

# Hydroxypropyl methylcellulose and gum Arabic composite edible coatings amended with geraniol to control postharvest brown rot and maintain quality of cold-stored plums

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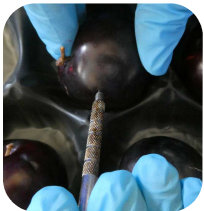
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## Introduction

Preserving the quality of plums during cold storage poses challenges due to chilling injury and postharvest decay caused by fungi. Synthetic fungicides, while effective, raise concerns regarding residues and resistance. **Geraniol (GE)**, a common component of essential oils, shows antimicrobial properties against various postharvest pathogens. **Edible coatings (ECs)** incorporating antifungal agents maintain fruit quality and enhance **antifungal activity**. This work aimed to study the effect of hydroxypropyl methylcellulose (HPMC) and gum Arabic (GA) edible coatings amended with 0.2% GE to **control brown rot**, caused by *Monilinia fructicola*, and **maintain quality** of plums (*Prunus salicina* Lindl., cv. Angeleno) stored for 5 weeks at 1 °C.

## Methodology

### Effect of Coatings on Brown Rot Control



Inoculation with *Monilinia fructicola* (10<sup>3</sup> spores/mL) plus incubation at 20 °C for 24 h

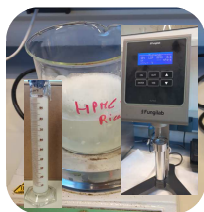


Application of antifungal ECs and storage for up to 5 weeks at 1 °C and 90% RH, plus 3 days at 20 °C



Evaluation of disease incidence (% of infected fruits) and severity (lesion diameter, mm)

### Effect of Coatings on Plum Fruit Quality



Preparation and characterization of HPMC and GA antifungal ECs



ECs application and storage for up to 8 weeks at 1 °C, followed by 3 d at 7 °C and 7 d at 20 °C, simulating packinghouse, transportation, and retail handling conditions



Evaluation of chilling injury and physicochemical quality after the shelf-life period

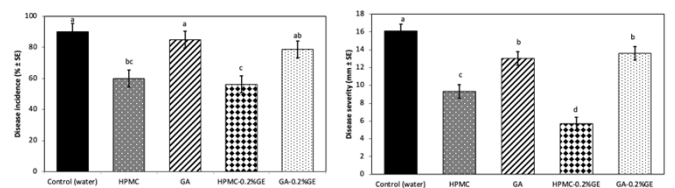
## Acknowledgements



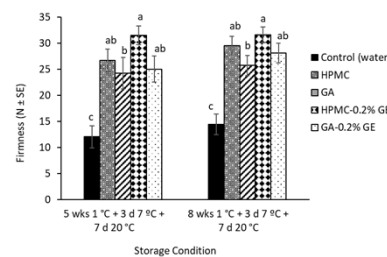
StopMedWaste project (EU PRIMA Programme-2019; NextGenerationEU/PRTR; Spanish "Agencia Estatal de Investigación", PCI2020-112095).

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## Results



**Figure 1.** Incidence and severity of brown rot on 'Angeleno' plums artificially inoculated with *Monilinia fructicola*, uncoated (control) or coated 24 h later with HPMC or GA based edible composite coatings amended with GE and stored for 5 weeks at 1 °C and 90% RH. Means with different letters are significantly different according to Fisher's protected LSD test ( $p < 0.05$ ).



**Figure 2.** Firmness (N) of 'Angeleno' plums uncoated (control) or coated with HPMC or GA based edible composite coatings amended with GE after storage for 5 and 8 weeks at 1 °C, followed by 3 days at 7 °C plus 7 days at 20 °C. For each evaluation date, different letters indicate significant differences using Fisher's protected LSD test ( $p < 0.05$ ). Firmness at harvest was 30.4 ± 1.5 N.

**Table 1.** Juice quality attributes of 'Angeleno' plums uncoated (control) or coated with HPMC or GA based edible composite coatings amended with GE after storage for 5 and 8 weeks at 1 °C, followed by 3 days at 7 °C plus 7 days at 20 °C.

Storage period at 1 °C	Treatment	TA (g/L malic acid)	SSC (°Brix)	MI	Ethanol (mg/L)	Acetaldehyde (mg/L)
5 weeks	Control	6.6 ± 0.4 <sup>a</sup>	16.9 ± 0.1 <sup>b</sup>	25.6 ± 0.7 <sup>a</sup>	13.5 ± 7.3 <sup>c</sup>	5.7 ± 1.2 <sup>a</sup>
	HPMC	7.0 ± 0.5 <sup>a</sup>	17.4 ± 0.0 <sup>a</sup>	25.1 ± 0.7 <sup>a</sup>	51.3 ± 3.7 <sup>b</sup>	4.0 ± 0.3 <sup>bc</sup>
	GA	6.6 ± 0.2 <sup>a</sup>	16.7 ± 0.3 <sup>b</sup>	25.2 ± 0.3 <sup>a</sup>	3.1 ± 0.2 <sup>c</sup>	3.0 ± 0.6 <sup>c</sup>
	HPMC-0.2%GE	6.9 ± 0.6 <sup>a</sup>	17.1 ± 0.1 <sup>ab</sup>	24.9 ± 0.8 <sup>a</sup>	94.0 ± 19.5 <sup>a</sup>	5.2 ± 0.9 <sup>ab</sup>
	GA-0.2%GE	7.0 ± 0.6 <sup>a</sup>	16.2 ± 0.2 <sup>c</sup>	23.2 ± 0.6 <sup>b</sup>	16.6 ± 5.9 <sup>c</sup>	3.8 ± 0.7 <sup>bc</sup>
8 weeks	Control	6.6 ± 0.2 <sup>a</sup>	16.5 ± 0.2 <sup>b</sup>	25.1 ± 0.5 <sup>b</sup>	21.3 ± 6.9 <sup>c</sup>	15.8 ± 1.2 <sup>b</sup>
	HPMC	7.1 ± 0.4 <sup>a</sup>	17.1 ± 0.1 <sup>a</sup>	24.0 ± 0.5 <sup>b</sup>	212.7 ± 91.8 <sup>b</sup>	12.5 ± 2.2 <sup>c</sup>
	GA	6.8 ± 0.4 <sup>a</sup>	17.4 ± 0.3 <sup>a</sup>	25.5 ± 0.4 <sup>b</sup>	15.4 ± 1.2 <sup>c</sup>	8.9 ± 2.0 <sup>d</sup>
	HPMC-0.2%GE	6.5 ± 0.6 <sup>a</sup>	16.3 ± 0.2 <sup>b</sup>	25.0 ± 0.9 <sup>b</sup>	587.7 ± 44.5 <sup>a</sup>	20.7 ± 1.4 <sup>a</sup>
	GA-0.2%GE	6.1 ± 0.2 <sup>a</sup>	17.3 ± 0.1 <sup>a</sup>	28.2 ± 0.3 <sup>a</sup>	46.2 ± 14.1 <sup>c</sup>	6.7 ± 0.8 <sup>d</sup>

**Table 2.** Flesh bleeding of 'Angeleno' plums uncoated (control) or coated with HPMC or GA based edible composite coatings amended with GE after 5 and 8 weeks of storage at 1 °C, followed by 3 days at 7 °C plus 7 days at 20 °C.

Treatment	Storage Conditions			Plum flesh bleeding rated with scores from 1 (none) to 3 (severe, >50% of the flesh surface). For each evaluation date, different letters indicate significant differences using Fisher's protected LSD test ( $p < 0.05$ ). Values are means ± SE.
	5 Weeks 1 °C + 3 d 7 °C + 7 d 20 °C	8 Weeks 1 °C + 3 d 7 °C + 7 d 20 °C	Control	
Control	2.4 ± 0.1 <sup>a</sup>	3.0 ± 0.0 <sup>a</sup>	3.0 ± 0.0 <sup>a</sup>	
HPMC	1.9 ± 0.2 <sup>b</sup>	1.9 ± 0.2 <sup>c</sup>	1.9 ± 0.2 <sup>c</sup>	
GA	2.1 ± 0.2 <sup>ab</sup>	2.7 ± 0.1 <sup>ab</sup>	2.7 ± 0.1 <sup>ab</sup>	
HPMC-0.2% GE	1.5 ± 0.1 <sup>c</sup>	1.9 ± 0.2 <sup>c</sup>	1.9 ± 0.2 <sup>c</sup>	
GA-0.2% GE	2.0 ± 0.2 <sup>b</sup>	2.6 ± 0.1 <sup>b</sup>	2.6 ± 0.1 <sup>b</sup>	

## Conclusion

HPMC-based coatings containing GE at a concentration of 0.2% showed potential to **control brown rot** and significantly **reduced chilling injury** symptoms manifested as flesh bleeding on 'Angeleno' plums during long-term cold storage. Furthermore, HPMC and GA coatings **contributed to maintaining fruit firmness** and did not negatively affect other fruit quality attributes.