Dynamics of Multi-species Biofilm Formation on Food Contact Surfaces

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Introduction

Food packaging is an essential component of the food industry as **it protects and conserves foods and products**. However, **food contact surfaces** are prone to **microbial adhesion and biofilm formation**, which, in turn, contribute to **food contamination** and **increase the risk of foodborne illness**.

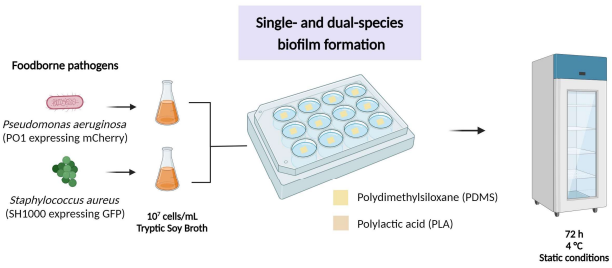
Foodborne pathogens, such as *Staphylococcus aureus*, *Escherichia coli* and *Pseudomonas aeruginosa* are able to form single- or multi-species biofilms. The **formation of multi-species biofilms** is particularly problematic, as they are often **less susceptible to disinfection procedures**.

Objective

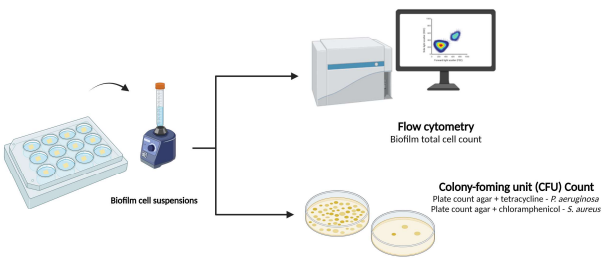
To understand the **dynamics of dual-species biofilm formation** on **polymeric surfaces** typically used for **food packaging** (e.g., polylactic acid (PLA) and silicone) in order to develop effective strategies to prevent biofouling.

Methodology

1. BIOFILM FORMATION



2. BIOFILM ANALYSIS



Results

SINGLE-SPECIES BIOFILMS

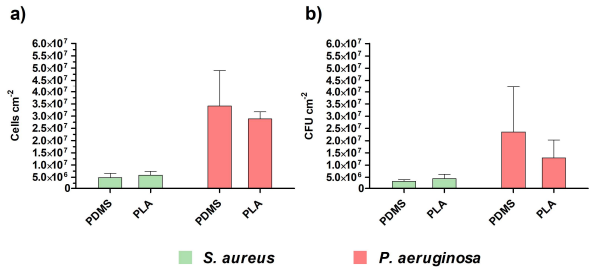


Figure 1. Total (a) and culturable (b) cells of *S. aureus* and *P. aeruginosa* biofilms formed on polydimethylsiloxane (PDMS) and polylactic acid (PLA) surfaces for 72h . Data are presented as mean ± standard deviation.

- ✓ Results showed that there were **no significant differences** between the number of total and culturable cells of ***S. aureus*** **and** ***P. aeruginosa*** **biofilms** formed on **PDMS** and **PLA surfaces**.
- ✓ ***S. aureus*** displayed **lower biofilm-forming capability** compared to *P. aeruginosa* ($p < 0.001$).

DUAL-SPECIES BIOFILMS

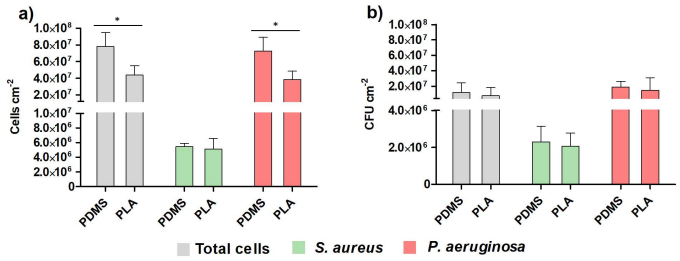


Figure 2. Total (a) and culturable (b) cells of dual-species biofilms of *S. aureus* and *P. aeruginosa* formed on polydimethylsiloxane (PDMS) and polylactic acid (PLA) surfaces for 72h . Data are presented as mean ± standard deviation. Asterisks denote significant differences between the number of cells obtained for PDMS and PLA (* *p*-value < 0.05).

- ✓ **Dual-species biofilms** exhibited a **higher number of cells** than **single-species biofilms** formed by *S. aureus* or *P. aeruginosa* ($p = 0.001$).
- ✓ **Dual-species biofilms** were almost entirely composed of ***P. aeruginosa*** (90%) and presented a **higher number of cells** on **PDMS than on PLA surface** ($p = 0.003$).

Conclusions

Both **polydimethylsiloxane and polylactic acid surfaces are susceptible to microbial adhesion and biofilm formation**, which can compromise food quality and safety.

Acknowledgements

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