

Nano-emulsion of denak (*Oliveria decumbens* Vent.) essential oil: ultrasonic synthesis and antifungal activity against *Penicillium digitatum*

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Abstract

Denak (*Oliveria decumbens* Vent.) is an endemic aromatic plant belonging to *Apiaceae* family. This study evaluated the antifungal activity of denak essential oil (EO) nano-emulsions formulated by ultrasonic emulsification on *Penicillium digitatum*, the main causal agent of postharvest decay of citrus fruit. EO chemical compositions detected by gas chromatography demonstrated that thymol (28.5%), carvacrol (26.2%), myristicin (17.5%) and elemicin (9.9%) were the dominant components. Denak EO nano-emulsions with droplet diameter of 26.9 nm formulated by ultrasonic emulsification. Inhibition of mycelial growth was observed at EO concentrations higher than $0.5 \mu\text{L mL}^{-1}$. The antifungal activity of the EO increased with increasing the concentration of EO. The minimal inhibitory concentration of EO nano-emulsion was found to be $0.5 \mu\text{L mL}^{-1}$. These results demonstrate the potential of ultrasonication for preparing denak EO nano-emulsion which could be used as a suitable treatment to control postharvest diseases caused by *P. digitatum* and possibly other pathogens. This newly formulated denak EO nano-emulsion can be applied as a useful treatment for prevention of citrus losses.