

# Herbal essential oils exert a preservative effect against the potato soft rot disease

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## Abstract

As part of ongoing studies with the aim of finding novel botanical bactericides for management of plant diseases, the efficacy of several plant-derived compounds was tested against *Pectobacterium carotovorum* subsp. *carotovorum* (*Pcc*), the causal agent of potato soft rot. The antibacterial activity of herbal volatile oils from six plant species (*Myrtus communis*, *Citrus sinensis*, *Ferula gummosa*, *Artemisia dracunculus*, *Syzygium aromaticum* and *Pimpinella anisum*) against *Pcc*, was studied by disk diffusion test, measurement of minimum inhibitory concentration (MIC) and minimum bactericidal concentration (MBC). In the disk assay, *M. communis* and *F. gummosa* essential oils (EO) showed strong activity against *Pcc*. The other EO had only weak activity against the pathogens, except *A. dracunculus*, which had moderate effect against one *Pcc* strain. In liquid cell suspensions, *M. communis* and *F. gummosa* showed the highest antibacterial activity among the EO, with a MIC of 15 and 20 g L<sup>-1</sup> and MBC of 25 and 30 g L<sup>-1</sup>, respectively. These two EO were selected for further experiments. In time-kill studies, application of these EO at 0.5 and 1 × MIC and 1 × MBC significantly decreased viable cell numbers throughout 30 h of testing. A checkerboard dilution test of *M. communis* and *F. gummosa* EO showed synergistic interactions against *Pcc*. GC-MS analysis identified and quantified the chemical composition of both EO.  $\alpha$ -Pinene, 1,8-Cineol and limonene were the major constituents of *M. communis* EO, whereas in *F. gummosa* oil,  $\beta$ -Pinene and  $\gamma$ -Elemene were the dominant components. These two EO, alone and in combination, were applied to protect potato tubers from soft rot in both preventive and curative conditions. The EO treatments decreased disease incidence by 31.9-56.6 % and reduced pathogen penetration by 2.3-4.6 mm. This study highlights the potential of herbal EO as natural antibacterial product, both *in vitro* and *in vivo*. Application of EO as a preservative coating for potato tubers is an

innovative approach which could be integrated with other available disease management strategies to control soft rot disease of this product.