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A Rapid Screening Method to Evaluate Waterproof Degree of Halal Mascara by Contact Angle Measurement and Adhesion Tape Test

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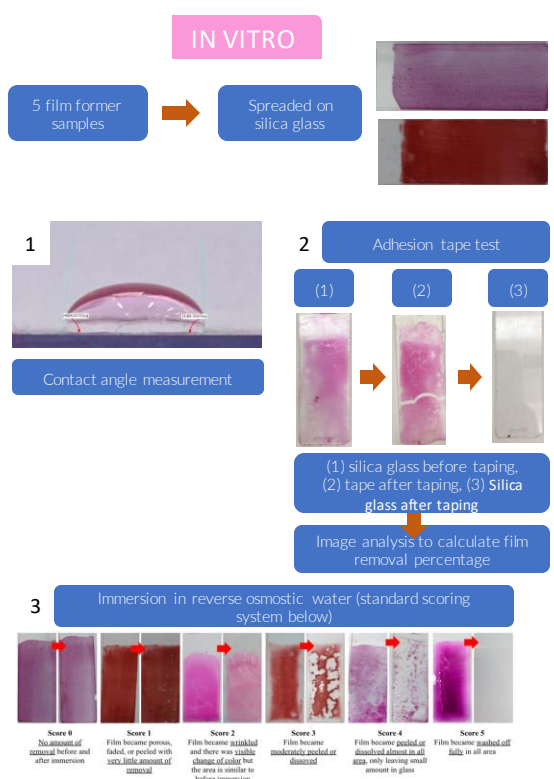
INTRODUCTION

Waterproof character produced by film former incorporation in mascara products is one of the essential attributes for customer's preference. This study aimed to find rapid screening methods to assess the waterproof degree of halal mascara products and their film former ingredients. Through this research we assess several in vitro parameters such as contact angle and adhesion to predict the in vivo waterproof ability of mascara by consumer test.

MATERIALS & METHODS

In-vitro test was conducted by spreading layers of film formers and mascara samples. For the immersion test, the film was immersed in reverse osmosis water. Contact angle of the water droplet on film samples was measured using a digital microscope. For the tape test, the film was pulled by pressure sensitive tape and evaluated using image analysis. The in-vivo test was performed to represent the mascara condition after wudu. Statistical analysis was conducted to determine the correlation between in-vitro and in-vivo tests.



FF1	Trimethylsiloxysilicate
FF2	VP/Eicosene Copolymer
FF3	Acrylates/Polytrimethylsiloxymethacrylate Copolymer
FF4	Styrene/Acrylates/Ammonium Methacrylate Copolymer
FF5	Styrene/Acrylates Copolymer

RESULTS & DISCUSSION

Result from in vitro test (contact angle, adhesivity, water immersion) and in vivo waterproof consumer test are shown in **Figure 1, Table 1 and Figure 2** below, respectively :

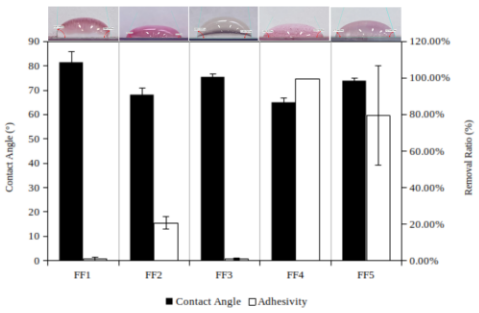


Figure 1. Contact angle (with visualization) and adhesivity test result in film former samples

Table 1. Water immersion score on silica glass plate of each material

Sample	Film Former	Mascara
FF1	0	0
FF2	0	0
FF3	3	0
FF4	4	3
FF5	3	3

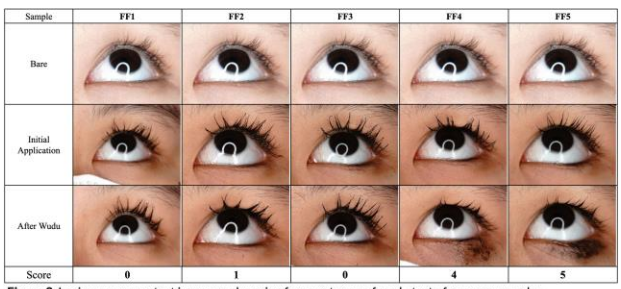


Figure 2. In vivo consumer test images and scoring from waterproof wudu test of mascara samples.

The Spearman correlation test between in vitro and in vivo parameters are shown in **Table 2** below :

Table 2. Spearman correlation test between in vitro and in vivo parameters.

Parameter	Correlation coefficient (r)	P-value
In vitro film former contact angle vs immersion test	0.527	0.361
In vitro film former adhesivity vs immersion test	0.738	0.155
In vitro film former immersion test vs mascara immersion test	0.761	0.135
In vitro mascara immersion test vs in vivo waterproof test	0.889	0.044

The Spearman correlation test between both contact angle and adhesivity with immersion test in film former samples showed higher strength of coefficient value in adhesivity. It means that waterproof ability is both the result of how film layers were affected by external impact of water (represented by contact angle) and how the film layers were attached to the substrate (represented by adhesion). The illustration can be seen in **Figure 3** below :

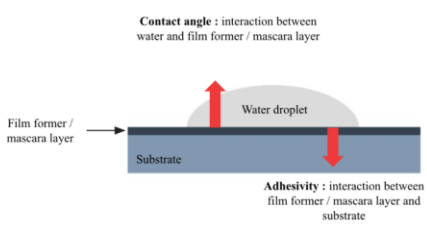


Figure 3. Illustration of constructive impact of contact angle and adhesivity to waterproof ability

Further, Spearman correlation test also shown significant correlation between in vitro immersion test of mascara with in vivo waterproof test on consumer. This indicated that in vitro immersion test in mascara is a representative method to check quality of waterproof ability from selected film former.

CONCLUSIONS

A simple and cost-effective in vitro method has been found for evaluating waterproof mascara based on contact angle and adhesiveness. There is an in vitro test correlation. Mascara with low contact angle and adhesion test tends to have a lower immersion test score. The result correlates with the in-vitro test in which less waterproof mascara shown worse wudhu test results with many peeled off film and smudge after face washing step. To create a halal market in the future, further research is needed on formulations and evaluations based on waterproof mascara permeability.

ACKNOWLEDGEMENT

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