

**Phaleria macrocarpa (Scheff.) Boerl. (Mahkota Dewa) seed essential oils:
Extraction yield, volatile components, antibacterial, and antioxidant activities
based on different solvents using Soxhlet extraction**

ABSTRACT

Phaleria macrocarpa (Scheff.) Boerl., locally known as 'Mahkota Dewa', is a fruit commonly found in Malaysia. It demonstrates high potential for various biological activities, including antioxidant, anti-inflammatory, antibacterial, and anticancer properties. Nevertheless, there is a lack of research on the effect of essential oil extraction using different solvents on the antibacterial and antioxidant activities of this seed's fruit. This study aims to investigate the extraction yield, volatile components, antibacterial, and antioxidant activities of essential oil extracted from *P. macrocarpa* seeds using ethyl acetate, hexane, and petroleum ether as solvents. Gas chromatography-mass spectrometry was used to analyse the volatile components, while the antibacterial activity was assessed against *Listeria innocua* and *Serratia marcescens*. The antioxidant activity was evaluated using total phenolic content (TPC), total flavonoid content (TFC), and the 2,2-diphenyl-1-picrylhydrazyl (DPPH) assay. Hexane showed the highest extraction yield ($51.87 \pm 0.21\%$), followed by petroleum ether ($44.40 \pm 0.14\%$) and ethyl acetate ($27.08 \pm 0.10\%$). The essential oils extracted with ethyl acetate, hexane, and petroleum ether contained 24, 26, and 21 volatile components, respectively. The major component, 1-(ethenylthio)-octane was found in concentrations ranging from 42.371 to 54.863 ppm, followed by 2,2-dimethyl-5-(3-methyl-2-oxiranyl) cyclohexanone, with concentrations between 30.771 and 40.783 ppm. The essential oil exhibited moderate antibacterial activity, as indicated by the zone of inhibition against *L. innocua* (8.00 ± 1.30 mm to 11.00 ± 1.40 mm) and *S. marcescens* (9.00 ± 1.00 mm to 14.00 ± 1.20 mm) compared to the positive control. Additionally, the essential oil demonstrated good antioxidant activity, with TPC, TFC, and DPPH values for hexane (65.56 ± 0.02 mg GAE/g, 4.46 ± 0.17 mg RE/g, 223.78 ± 29.69 $\mu\text{g/mL}$), ethyl acetate (72.99 ± 0.05 mg GAE/g, 19.47 ± 0.41 mg RE/g, 294.02 ± 12.70 $\mu\text{g/mL}$), and petroleum ether (70.29 ± 0.07 mg GAE/g, 4.83 ± 0.05 mg RE/g, 803.64 ± 27.76 $\mu\text{g/mL}$), respectively. Nonetheless, correlation analysis revealed a moderate relationship between DPPH and TFC. The essential oils from *P. macrocarpa* seeds demonstrates strong natural antibacterial and antioxidant potential, with hexane as the most efficient solvent. Exploring compounds like 1-(ethenylthio)-octane and 2,2-dimethyl-5-(3-methyl-2-oxiranyl)cyclohexanone may reveal medicinal applications and lead to innovative remedies.