

The effect of cold preservation and extract formulation on the technological properties of cardoon (*Cynara cardunculus* L.) flower extracts for cheesemaking



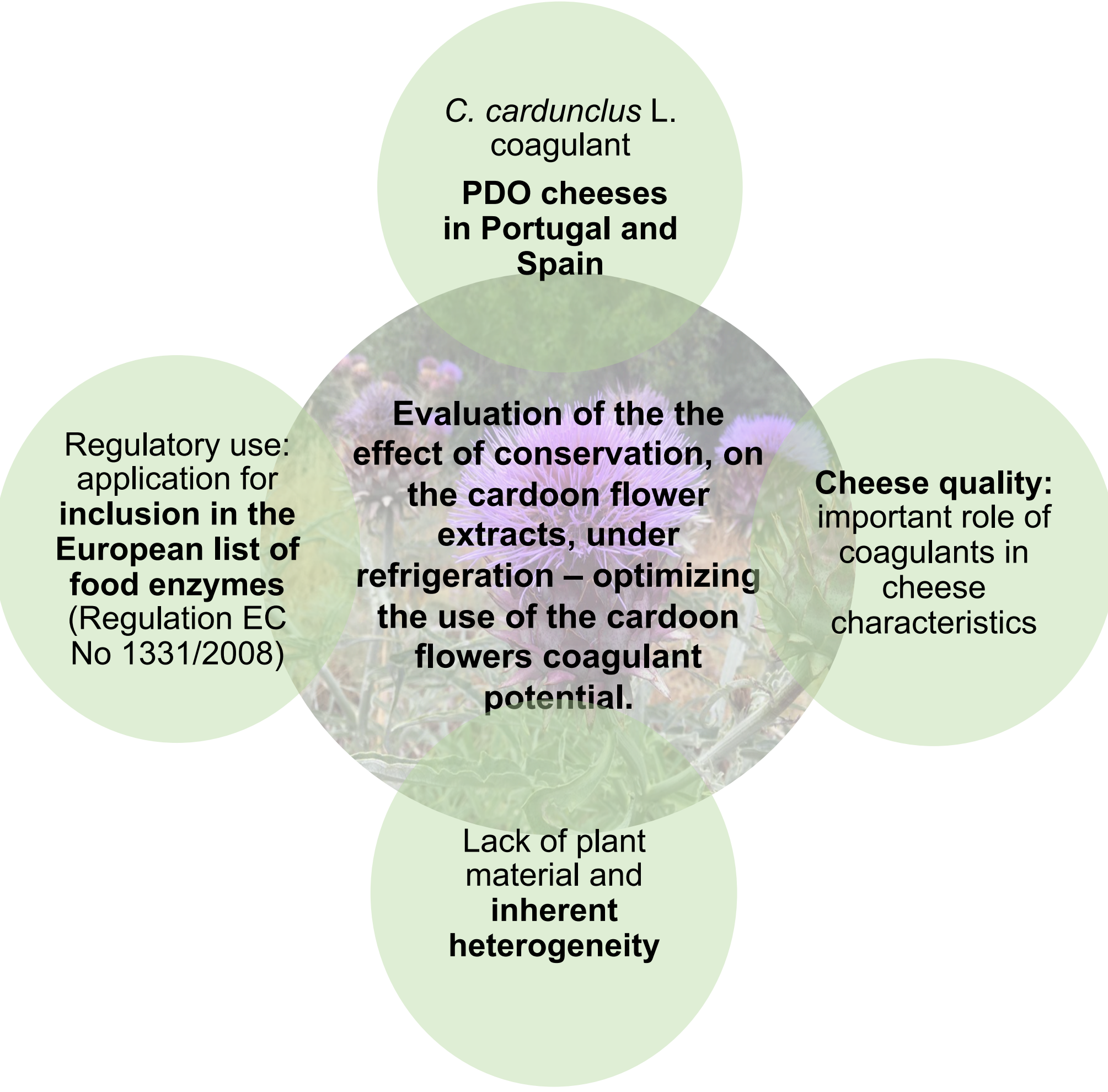
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Introduction

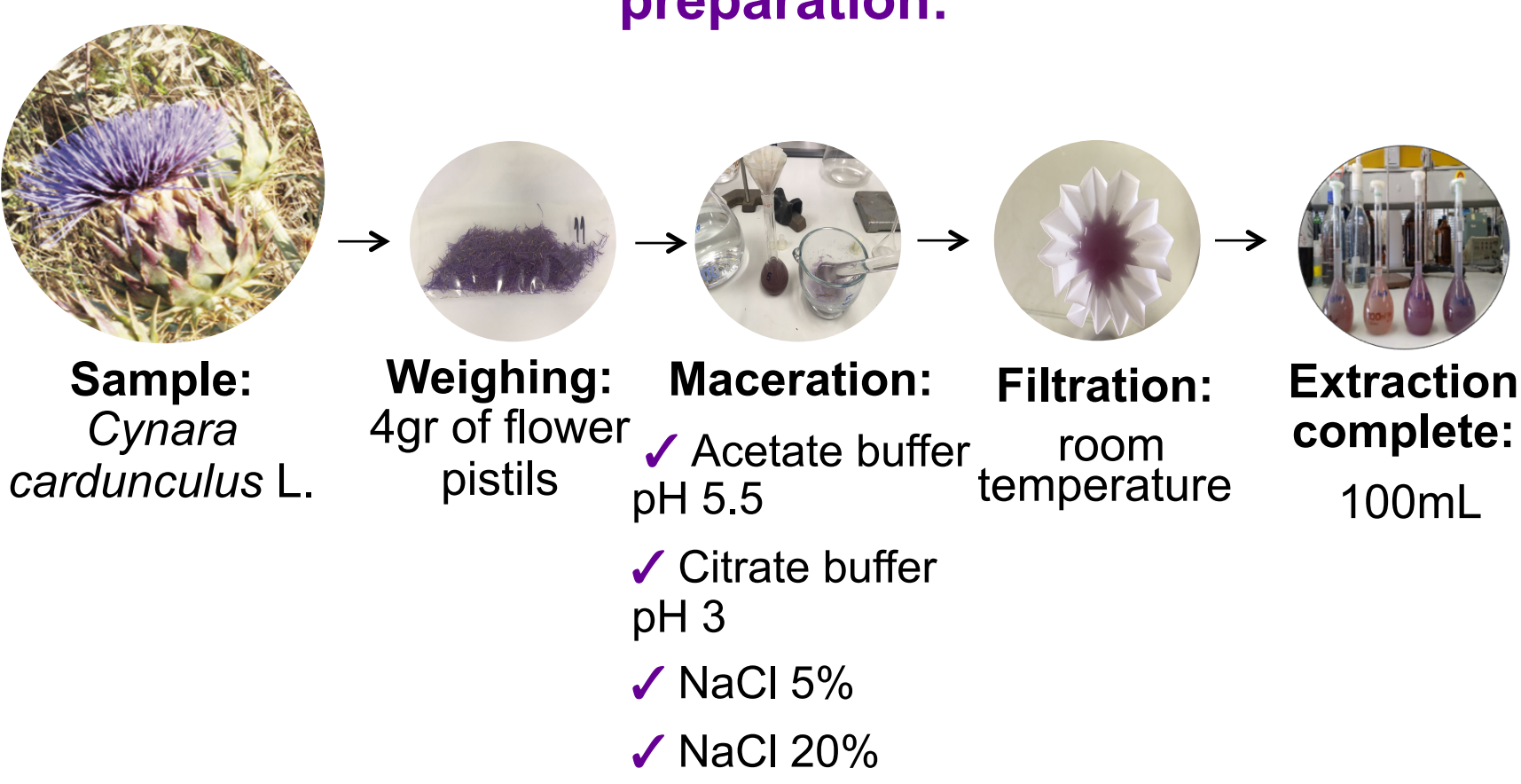


Materials and Methods

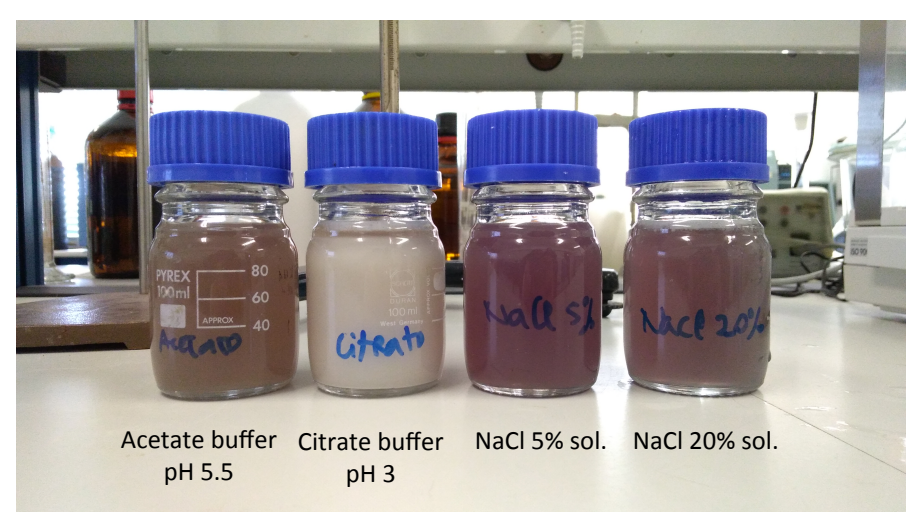
Sampling:

- Pool of cardoon flowers;
- INIAV campus in Oeiras, Portugal;
- 2016.

Cynara cardunculus L. traditional coagulant extract preparation:



Formulations obtained with different extracting solutions with the addition of **potassium sorbate 0,2%** to each extract:



Conservation trials:
(in duplicate)

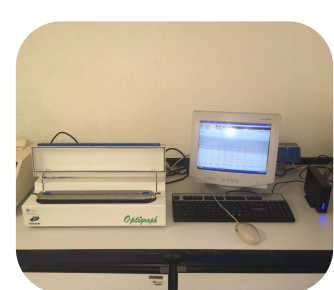
6°C

4.5 months

The samples were evaluated for the **technological properties** considering the use as a coagulant agent in cheesemaking :



Milk Clotting Activity (MCA):
(IDF 199 / ISO 23058: 2006)

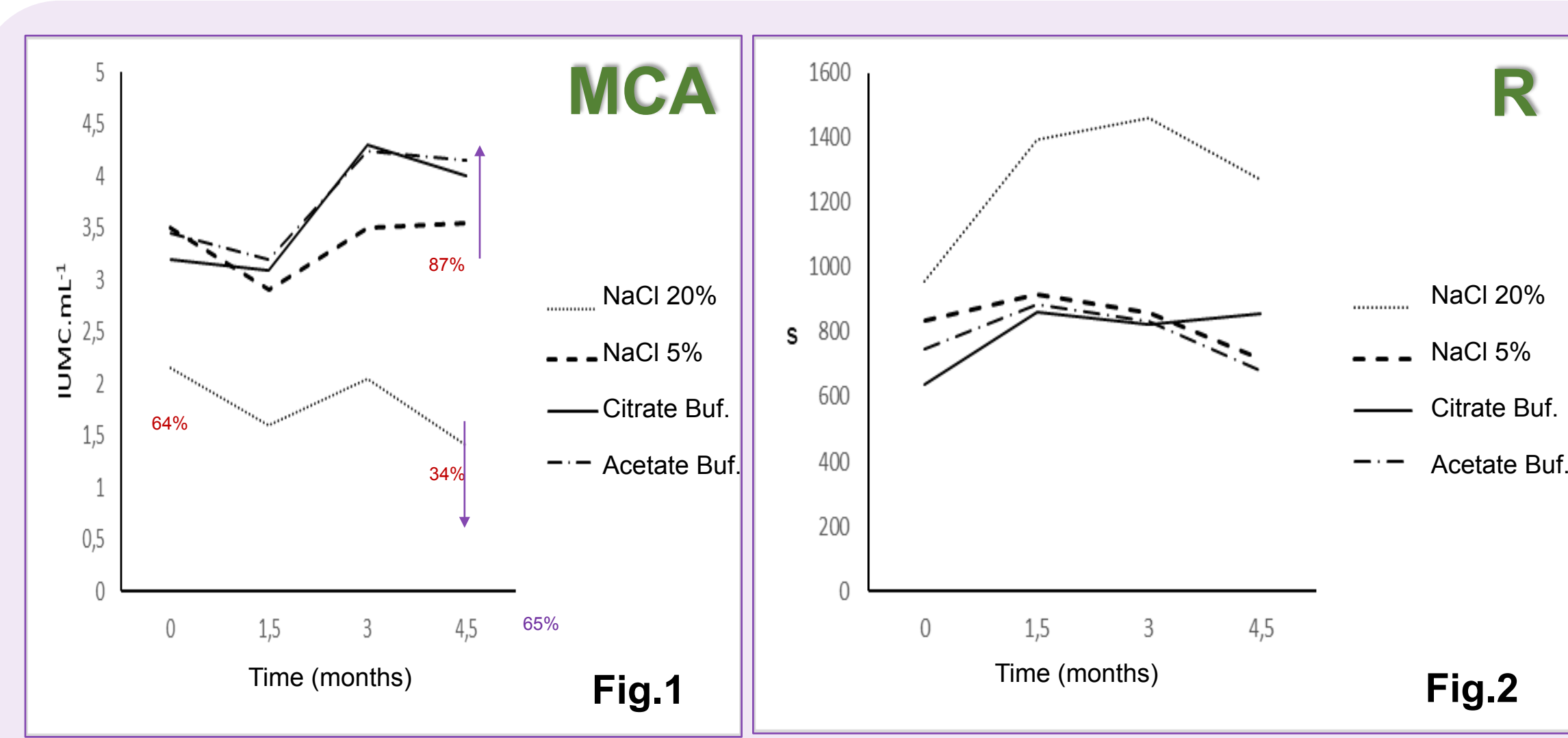


Monitoring of enzymatic coagulation:
Optigraph (Alves *et al.*, 2004)

References

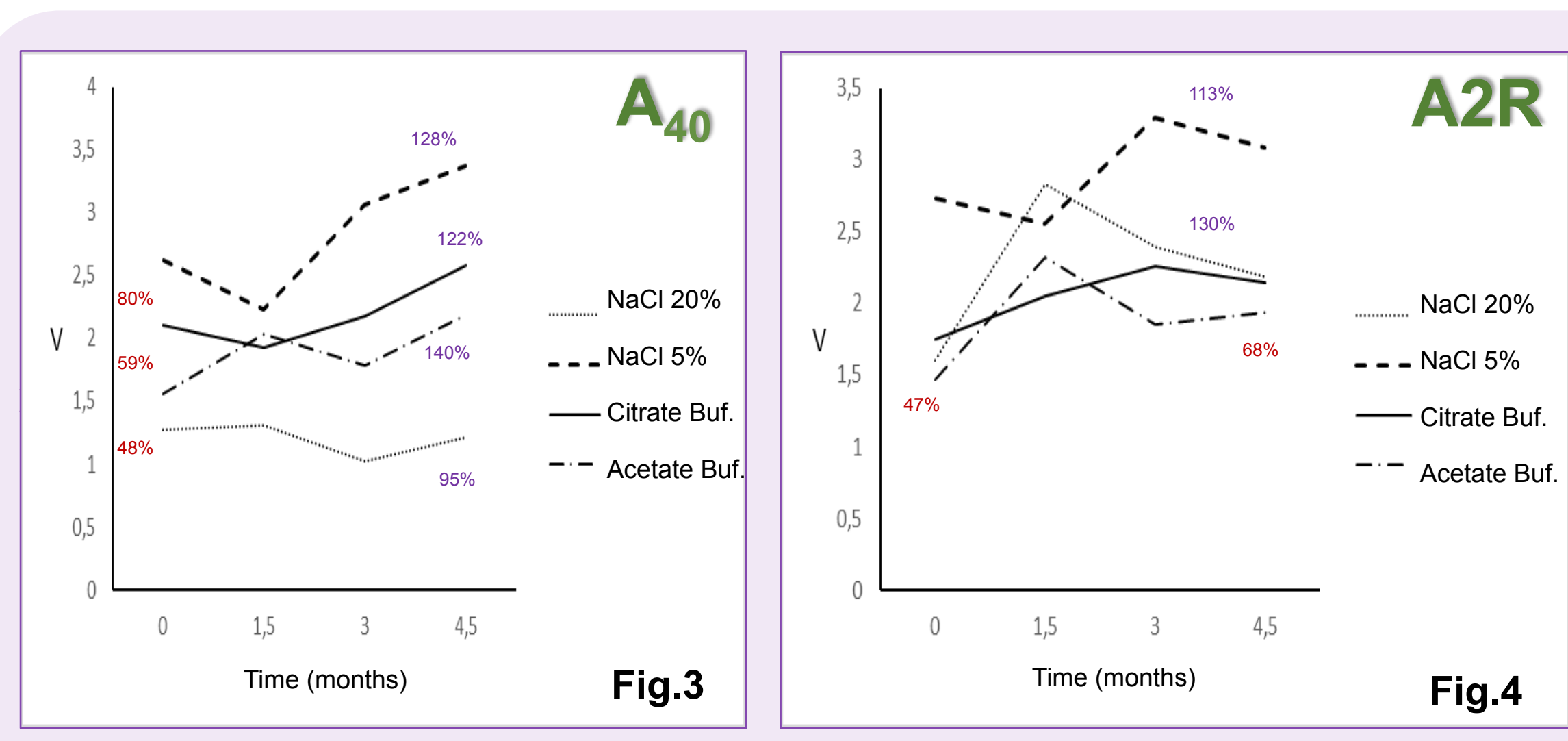
- Martins A.P.L., De Vasconcelos M.M.P., De Sousa R.B. 1996. Thistle (*Cynara cardunculus* L.) flower as a coagulant agent for cheesemaking. Short characterization. *Lait* 1996;76:473-477. DOI: 10.1051/lait:1996536
- Martins A.P.L. 1999. A flor de cardo (*Cynara cardunculus* L.) como agente coagulante no fabrico de queijo. Caracterização e influência dos processos de conservação na atividade coagulante. Tese de doutoramento em Engenharia Agroindustrial, Universidade Técnica de Lisboa, Lisboa.
- Martins, A.P.L. 2018. Caracterização tecnológica de populações de cardo (*Cynara cardunculus* L.) da região do Alentejo. Comunicação oral no I Simpósio Nacional da Valorização do Cardo, Beja, 5-6 de Dezembro.

Results and Discussion



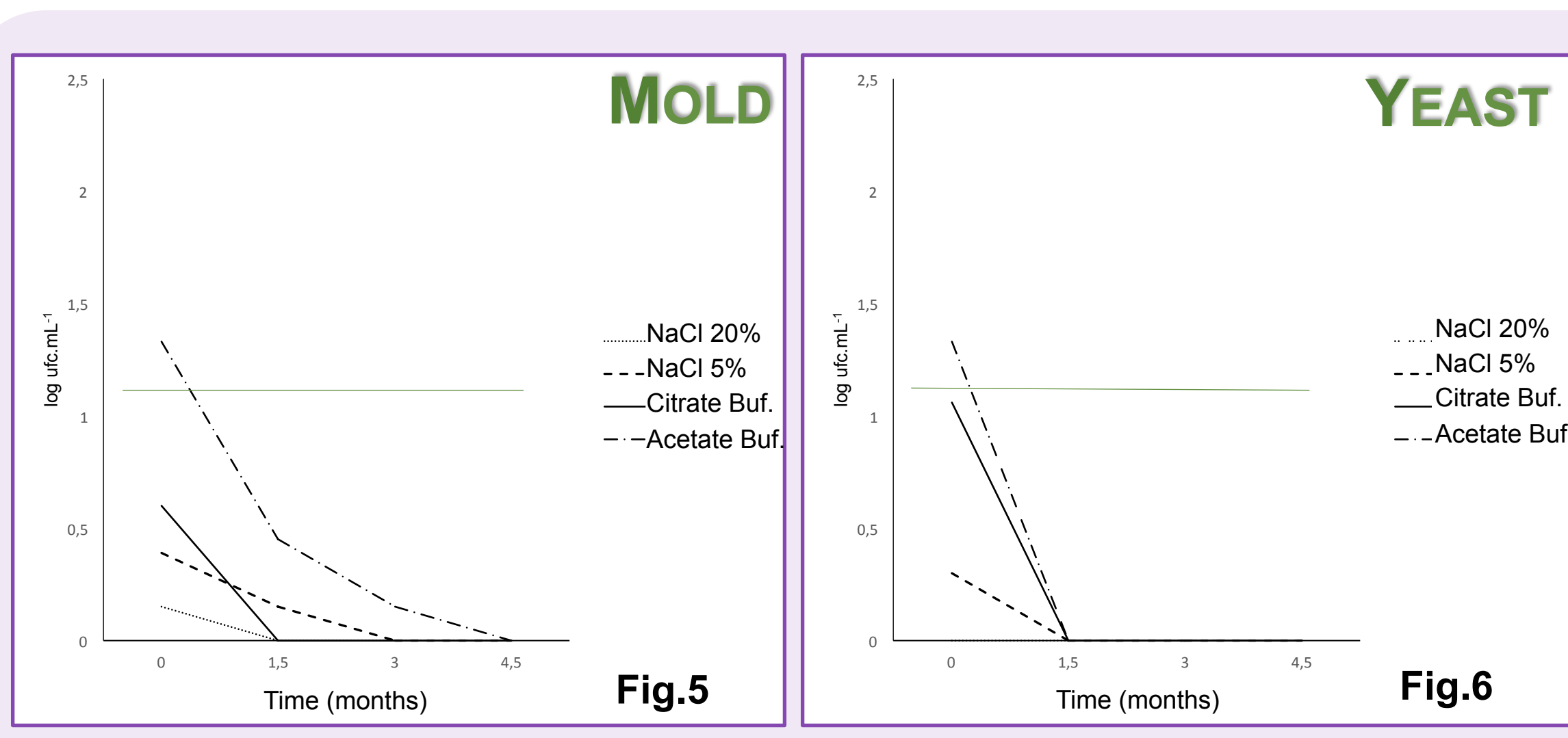
Evolution of the milk clotting activity (MCA) and R values for each extract formulation (Fig.1 and 2).

- ✓ NaCl 20% extract revealed the lowest milk clotting activity (pH 6.5) during all the evaluation period (Fig. 1).
- ✓ NaCl 20% extract showed lower MCA (~60%) than the other formulations and loss ~30% MCA along conservation period (Fig. 1);
- ✓ As for the coagulation trials (pH 6.6), the beginning of the micellar aggregation was very slow for the NaCl 20% extract, with significance throughout the conservation trial (Fig. 2).



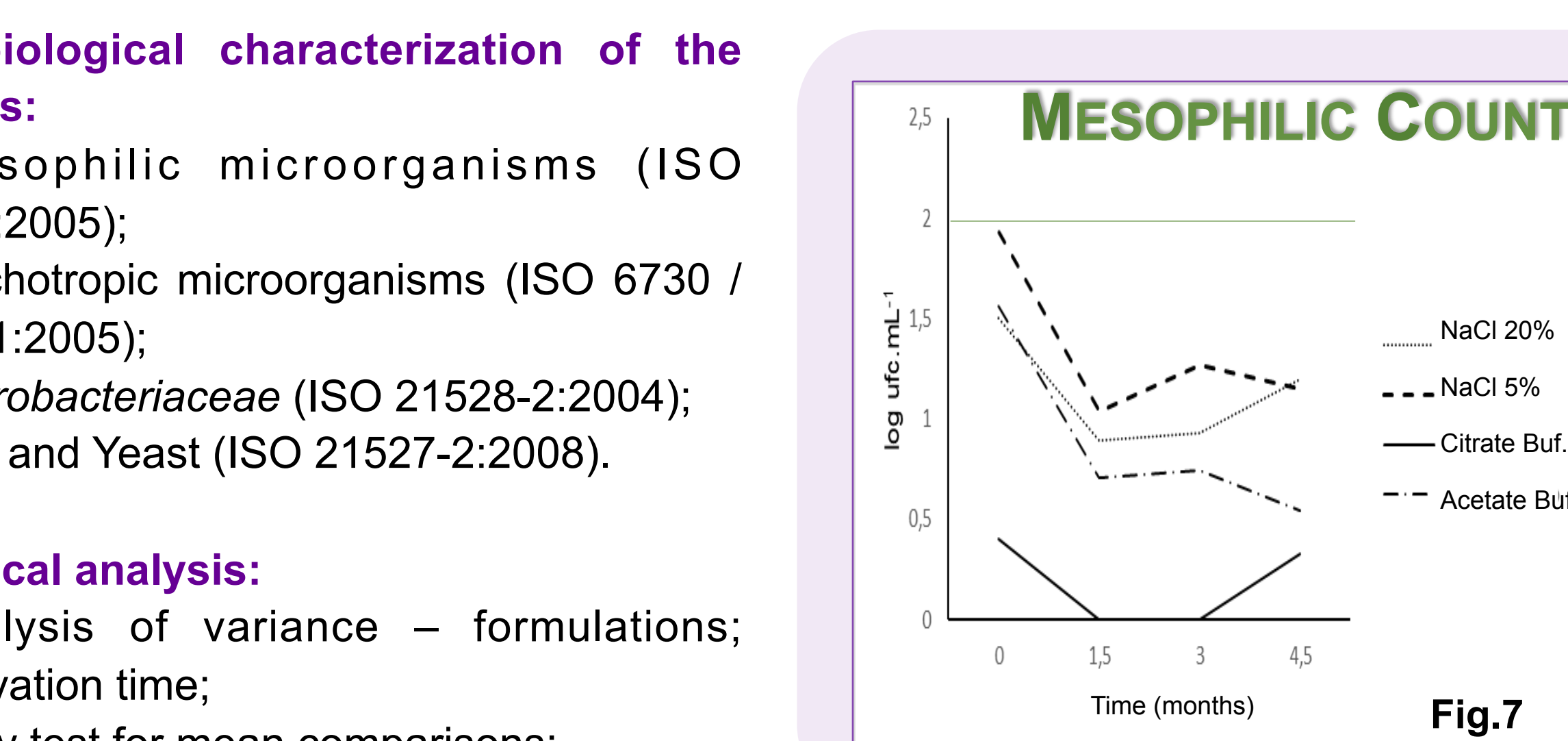
Evolution of the clot firmness for each extract formulation (Fig. 3 and 4).

- ✓ With the exception of the NaCl 20% extract, all formulations resulted in firmer curds (120-140%) towards the end of the storage period (Fig. 3).
- ✓ NaCl 20% extract showed a gel quality at the same level of the other extracts, but only for relative measurements, for a much longer time (Fig. 4).



Evolution of mold and yeast counts for each extract formulation (Fig. 5 and 6).

- ✓ The microbiological load of the extracts proved to be very low. Despite of a small initial contamination, the solutions remained in good condition over the 4.5 month period.



Evolution of the mesophilic microorganisms count for each extract formulation (Fig. 7).

- ✓ The total mesophilic counts decreased significantly with conservation period. Citrate buffer solution was found to have higher antimicrobial capacity, with lower logarithmic values along all study times;
- ✓ The final microbial level remained lower than the usual standards for commercial coagulant solutions.

Conclusions

The results demonstrate that the extracts obtained with **citrate buffer** showed a **more stable behavior** concerning both **milk clotting activity and technological properties**, remaining almost without microbial contamination.

The **NaCl 5%** extracts were the **most suitable**, both for **extraction and preservation**; the extracts presented superior technological properties, with a higher gel consistency in comparison with the other solutions, due to a higher micellar aggregation rate. Microbial performance was slightly lower than citrate buffer extract but microbial count levels were well below the requirements for most of the commercial coagulant solutions.

The **NaCl 20%** formulations induced the **greatest losses concerning milk clotting activity**, leading to the **worst performance concerning milk coagulation properties**.

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