

Extraction, analysis, and comparison of volatile oils from leaves and fruit peels of *Citrus sinensis* by using two different extraction techniques

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Essential oils from the Citrus family are commonly used in aromatherapy, to relieve anxiety and pain. In the traditional systems of medicine, it is also used as an anti-inflammatory and antiseptic agent. Microwave-assisted hydro-distillation (MAHD) is a modern technique which uses the microwave for the extraction of essential oils from aromatic and medicinal plants. The aim of this study is to analyze the chemical composition of the essential oils of leaves and fruit peel of *Citrus sinensis* (Sweet orange) by Gas Chromatography (GC) and Gas Chromatographic–Mass Spectrometry (GC-MS) techniques, extracted using MAHD and hydro-distillation (HD) methods. The fresh leaves and peels were separately subjected to MAHD (microwave power 250W for 5 min followed by 500W for 55 min.) required less time (1.0 h) compared to HD (5.0 h) to obtain the yield of essential oils from leaves (MAHD: 0.089% and HD: 0.30%) and peels (MAHD: 0.40% and HD: 0.53%), respectively. Out of 73 compounds identified from MAHD leaf oils, Citral (18.02%), Sabinene (17.25%),

Linalool (16.75%) and 3-Carene (10.42%) were major compounds. Among 34 compounds from HD leaf oils, the major compounds were Sabinene (42.93%), 3-Carene (22.16%) and D-Limonene (7.33%). Out of 52 compounds, D-Limonene (84.21%) and Linalool (2.17%) were identified as major compounds from *Citrus sinensis* fruit peel from MAHD whereas HD has given D-Limonene (91.69%) and Linalool (3.39%) as major compounds from 39 compounds. There was an obvious difference in the quality of essential oils extracted and the rapid heating process yielded essential oil with higher amounts of more valuable oxygenated compounds. Saving time, energy, and plant material were some advantages of MAHD however there was a reduction in extraction yield in the MAHD technique compared with HD.

Keywords: Hydro-distillation, Microwave-assisted hydro-distillation, Gas Chromatography, Mass Spectrometry.