

# Effect of flame cleaning of platinum plates when using the Wilhelmy plate method for surface tension measurements

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**Device** Surface Tensiometers and Contact Angle Meters (DMo series)

**Point** Flame-cleaning platinum plates for surface tension measurements using the Wilhelmy plate method is vital

**Keywords** Surface tension, cleaning, platinum plate cleaning, Wilhelmy method



## Principle

The platinum plate must have a contact angle of 0° with the liquid sample to be measured; in other words, it must be completely wetted. If a contact angle exists, the direction of surface tension is oblique to the direction of balance detection (vertical downward), resulting in a smaller surface tension value than the liquid's actual (true) value (Fig. 1).

$$\gamma = F/L \cos\theta$$

- $\gamma$  : Surface tension
- F : Pulling force on the plate
- L : Perimeter of the plate
- $\theta$  : Contact angle of the plate and the liquid

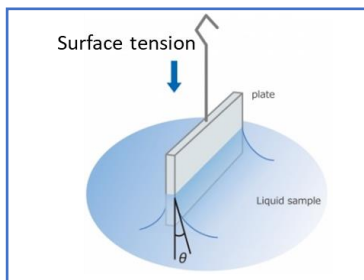


Fig. 1 - Illustration of the surface tension measurement

## Measurements and results

We conducted the test using our former surface tensiometer model CBVP-Z using the Wilhelmy plate method under the following conditions:

Liquid sample: about 30 mL of distilled water  
 Measurement probe: Platinum plate  
 Room temperature: 24.8 ± 0°C  
 Relative humidity: 43.0 ± 0%

As a result (Fig. 2 indicated on red box), the water surface tension value before the flame cleaning (2<sup>nd</sup> time) was about 9 mN/m lower than that after the cleaning (3<sup>rd</sup> time), and the error was larger than the reference value of about 72 mN/m. From this, one can conclude that before the flame cleaning, the surface of the plate was contaminated, affecting the water contact angle and resulting in a lower surface tension.

Comment	Ave.	S.D.	1	2	3
	Surface Tension	Surface Tension	Surface Tension	Surface Tension	Surface Tension
	mN/m	mN/m	mN/m	mN/m	mN/m
1 n=2,before, n=3,after	69.51	5.02	72.14	63.72	72.68

Fig. 2 - Raw data of water surface tension. The red box indicates the value obtained before and after flame cleaning the Platinum plate.

To corroborate the measured data, we measured the water contact angle of the Platinum plate with our legacy contact angle meter model DMO-501 immediately after flame cleaning (A) and after exposing it in the air for an hour (B) and a day (C). The results are shown in Fig. 3.

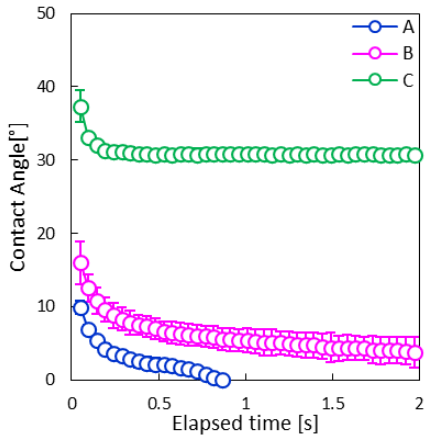


Fig. 2 - Relation of the platinum plate with/without flame cleaning and the water contact angle

In the case of A, the initial water contact angle was  $10^\circ$ , but it became  $0^\circ$  in less than a second, indicating its ideal state for measuring surface tension. In the case of B and C, the water contact angle of the platinum plate exposed to the atmosphere is about  $5^\circ$  and  $30^\circ$ , respectively. Hence, the surface of the platinum plates was contaminated compared to A.

### Conclusion

Flame cleaning of the platinum plate is critical to avoid sample contamination and accurately measure surface tension using the Wilhelmy plate method.