Experimental investigation of the drying effect on the interaction force between particles and substrate

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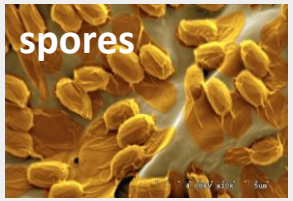
Background

In food industries many surfaces contaminated with *B. cereus*



- adhere strongly on all materials
- resistant to drastic environmental conditions

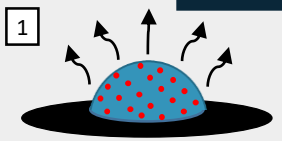
Motivation

To **understand the mechanisms of adhesion** and resistance to detachment, an essential parameter is the **interaction strength** F as a function of:

- Drying time
- Temperature
- Hydrophobicity

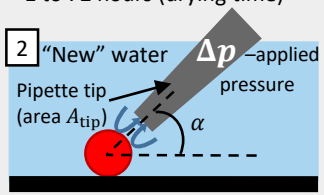
Method

1



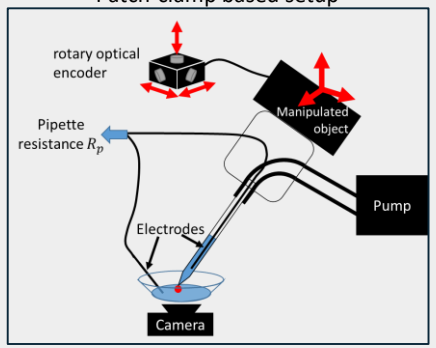
Complete drying under controlled temperature during 1 to 72 hours (drying time)

2 "New" water



$$F = A_{tip} \cdot \Delta p \cdot \sin \alpha$$

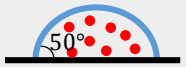
Patch-clamp based setup

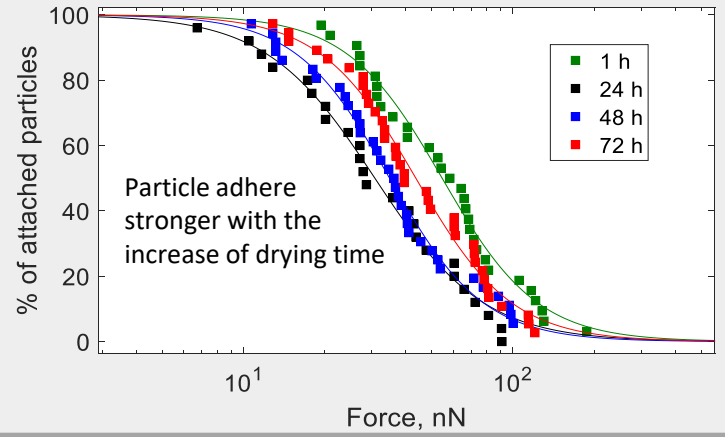


B.V. Safronov, W. Vogel, Electrical Activity of Individual Neurons: Patch-Clamp Techniques, in: W. U., J. H. (Eds.) Modern Techniques in Neuroscience Research. , Springer, Berlin, Heidelberg, 1999, pp. 173-192

Drying time effect

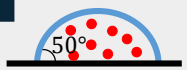
Hydrophobic latex particles (104°) of 6 μm diameter
Droplet contact angle with substrate 50°, temperature 50°C

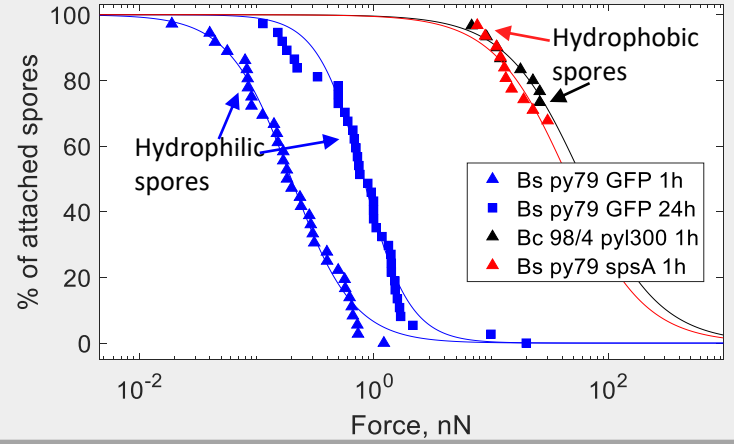




Spores

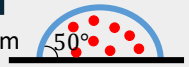
Diameter of spores ~ 1 μm
Temperature 40°C

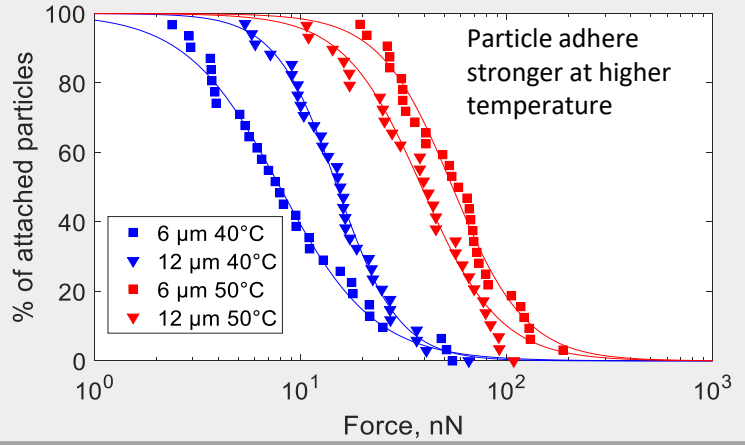




Temperature effect

Drying time 1h for latex particles of 6 or 12 μm
Temperature 40 or 50°C





Conclusions

- Wide adhesion force range for both, spores and particles
- Increase of drying time → Increase of adhesion force (except for 1h)
- Increase of temperature → Increase of adhesion force
- Hydrophilic spores adhere less than hydrophobic ones