Dissertation Title	Chemical Compostition and Bioactivities of *Citharexylum spinosum* and *Osmanthus fragrans* flowers
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ABSTRACT

The chemical composition of essential oil and various solvent extracts of *C. spinosum* and *O. fragrans* flowers were reported. Essential oil was extracted with hydrodistillation method. The fresh *C. spinosum* and *O. fragrans* flowers were macerated with various solvents including *n*-hexane, dichloromethane, and ethanol to produce crude extracts. The chemical composition of *C. spinosum* were determined by gas chromatography-mass spectrometory (GC-MS) with 151 identified volatile constituents. This included 86, 41, 83, 59 compounds from flowers oil, hexane extract, dichloromethane extract, and ethanol extract respectively. Maltol and piperitone were the dominant compounds, followed by 2*Z*,6*E*-farnesyl acetate, methyl benzoate, indole, and benzyl benzoate in essential oil of *C. spinosum*. The major components of hexane extract were methyl benzoate followed by maple furanone, isolongifolan-7α-ol, amorpha-4,9-dien-14-al, β-chenopodiol and allyl anthranilate. Benzyl acetate, piperitone, maple furanone, isopropyl isobutyrate, 2*Z*,6*E*-farnesyl acetate, and furfural were found as the major constituents in dichloromethane extract. In contrast, *cis*-α-ambrinol, 2*Z*,6*E*-farnesyl acetate, maltol,

thujopsan-2β-ol, dihydroeudesmol, and dihydroeremoligenol were identified as the principle components in ethanol extract.

In total, 76, 79, 95 and 106 volatile components were detected in essential oil, hexane, dichloromethane and ethanol extract of *O. fragrans*, respectively. The prominent scent components of the essential oil were α-terpinyl isobutanoate, geranial, γ-decalactone, anisyl methyl ketone, *E*-β-ionone, *cis*-verbenyl acetate, pentyl salicylate, β-biotol, and linalool isovalerate. The major volatile compounds of hexane extract were *E*-isoeugenyl benzyl ether, *Z*-β-damascenone, *E,Z*-geranyl linalool, *E*-β-ionone, γ-decalactone while anisyl methyl ketone, benzyl cinnamate, γ-decalactone and *E*-β-ionone were considered as the principle components of dichloromethane extract. Ethanol extract presented α-patchoulene, pentadecanol, pentyl salicylate and geranyl benzoate as major constituents. Thus, quantitation of each compound could be related to environmental conditions and plant habitat.

Highly odor volatile compounds of fresh *C. spinosum* and *O. fragrans* flowers were extracted by using solid phase microextraction prior analysis by gas chromatography-mass spectrometry (SPME-GC-MS). Three fibers including PDMS, CAR/PDMS and DVB/CAR/PDMS were chosen for extraction of *C. spinosum* and *O. fragrans* odor constituents. Fifty-two odor volatile components were identified among these fibers. Twenty-two compounds were detected with PDMS fiber. The key odor volatiles were methyl benzoate, phenyl ethyl alcohol and 2-phenyl ethyl acetate while thirty-four constituents were found when using CAR/PDMS fiber with the major compounds of octen-3-ol, methyl benzoate, phenyl ethyl alcohol and 2-phenyl ethyl acetate. For DVB/CAR/PDMS fiber, thirty-six compounds were investigated. The major volatiles were octen-3-ol, methyl benzoate, phenyl ethyl alcohol, methyl salicylate and 2-phenyl ethyl acetate. Different contents of volatile components of *C. spinosum* flowers were related to composites on each fiber. The DVB/CAR/ PDMS fiber was considered to be the best fiber for extraction of odor volatiles of fresh *C.*

spinosum flowers due to the highest number of volatile components compared to other fibers. It is noted that the solid phase microextraction technique is more sensitive to extract the volatile components which played the significant role as the key scent in *C. spinosum* flower.

Highly volatile compounds of *O. fragrans* flowers were investigated using SPME-GC-MS method. Twenty-nine compounds were detected with PDMS fiber. The key odor volatiles were naphathalene, heptadecane, *E*-β-ionone, and isobazzanene while thirty-seven constituents were found when using CAR/PDMS fiber with the major compounds of isobazzanene, octane, 3*Z*-hexenol, 3-3-methyl-3-butenyl-methyl butanoate, *E*-β-ocimene, *E*-β-ionone, γ-delactone. Using DVB/CAR/PDMS fiber, we obtained 59 identified volatiles. The major volatiles were isobazzanene, *E*-β-ionone, γ-decalactone, undecane, *E*-β-ocimene, *cis*-linalool oxide, 3-3-methyl-3-butenyl- methyl butanoate, and *trans*-linalool oxide.

All extracts and essential oil of *C. spinosum* and *O. fragrans* flowers were tested for their antibacterial activities. The flower oil of *C. spinosum* had the greatest antibacterial activity against all bacterial strains (MIC values of 31.2 µg/mL), while the other solvent extracts had MIC values ranging from 31.2 to 1000 µg/mL. For *O. fragrans* flowers, the best antibacterial and antifungal activity was obtained from the exthanol extract of *O. fragrans* flowers followed by dichloromethane and hexane extracts, respectively. The presence of various terpene components with their derivatives such as α-patchoulene, γ-decalactone, *E*-β-ionone, γ-gurjunene, hinesol acetate, geraniol and *epi*-cubenol and 1,8-cineole were contributed to promote the antimicrobial activities.

Keywords: *Citharexylum spinosum*/*Osmanthus fragrans*/Volatile compounds/ SPME-GC MS/ Antibacterial/Antifungal