In Vitro Characterization of a Lytic Bacteriophage Against *Pseudomonas fluorescens* for Application in Low-Sodium Cheeses

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INTRODUCTION

The problem

- **Excessive sodium intake** is associated with an **increased** risk of several diseases, driving the demand for **reduced-sodium dairy products**.
- **In cheese**, however, salt contributes not only to **flavour** and **texture** but also acts as an **important barrier** against spoilage microorganisms[1].
- **Reducing salt content** may improve nutritional value, but can also make cheese more **vulnerable** to **contamination** and **spoilage**, highlighting the need for alternative preservation strategies that ensure **safety**, **quality**, and **shelf life**.

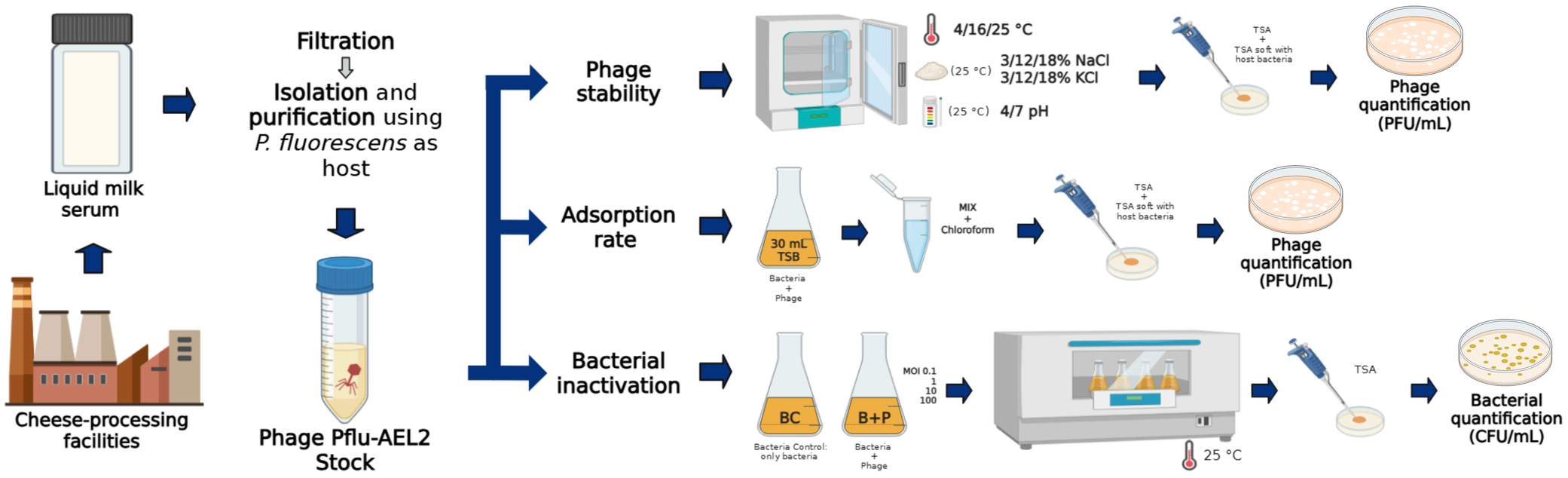
P. fluorescens

- ***Pseudomonas fluorescens*** is a **major food spoilage** microorganism frequently associated with **dairy products** and other **refrigerated foods**[2].
- Its **rapid growth**, **psychrotrophic** nature, capability of forming **biofilms**, and production of **heat-resistant proteases** and **lipases** that remain active during **refrigeration** make this bacterium an important spoilage organism.
- **Spoilage in cheese** includes **discoloration**, **pigment formation**, **off-flavours**, and **texture deterioration**, leading to a significant quality loss.

Possible solution

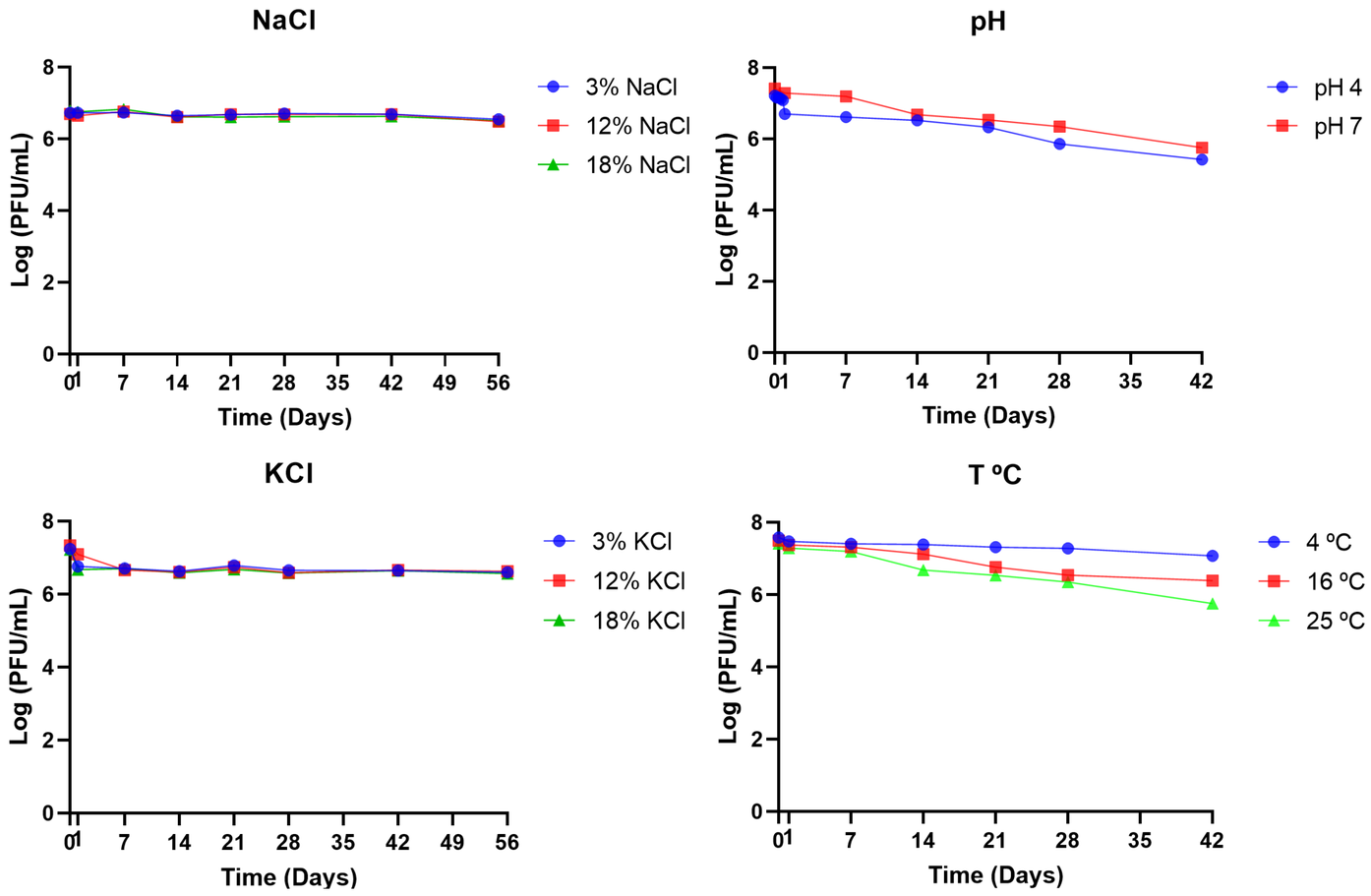
- **Bacteriophages (phages)** are **highly host-specific viruses** that infect and **lyse** undesirable bacteria, such as ***Pseudomonas fluorescens***, without affecting beneficial microbiota.
- **Lytic phages** are especially useful in **food applications** because they replicate inside the bacteria and cause cell lysis, leading to **rapid** bacterial reduction.
- In **dairy products,** the application of phages to milk or cheese surfaces has **shown potential** to control spoilage bacteria, representing a **promising strategy** for improving the quality and shelf life of low-sodium cheeses[3].

METHODOLOGY



RESULTS

Phage stability

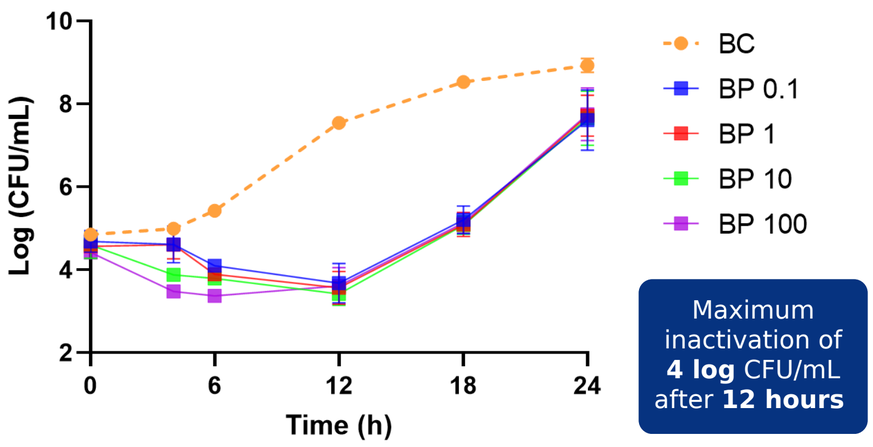


Highly stable at **all** the different concentrations of **NaCl** and **KCl**

Stable at **pH 4** and **7**

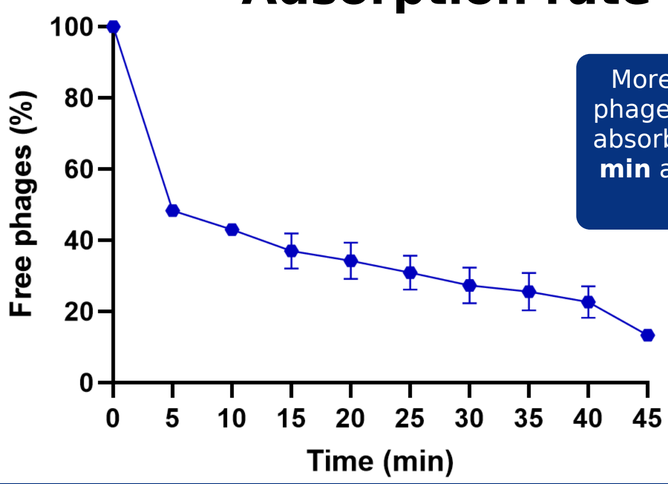
Stable at **4**, **16** and **25 °C**

Bacterial inactivation



Maximum inactivation of **4 log** CFU/mL after **12 hours**

Adsorption rate



More than **50%** of phage particles were absorbed after just **5 min** and **85%** after **45 min**

CONCLUSIONS

- The **phage Pflu-AEL2** exhibited **high stability** under salt stress, withstand different salt concentrations, and **remained stable**, for a long period of time, across the pH and temperature conditions **relevant to dairy processing**.
- The phage **adsorbed rapidly** to the bacterial host, indicating **efficient initial contact** and **fast binding** to the target cells, and demonstrated a **strong antibacterial activity**, being able to significantly **reduce** the bacterial population.
- From an application standpoint, these results suggest that Pflu-AEL2 has the **characteristics** required for food application and **compatible** with cheese production, highlight its potential to work as an **effective biocontrol agent** against ***P. fluorescens*-associated spoilage** in low-sodium dairy products.
- Further studies in **milk** and **cheese** are still necessary in order to fully understand the **efficacy** and consequently **safety** of this phage.

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