6th International Conference of Multidisciplinary Approaches (iCMA), 2019
Faculty of Graduate Studies,
University of Sri Jayewardenepura,
Sri Lanka

ISSN: 2386 – 1509

INVESTIGATION OF DIFFERENT DROP SHAPE ANALYSIS TECHNIQUES FOR MEASURING CONTACT ANGLES IN SESSILE DROPS

Senarathna RMDM[1,2], Wanniarachchi WKIL[1] and Jayawardhana S[1*]

[1]Department of Physics, Faculty of Applied Sciences,
University of Sri Jayewardenepura, Sri Lanka
[2]Faculty of Graduate Studies, University of Sri Jayewardenepura, Sri Lanka
sasanijay@sci.sjp.ac.lk

Abstract

Contact angle measurement is the most widely used technique for determining surface wettability and surface free energy. These parameters are vital in material development and fluid dynamics studies. Such studies rely on accurate contact angle measurement which can be obtained from a simple manual goniometric method or through an advanced automated system which deposits liquid on to a target surface (sessile drop method) and calculates contact angles by analyzing a captured image of the drop profile which is called drop shape analysis. Drop shape analysis is performed by fitting mathematical functions on the profile data. In this work, a comparison between common fitting methods using computer-generated image profiles and dynamic wettability measurements using the most accurate fitting method is reported. A custom-built device was used to create sessile drops and capture drop images. Widely used mathematical fitting methods that support non-axisymmetric profiles such as polynomial fitting of different orders and double circle fitting were compared. The results showed that the 2nd order polynomial fitting is the best method of measuring contact angles in the range 50° – 180° with an accuracy of 98.5 ± 0.1%. Advancing, receding and sliding angles can be accurately determined by the study of profile variation using the respective graphs. The advancing, receding contact angles and sliding angles were obtained for distilled water on top of a non-textured pure poly-dimethylsoloxane surface. The 2nd order polynomial fit was used to measure dynamic contact angles and the experimentally obtained advancing angle was ~90% accurate and receding contact angle was ~80% accurate compared to literature values. The sliding angle of sessile water drops was not compared due to insufficient literature.

Keywords: sessile drops, contact angle, curve fitting, drop shape analysis, polynomial fitting