Inhibiting *Pseudomonas aeruginosa* with *Staphylococcus epidermidis* encapsulated in a honey-based prebiotic-probiotic hydrogel

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Introduction

- In case of diabets, burns, or in hospital, a wound in the skin is the gateway to bacteria.
- Among them, the bacilli *Pseudomonas aeruginosa* can be lethal because of the increase in the resistance against antibiotics and therapeutic agent.
- In recent years, playing with skin microbiota (specifically, *Staphylococcus epidermidis*, a commensal bacterium[1]) represents a novel opportunity for anti-pathogen therapy[2,3]

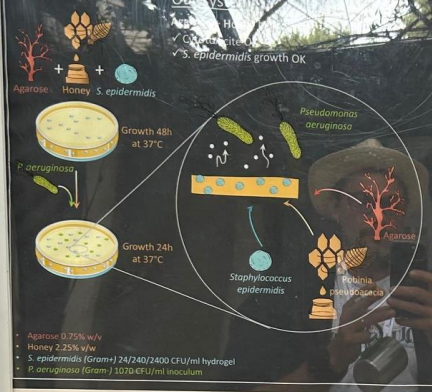
REF: [1] Nakatsuji et al., 2017, [2] Grice and Segre, 2011, [3] Callewaert et al., 2021.

My thesis focuses on developing a honey-based prebiotic-probiotic hydrogel capable of preventing the growth of *P. aeruginosa*.

Our Approach

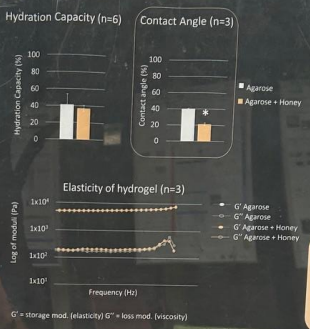
Our system

- Agarose
- Honey
- Good site of [illegible]
- ✓ *S. epidermidis* growth OK



- Agarose 0.75% w/v
- Honey 2.25% v/w
- *S. epidermidis (Gram+)* 24/240/2400 CFU/ml hydrogel
- *P. aeruginosa (Gram-)* 1070 CFU/ml inoculum

Our system's characteristics



G' = storage mod. (elasticity) G'' = loss mod. (viscosity)

⚠ Experiment without *S. epidermidis* in the hydrogel

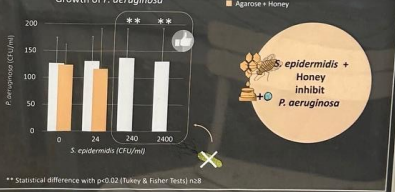
S. epidermidis in hydrogel

- ✓ No difference in hydration capacity
- ✓ No difference in viscosity and elasticity
- ✓ **Difference** in hydrophilicity
- ✓ **Honey modifies the size & the shape** of *S. epidermidis*

TEM : Thank to Eric Mathieu

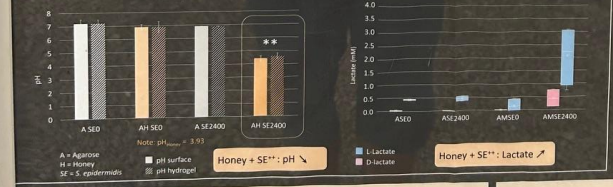
Inhibition of *P. aeruginosa* growth

- *P. aeruginosa colonies (on the surface of the hydrogel)*
- *S. epidermidis colonies (in the hydrogel)*

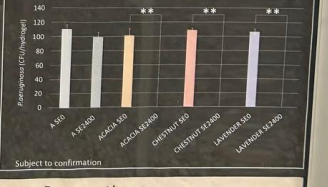


** Statistical difference with p<0.02 (Tukey & Fisher Tests) n≥8

Mechanisms



With other honey types



Subject to confirmation

Conclusion

- Honey and *S. epidermidis* separately influence the shape and aspects of *P. aeruginosa* colonies.
- Honey + *S epidermidis* influence the pH and lactate → **modification of sugar metabolism** by *S.epidermidis*
- **SYNERGY of Honey + *S. epidermidis* → inhibition of *P. aeruginosa growth***
- **SYNERGY depends on *S. epidermidis* concentration.**

Perspectives

- Understand the organization of colonies in & on hydrogels by confocal microscopy
- Confirming the modifications of SE's sugar metabolism by metabolomics and proteomics
- Completing the investigation of inhibition on other pathogens

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