

# Effects of combining organic acid and essential oil as an alternative to replace potassium sorbate in fruit preparations

Melo, A.<sup>1\*</sup>, Sorathiya, K.<sup>1</sup>, Paulico, L.<sup>2</sup>, Magalhães, I.<sup>3</sup>, Hogg, M.C.<sup>1</sup>, Pintado, M.<sup>1</sup>

<sup>1</sup>Universidade Católica Portuguesa, CBQF- Centro de Biotecnologia e Química Fina - Laboratório Associado, Escola Superior de Biotecnologia, Rua Diogo Botelho 1327, 4169-005 Porto, Portugal.

<sup>2</sup>FRULACT - Headquarters & Frutech RDI Centre, Rua do Outeiro, 589, 4475-150 Maia, Portugal.

<sup>3</sup>MC Sonae, Rua João Mendonça, 529, 4464-501 Matosinhos, Portugal

\* e-mail: [admelo@ucp.pt](mailto:admelo@ucp.pt)

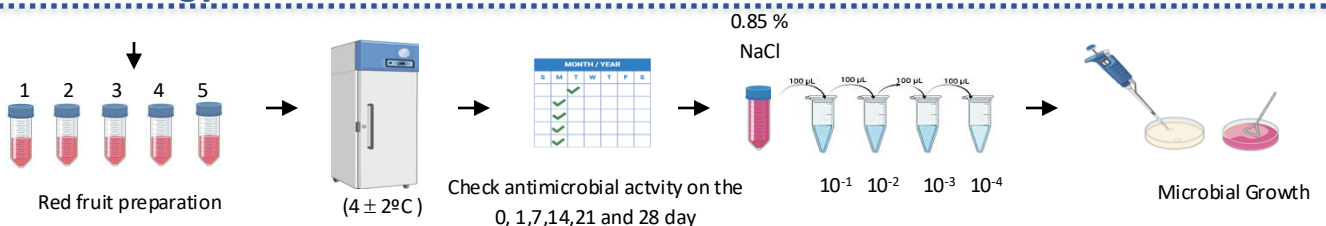
## Introduction

The replacement of synthetic preservatives by natural alternatives is an increasing demand in the food industry. Chemical preservatives, such as potassium sorbate (PS), are widely used in food preservation; however, they raise concerns due to potential health risks and increasing consumer demand for clean-label products. The replacement of synthetic antimicrobials with natural antimicrobial has emerged as a sustainable strategy to improve food quality and shelf life. Propionic acid (PA) and lemongrass essential oil (LEO) exhibit potential antimicrobial activity and their combination enhances inhibition of spoilage and pathogenic microorganisms.

## Objective

This study investigated the substitution of potassium sorbate (PS) in red fruit preparations using combinations of propionic acid (PA) and lemongrass essential oil (LEO) with antimicrobial potential against fungi, yeasts, and bacteria, while maintaining safety and stability of the product.

## Methodology



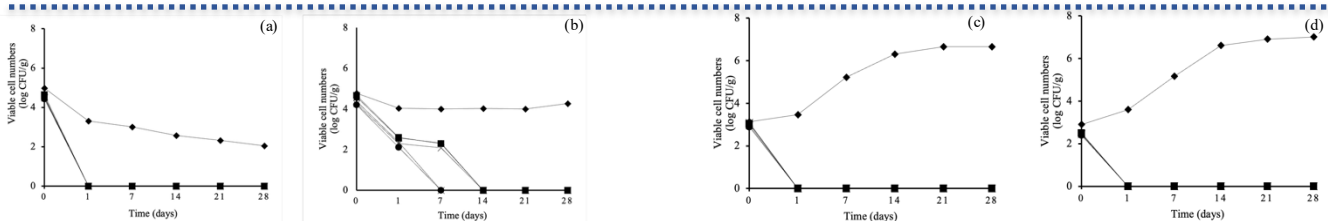
**Table 1.** Treatments for the antimicrobial activity assay in red fruit preparation.

Treatment 1 (+ve control)	Treatment 2 (-ve control)	Treatment 3 (1/4MIC)	Treatment 4 (1/2MIC)	Treatment 5 (MIC)	Treatment 6 (2MIC)
	PS (0.1%) -ve control	LGO (0.195%) + PA (0.0312%)	LGO (0.390%) +PA (0.0625%)	LGO (0.781%) +PA (0.125%)	LGO (1.562%) +PA (0.25%)
Microorganism	Microorganism	Microorganism	Microorganism	Microorganism	Microorganism

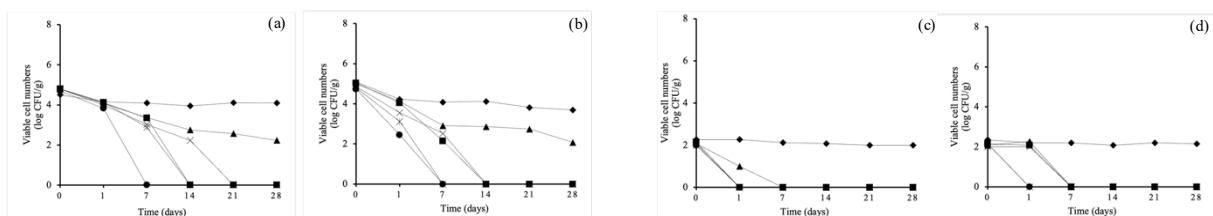
PS: potassium sorbate; LGO: lemongrass oil; PA: propionic acid; MIC: Minimum inhibitory concentration.

Microorganisms: *Escherichia coli* and *Lactobacillus plantarum* ( $10^6$  CFU/mL); *Candida intermedia* and *Pichia fermentans* ( $10^3$  CFU/mL); *Penicillium glabrum* and *Aspergillus niger* ( $10^5$  and  $10^2$  spores/mL).

## Results



**Fig. 1.** Anti-microbial activity of different combinations of LGO and PA against *E. coli* (a), *L. plantarum* (b), *C. intermedia* (c) and *P. fermentans* (d) in red fruit preparation for 28 days. (—◆—) positive control; (—■—) negative control (0.1% PS); (—▲—) 1/4MIC (0.195% LGO + 0.0312% PA); (—✱—) 1/2MIC (0.390% LGO + 0.0625% PA); (—✱—) MIC (0.781% LGO + 0.125% PA); and (—●—) 2×MIC (1.562% LGO + 0.25% PA).



**Fig. 2.** Antimicrobial activity of different combinations of LGO and PA against: *A. niger* (a) and *P. glabrum* (b) - ( $10^5$  spores/g) and *A. niger* (c) and *P. glabrum* (d) - ( $10^2$  spores/g) in red fruit preparation for 28 days. (—◆—) positive control; (—■—) negative control (0.1% PS); (—▲—) 1/4MIC (0.195% LGO + 0.0312% PA); (—✱—) 1/2MIC (0.390% LGO + 0.0625% PA); (—✱—) MIC (0.781% LGO + 0.125% PA); and (—●—) 2×MIC (1.562% LGO + 0.25% PA).

## Conclusion

These findings demonstrate the potential of replacing potassium sorbate with natural antimicrobial systems based on propionic acid and lemongrass essential oil in fruit-based products. Future work will focus on optimizing sensory attributes, assessing shelf-life performance, and evaluating the scalability of these formulations for industrial implementation.

## Acknowledgements:

This work was supported by PRR (Programa de Recuperação e Resiliência) agenda VIAFOOD - Platform for Valorization, Industrialization and Commercial Innovation for Agro-Food (no. C644929456-0000040).