

Title Combined application of essential oils from *Origanum vulgare* L. and *Rosmarinus officinalis* L. to inhibit bacteria and autochthonous microflora associated with minimally processed vegetables

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Abstract

This study assessed the occurrence of an enhancing inhibitory effect of the combined application of *Origanum vulgare* (OV) and *Rosmarinus officinalis* (RO) essential oils against bacteria associated to minimally processed vegetables using the determination of Fractional Inhibitory Concentration (FIC) index, kill-time assay in vegetal broth and application in vegetable matrices. Moreover, it was determined chemical composition of the essential oils and their effects alone and in mixture on sensory characteristics of minimally processed vegetables. Carvacrol (66.9 g/100 g) was the most prevalent compound in OV essential oil, while for RO was 1.8-cineole (32.2 g/100 g). OV and RO essential oil showed MIC in a range of 1.25–5 and 20–40 µL/mL, respectively. FIC indices of the combined application of the essential oils were 0.5 against *Listeria monocytogenes*, *Yersinia enterocolitica* and *Aeromonas hydrophilla* suggesting a synergic interaction. Only for *Pseudomonas fluorescens* FIC index was 0.75 purposing additive effect. Application of the essential oils alone (MIC) or in mixture ($\frac{1}{4}$ MIC + $\frac{1}{4}$ MIC or $\frac{1}{4}$ MIC + $\frac{1}{2}$ MIC) in vegetable broth caused significant decrease ($p < 0.05$) in bacterial count over 24 h. Mixture of essential oils reduced ($p < 0.05$) the inocula of all bacteria in vegetable broth and in experimentally inoculated fresh-cut vegetables. Similar efficacy was found to reduce the autochthonous microflora in vegetables. Sensory evaluation of vegetables sanitized with essential oils revealed that the scores of the most evaluated attributes fell between like slightly and neither like nor dislike. The combination of essential oils at sub-inhibitory concentrations could mean an interesting approach to sanitize minimally processed vegetables.