# Antimicrobial activity of alginate films and coatings: a comparison

Ana Isabel Lopes[1], Adma Melo[1], Eliana Pereira[2,3], Cristina Caleja[2,3], Lillian Barros[2,3], Freni Tavaria[1], Manuela Pintado[1*]

[1] Universidade Católica Portuguesa, CBQF- Centro de Biotecnologia e Química Fina - Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal

[2] Centro de Investigação de Montanha (CIMO), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal.

[3] Laboratório Associado para a Sustentabilidade e Tecnologia em Regiões de Montanha (SusTEC), Instituto Politécnico de Bragança, Campus de Santa Apolónia, 5300-253 Bragança, Portugal.

** e-mail: mpintado@ucp.pt*

CATÓLICA FACULTY OF BIOTECHNOLOGY PORTO

CIÊNCIA 2023 ENCONTRO COM A CIÊNCIA E A TECNOLOGIA EM PORTUGAL

## Introduction

Nowadays, food packaging containers have been the target of increasing attention because they are mostly produced with plastics. These materials are usually made with polymers from non-renewable sources contributing to environmental pollution[1]. Edible films and coatings can act as complements to traditional plastics because their functional properties are able to extend food's shelf-life[1]. An edible film is a structure with a continuous matrix that can be made of proteins, polysaccharides and/or lipids[2]. A coating is a thin polymer layer (approximately 10-20 µm) that is directly formed on the food surface[2].

Plant extracts are a source of valuable bioactive compounds, in particular polyphenols, that exhibit antimicrobial activity against a wide range of microorganisms. They can be effective at low concentrations, are affordable and easy to apply, presenting low toxicity levels and high stability during processing and depending on the extract may not affect the sensory characteristics of food products[3].

The addition of plant extracts to edible films and coatings confers them with the ability to act as food preservatives against a broad spectrum of food poisoning/contaminants microorganisms and taking the opportunity of their antioxidant properties they may also avoid the deterioration of fats and other food constituents[4].

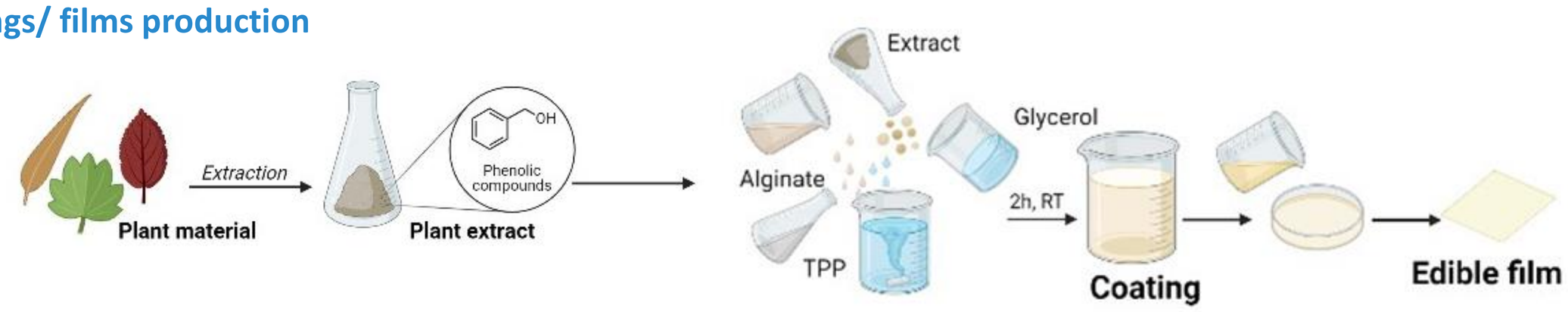
## Objectives

In this work, alginate films and coatings containing extracts from licorice (*Glycyrrhiza glabra* L.), eucalyptus (*Eucalyptus globulus* Labill.), sage (*Salvia officinalis* L.) and thyme (*Thymus vulgaris* L.) were created.

Their antimicrobial activity was determined against bacteria *Staphylococcus aureus* (*S. aureus*) and *Escherichia coli* (*E. coli*).

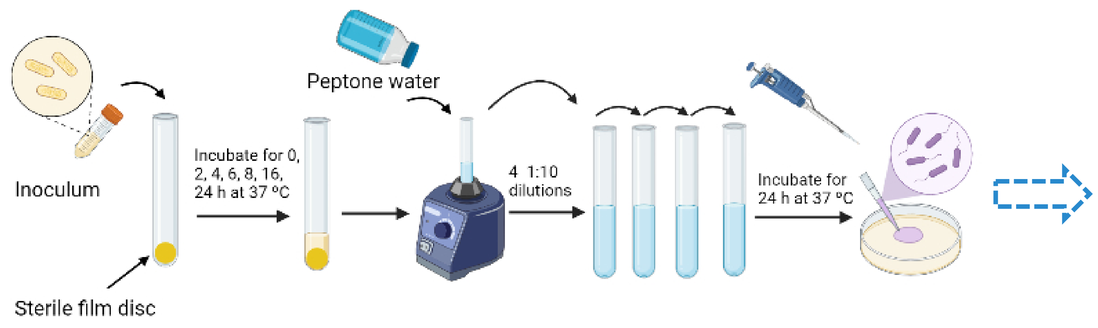
## Methods and Results

### Coatings/ films production

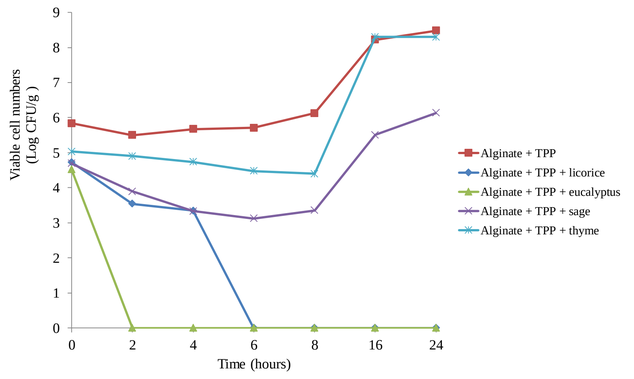



### Antimicrobial activity

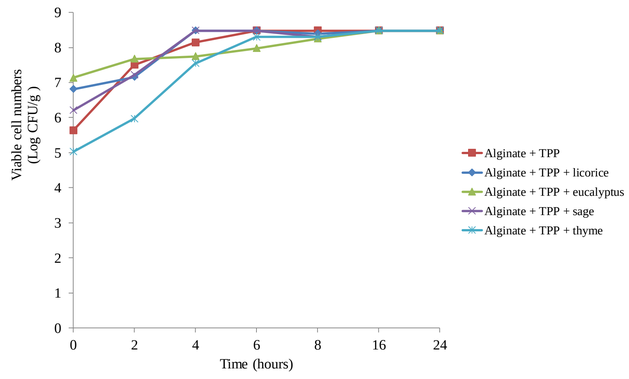
#### Film



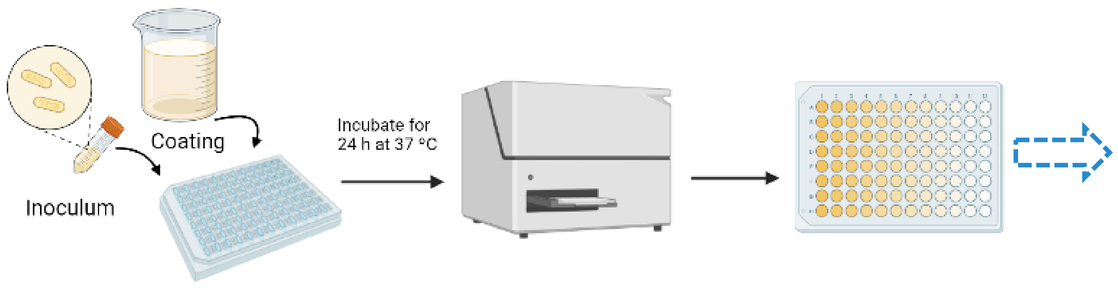

*S. aureus*

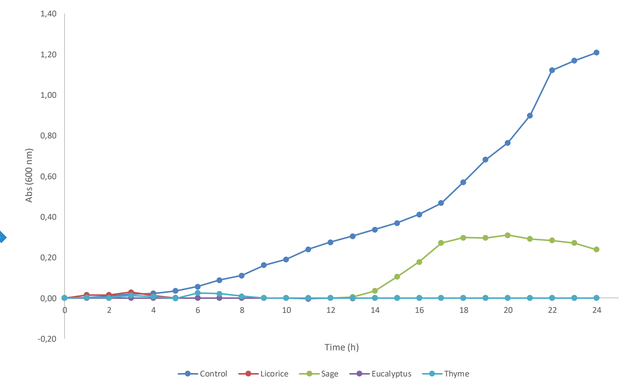


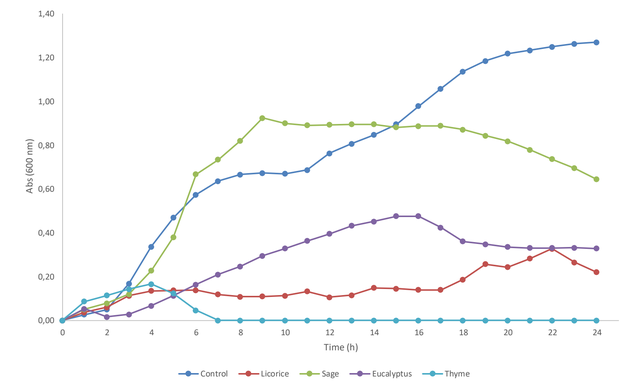

*E. coli*




#### Coating




## Conclusions

**Films:**

The films incorporated with licorice and eucalyptus extracts inhibited the growth of *S. aureus*.

None of the films showed antimicrobial activity against *E.coli*.

**Coatings:**

All coatings incorporated with plant extracts were able to completely inhibit *S. aureus* (except the coating with eucalyptus extract).

Only the coating incorporated with thyme extract could completely inhibit the growth of *E. coli*.

**In summary:**

When an extract is incorporated into a coating or a film, its antimicrobial activity changes and it is usually higher in the coating. This different behavior observed for plant extracts is probably due to the nature of the different matrices because, in a solid matrix (film), the bioactive compounds are less dispersed and are released more slowly than in a liquid matrix (coating).

**References**:

[1] D. Campos, C. Piccirillo, R. C. Pullar, P. M. Castro, M. M. Pintado, *J. Sci. Food Agric*. **2014**. *94* (10). 2097-103

[2] López de Dicastillo, C., et al. *Food Hydrocoll*. **2016**. *60*. 335-344

[3] Liu, T.; Liu, L.; Gong, X.; Chi, F.; Ma, Z., *LWT* **2021**, *135*, 110181.

[4] I.R. Freitas and M.G. Cattelan. Microbial Contamination and Food Degradation**.** Academic Press. USA. **2018**

**Acknowledgements**: This work was financially supported by project BIOma - Soluções integradas de BIOeconomia para a Mobilização da cadeia Agroalimentar (POCI-01-0247-FEDER-046112) co-financed by Fundo Europeu de Desenvolvimento Regional (FEDER) through Programa Operacional Competitividade de Internacionalização (POCI). This research was also funded by National Funds from FCT - Fundação para a Ciência e a Tecnologia through projects UIDB/50016/2020 (CBQF), UIDB/00690/2020 and UIDP/00690/2020 (CIMO) and LA/P/0007/2021 (SusTEC). Author Lillian Barros would like to acknowledge her contract through the institutional scientific employment program. Authors Ana Isabel Lopes and Adma Melo would like to acknowledge their individual grants.

COMPETE 2020 PROGRAMA OPERACIONAL COMPETITIVIDADE E INTERNACIONALIZAÇÃO

PORTUGAL 2020

UNIÃO EUROPEIA Fundo Europeu de Desenvolvimento Regional

bioma