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Comparison of Solvent-Free Microwave Extraction and Conventional Hydro-Distillation of Essential Oils from four Selected Underutilised *Citrus* sp. Plants

Palangasinghe P.[1*], Salim N.[1], Samarasekera R.[2], Perera S.[2], Bandara V.[2]

[1]Department of Botany, University of Sri Jayewardenepura, Nugegoda, Sri Lanka
[2]Herbal Technology Section, Modern Research and Development Complex, Industrial Technology Institute, Malabe, Sri Lanka
**piumipalangasinghe@gmail.com*

Abstract

Essential oils (EOs) are widely used in cosmetic, pharmaceutical, fragrance and food industry. Solvent Free Microwave Extraction (SFME) is a green method for the extraction of essential oils from aromatic plants. The aim of the study is to compare SFME with conventional hydro-distillation (HD) technique, for the extraction of EO from four selected underutilised Citrus plant species in the essential oil industry; *Citrus medica*, *C. reticulata*, *C. madurensis* and *C. limon* in terms of chemical composition, antioxidant activity and energy consumption. The EOs were extracted using SFME (Microwave power: 700 W for 5 minutes and 400 W for 55 minutes) and HD (for 1 hour) and chemically analysed using Gas Chromatography (GC) and Gas Chromatography and Mass Spectrometry (GC-MS). The Antioxidant activity of the EOs were determined using Ferric Reducing Antioxidant Power (FRAP) and Total Polyphenolic Content (TPC) assays. The GC and GCMS identified 4(10)-Thujene (33.82%) as the major compound in C. medica oil, extracted by HD while that was L- terpinene-4-ol (18%) when extracted by SFME technique. The β-Linalool was the major component in *C. reticulata* (42.98%) and *C. madurensis* (37.95%) in SFME extracted EOs, however, it has been dropped down to 26.71% and 26.83% respectively during HD extraction. In *C. limon*, D-Limonene (43.069%) was abundant in HD-extracted EOs while it was (R)-(+)-Citronellal (39.08%) in SFME-extracted EO. SFME yielded EOs with higher amounts of more valuable oxygenated compounds with higher antioxidant capacities over HD. In comparison with HD, the SFME technique presented higher efficiency with reduced extraction times, costs and energy, yielding EOs with excellent chemical profiles and relatively high antioxidant activity.

Keywords: Essential oils, Solvent free Microwave extraction, GC, GCMS, Antioxidant