BAY LEAVES ESSENTIAL OIL – BASED EDIBLE FILMS FOR ACTIVE FOOD PACKAGING

Esther Rincón[a], José J. Aguilar[b], Alina M. Balu[a], Antonio A. Romero[a], Rafael Luque[a], Araceli García[a]

[a]FQM-383 Nanoval Group, Organic Chemistry Department, University of Córdoba, Campus de Rabanales, Marie Curie Building, CTRA. Nnal. IV-A, Km 396, 14014 Córdoba, Spain; [b]Microbiology Department, University of Córdoba, Campus de Rabanales, Severo Ochoa Building, CTRA. Nnal. IV-A, Km 396, 14014 Córdoba, Spain

E-mail: **b32rirue@uco.es** / qo2ganua@uco.es

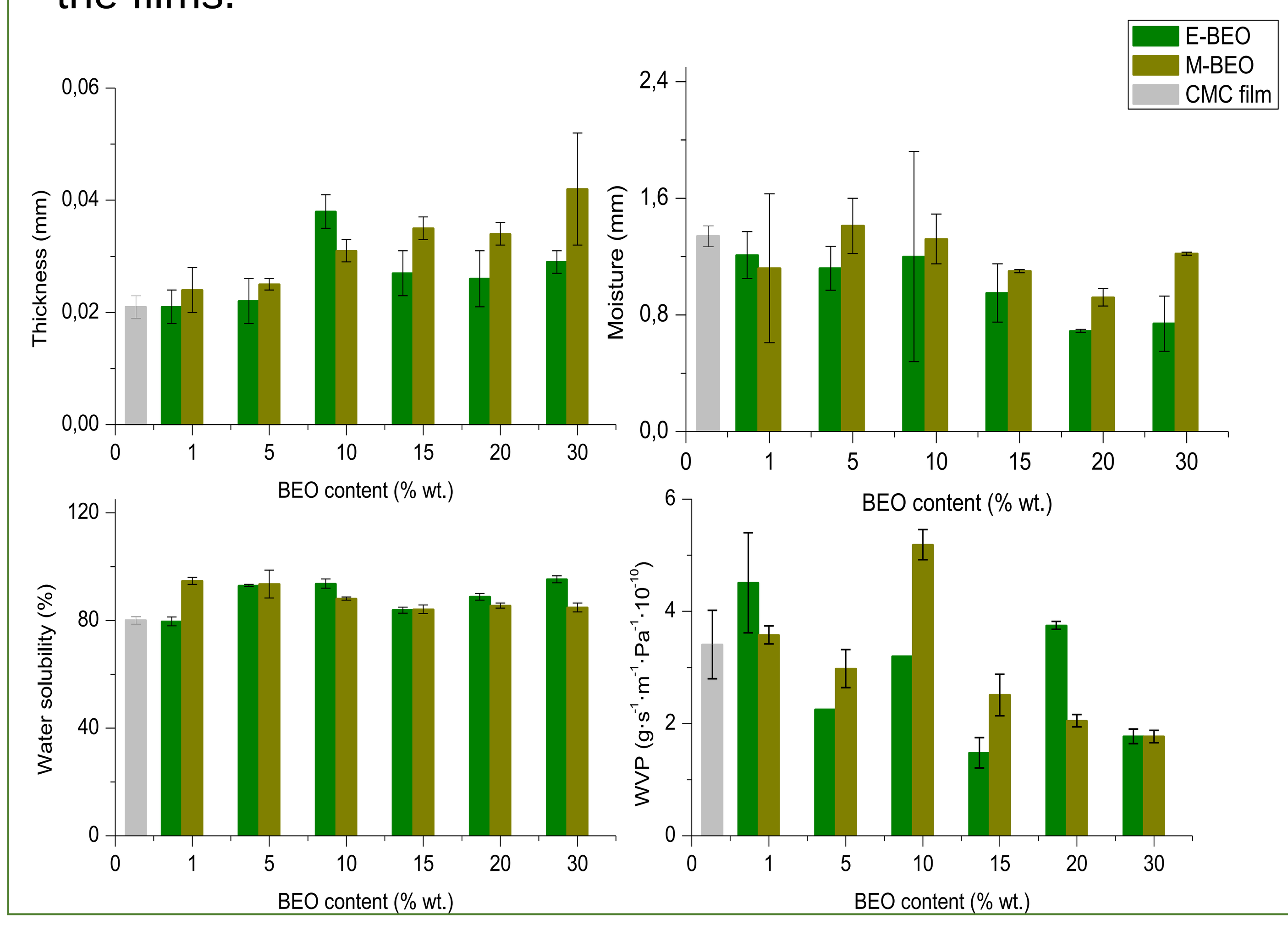
INTRODUCTION

Biopolymers have been studied to prepare packaging films and coating *[1]*. Cellulose is a renewable source and its derivatives have excellent properties forming films. Water soluble cellulose derivatives such as carboxymethyl cellulose (CMC) can form a continuous matrix. This polymer is also edible allowing its use as **packaging product** *[2]*. Spices are rich in phenolic compounds such as flavonoids and phenolic acids *[3]*. These compounds have antioxidant and antimicrobial properties. In this sense, **bay leaves essential oils** (BEO) contains mainly 1,8-cineol , in addition to eugenol, acetyl, methyl-eugenol, α and β-pinene, phellandrene, linalool, geraniol and terpineol *[4]*. Additionally, antioxidant and antimicrobial effects of this oil are known. The addition of BEO to edible films could contribute to the improvement of the properties.

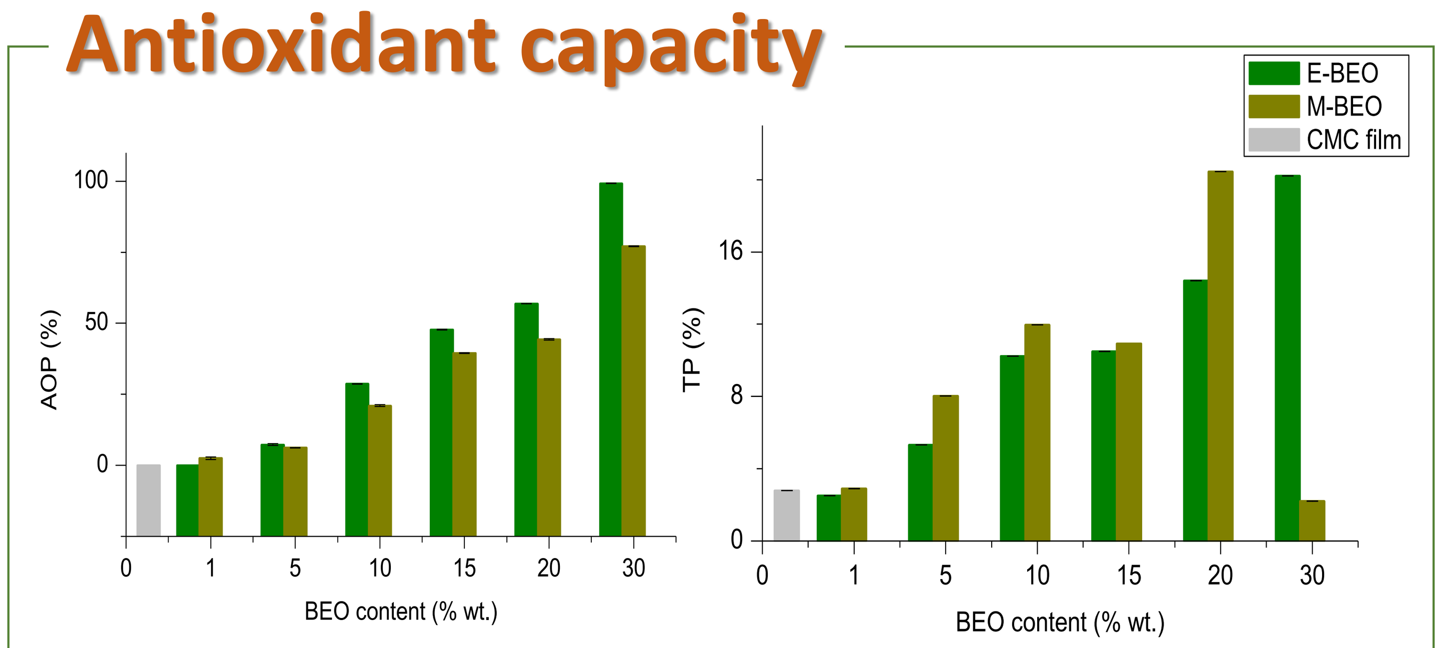
Films have been prepared by "solvent casting" technique, using CMC, with different concentrations of BEO (from 1 to 30 %wt). BEOs were extracted by Soxhlet method using ethanol (E-BEO) or methanol (M-BEO).

Physical properties

The WVP for the 15E-BEO film was 1.48 ± 0.27 ($g \cdot s^{-1} \cdot m^{-1} \cdot Pa^{-1} \cdot 10^{-10}$), which means that this film reduces the water vapor transmission by half compared to the control. In the case of M-BEO films, this occurs when they content 30% of M-BEO (1.77 ± 0.11 $g \cdot s^{-1} \cdot m^{-1} \cdot Pa^{-1} \cdot 10^{-10}$). This is because the presence of BEO increased the hydrophobicity ratio in the films.



Antioxidant capacity

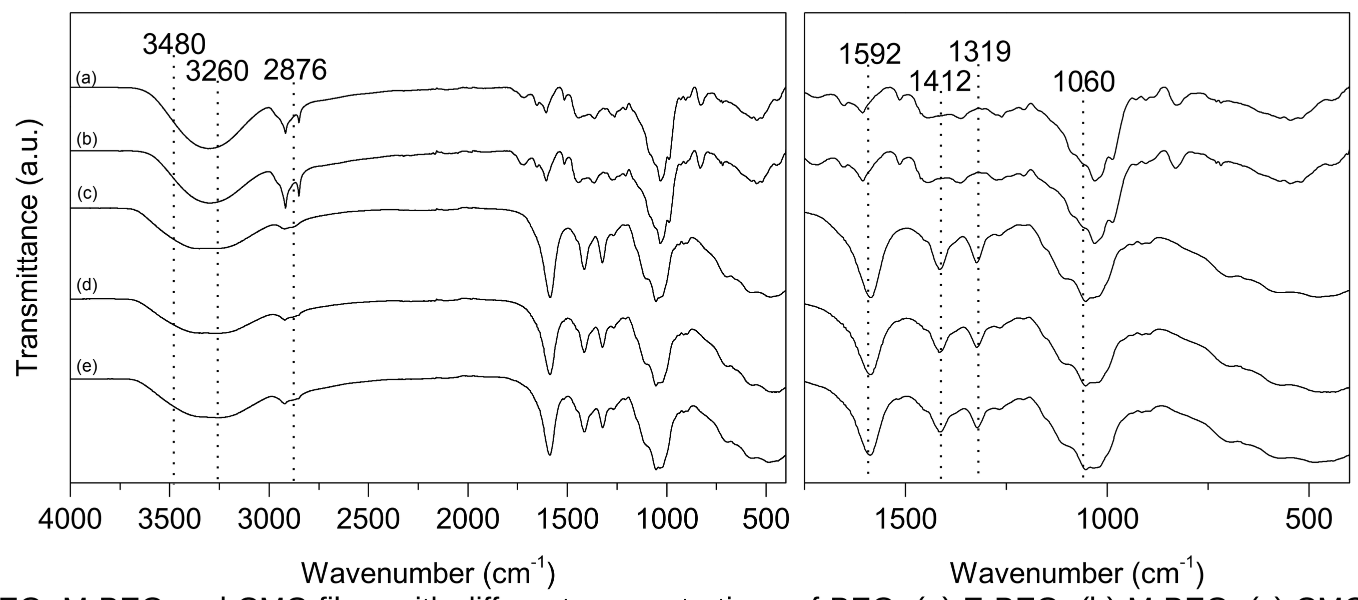


Films containing E-BEO at a level of 30% had the highest antioxidant activity (99.23%). Phenolic compounds are responsible for the antioxidant power of BEOs in quenching free radicals.

EXPERIMENTAL METHODS AND RESULTS

Functional groups

ATR-IR

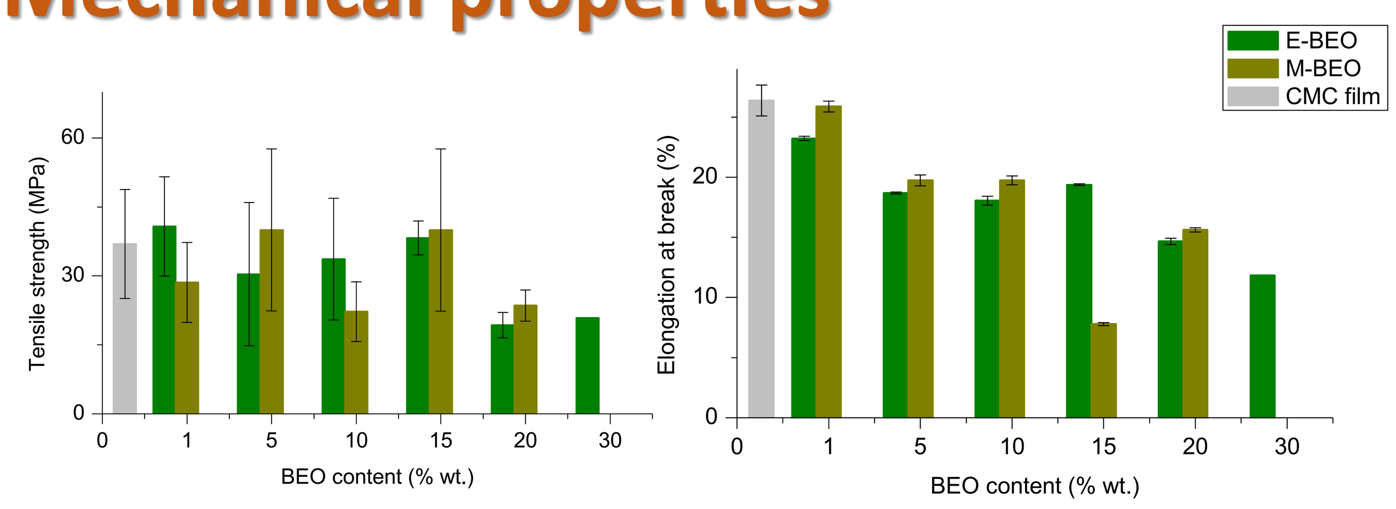


FT-IR spectra of E-BEO, M-BEO and CMC films with different concentrations of BEO. (a) E-BEO; (b) M-BEO; (c) CMC film (control); (d) 15E-BEO film; (e) 30M-BEO film.

As can be seen, the most representative peaks of these spectra coincide with those of the control film. For this reason, no differences are observed between the films, since the peaks and bands of the EO are masked with those of the CMC.

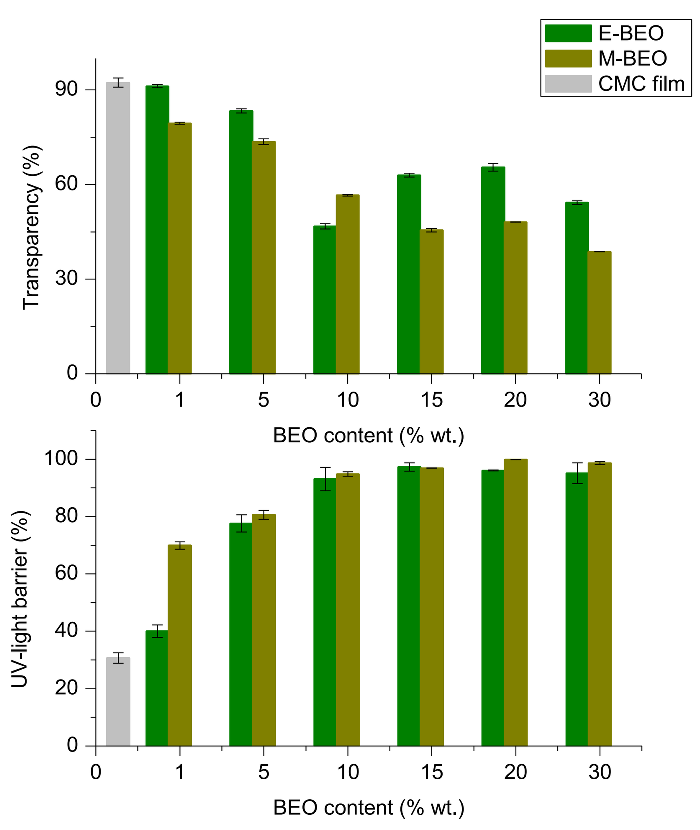
Mechanical properties

The 15E-BEO film showed the best result since it obtained a value of 38.26 MPa compared to 36.96 MPa in the control film. Same result was obtained for 15M-BEO film.



A strong interaction between the carbohydrate and the low concentration of BEO produced a cross-linking effect. TS decreased at the highest EO concentration; this difference can be explained by weaker polymer-oil interaction in higher EOs concentrations.

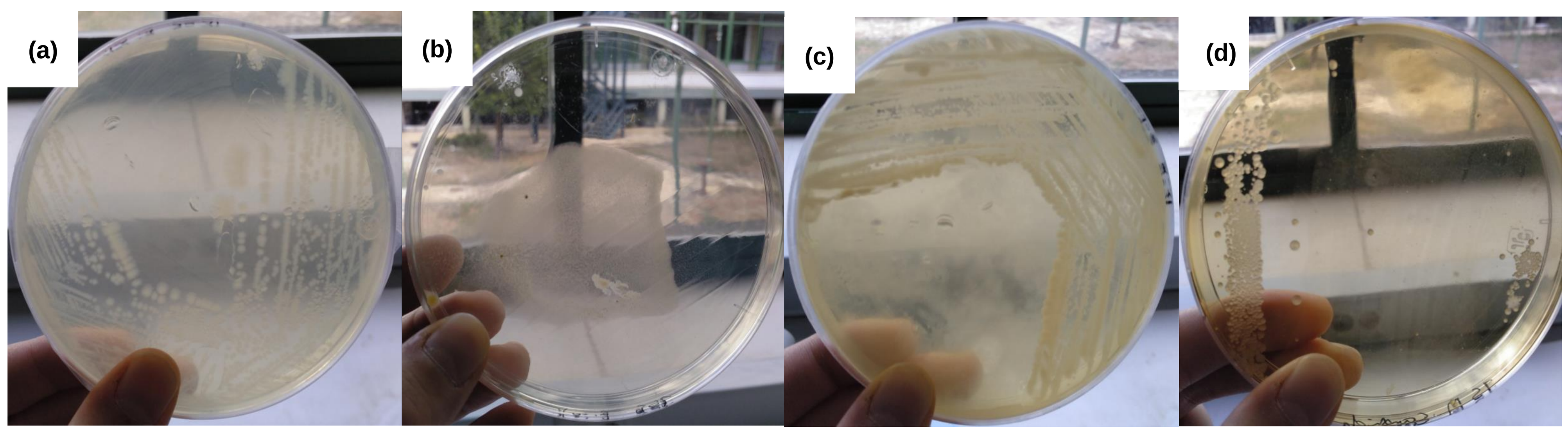
Optical properties



One of the common oxidation initiators in food systems is the UV light because produces lipids oxidation so it is important to pay attention to this phenomenon in the food active packaging field. As can be seen, as the amount of BEO in the film increases, the protective effect against UV light increases. This effect is more pronounced in films with E-BEO than in those with M-BEO. When the BEO is present, transparency is decreasing respect to the control film acquiring a greenish hue and increasing the UV-light barrier effect. The greenish hue is due to the chlorophyll *a* of the BEO.

Antimicrobial activity

In general, films are capable of inhibit, partially or totally, the growth of certain microorganisms. It is observed as much in the case of *E. coli* as of *C. glabrata*, the presence of the film produces a strong inhibition in the growth of the colonies with respect to the controls but without being able to observe any growth pattern (inhibition halo).



Escherichia coli growth in (a) control culture media and (b) in the presence of 15E-BEO film. *Candida glabrata* growth in (c) control culture media and (d) in the presence of 15M-BEO film.

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