$$

Where, γsv is surface tension at interface of the solid and vapour phase, γsl is surface tension at interface of solid and liquid phase while γlv is surface tension at interface of the liquid and vapour phase as described in figure 1.2.

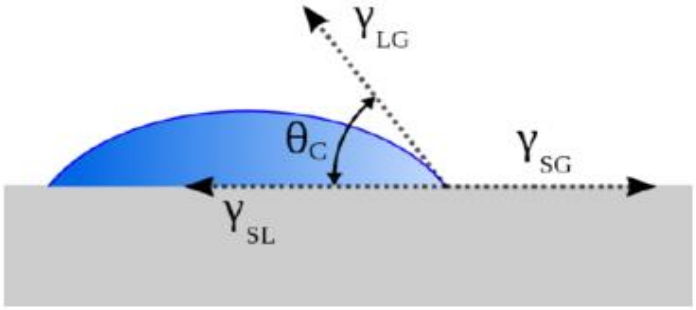

Figure 1.2: Description of Young's modulus

Source: (Rudawska et al. 2009; Zhao et al, 2004).

There are many factors that cause the differences of contact angle of liquid. Among them, the surface material that contact with the liquid droplet has become the main factor. As we know, the surface of material is not always in the because of the properties aspects. That is the different materials have different properties such as roughness, hardness, tensile, and so on. Thus in this study, four different types of material will be which are glass, wood, plastic and stainless steel.

REFERENCESS

This thesis is prepared based on the following references;

Chen, H., Tang, T., & Amirfazli, A. (2015). Effect of contact angle hysteresis on breakage of a liquid bridge. The European Physical Journal Special Topics, *224*(2), 277-288. doi:10.1140/epjst/e2015-02359-1

Das, A. K., & Das, P. K. (2010). Equilibrium shape and contact angle of sessile drops of different volumes—Computation by SPH and its further improvement by DI. Chemical Engineering Science, *65*(13), 4027-4037. doi:10.1016/j.ces.2010.03.043

Grundke, K., Pöschel, K., Synytska, A., Frenzel, R., Drechsler, A., Nitschke, M., . . . Welzel, P. B. (2015). Experimental studies of contact angle hysteresis phenomena on polymer surfaces — Toward the understanding and control of wettability for different applications. Advances in Colloid and Interface Science, *222*, 350-376. doi:10.1016/j.cis.2014.10.012

Jaroslaw Drelich, Emil Chibowski, Dennis Desheng Meng, & Konrad Terpilowski (2011) Hydrophilic and Superhydrophilic Surfaces and Materials. Soft matter, 7(21), 9804-9828

Kubiak, K. J., Wilson, M. C. T., Mathia, T. G., & Carval, P. (2011). Wettability versus roughness of engineering surfaces. *Wear*, *271*(3-4), 523-528. doi:10.1016/j.wear.2010.03.029

Schuster, J. M., Schvezov, C. E., & Rosenberger, M. R. (2015). Influence of Experimental Variables on the Measure of Contact Angle in Metals Using the Sessile Drop Method. *Procedia Materials Science, 8*, 742-751. doi:10.1016/j.mspro.2015.04.131

Yuan, Y., & Lee, T. R. (2013). Contact Angle and Wetting Properties. *51*, 3-34. doi:10.1007/978-3-642-34243-1_1

Zhou, X. B., & Hosson, J. T. M. D. (1995). Influence of surface roughness on the wetting angle. *AG Groningen, The Netherlands, 10*, 9.