Identifying the Compounds Responsible for the Smell of Jasmine Flower

Omar Masri

Abstract

Jasmine flowers are well-known for their strong, sweet aroma and are used worldwide in perfumes, lotions, and oils. The aim of this project was to determine the compounds that comprise the scent of jasmine flower and the most effective technique to do so. Star Jasmine (*Trachelospermum jasminoides*) was collected in Monrovia, CA and various solvent extractions and a steam distillation were performed in order to analyze the compounds present in the flower. Gas Chromatography-Mass Spectrometry (GC-MS) was then used to identify each compound. The results reveal that there are at least 54 compounds responsible for jasmine flower aroma and the most effective technique that yielded the most aromatic compounds was a separatory funnel extraction using untreated flowers and methanol as the solvent.

Introduction

The goal of this research was to identify the compounds responsible for the smell of jasmine and the most effective technique to detect them using GC-MS. Factors that were considered were time of day collected, the preparation of jasmine, sonication time, and volume injected into the GC-MS.

One study found 71 kinds of effective volatile components in jasmine, including 9 alcohols, 24 esters, 24 terpenes, 6 hydrocarbons, 1 ketone, and 3 aldehydes.[1]

Figure 1: Star Jasmine flowers outside of Oak Crest Institute of Science in Monrovia, CA.

Materials and Methods

Star Jasmine was collected outside of Oak Crest in Monrovia, CA on June 27th, June 30th, July 11th, and July 20th of 2023. Flowers were collected in the morning (9-11am) and afternoon (4pm).

Solvent extractions were performed using 20 mL vials, a 125 mL separatory funnel, and Eppendorf tubes. Different forms of jasmine (untreated, blended, and lyophilized) were tested. Heptane and Hexane, Dichloromethane (DCM), Acetonitrile (ACN), and Methanol were chosen as solvents because of their varying polarities. A steam distillation was performed in an effort to produce jasmine oil and other samples to analyze. For two sets of samples a second reading was taken the next day to compare it to the initial results.

GC-MS was used to separate the volatile compounds in each sample and identify them through chromatograms and mass spectrums. 1µL injections were used for every sample while 3µL injections were used for a few to get a comparison. The Agilent 7890A GC system and the MSD ChemStation software were utilized to accomplish this.

Results

Five Most Abundant Compounds

Compound	Smell [2]	Percentage of samples
Chavicol	Phenolic odor (sweet, smoky)	100%
Guaiacol	Smoky, medicine, spice, vanilla	73%
Vanillin	Vanilla-like	67%
2-Methoxy-4-vinylphenol	Spicy, clove-like	55%
5-Hydroxymethyl-2-furancarboxaldehyde	Fatty, caramellic	48%

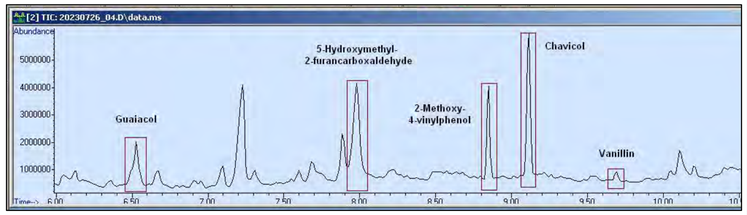

Figure 2: The five most abundant compounds are shown in the chromatogram of the concentrated methanol separatory funnel extraction with untreated flowers.

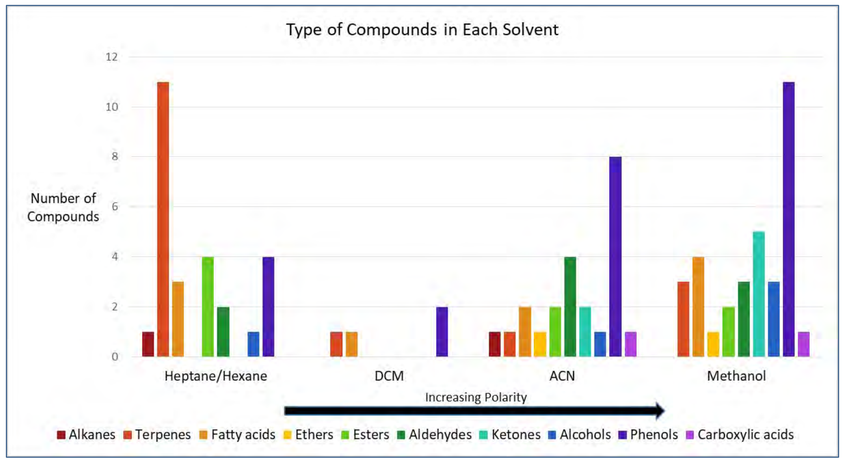

Figure 3: Quantity of each type of compound detected in each solvent. The solvents, as well as the compounds labeled on the bottom, increase in polarity from left to right.

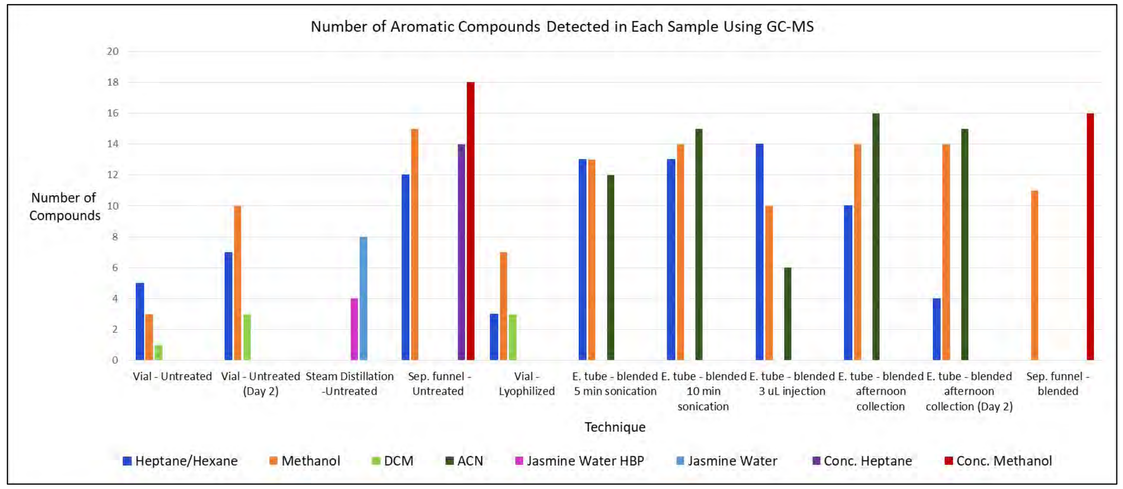

Figure 4: Sep. = separatory and E. = Eppendorf. "Jasmine Water HBP" refers to the high boiling point water that did not evaporate during distillation. A solvent became concentrated (Conc.) by letting it evaporate until dry, then reconstituting it with 3 mL of the solvent.

Conclusions

There are at least 54 compounds in jasmine that result in the flower having a sweet, smoky, spicy, vanilla-like aroma.

The sample and technique that yielded the highest number of compounds detected was concentrated methanol from the separatory funnel extraction with untreated flowers.

Figure 5: Separatory funnel extraction with untreated flowers.

The best solvent to use regardless of technique is methanol because every type of compound dissolved in it in relatively high amounts.

Steam distillation is not an effective method to obtain jasmine oil as none was produced.

References

1. Zhang, Y.; Xiong, Y.; An, H.; Li, J.; Li, Q.; Huang, J.; Liu, Z. Analysis of Volatile Components of Jasmine and Jasmine Tea during Scenting Process. Molecules **2022**, 27 (2), 479. DOI:10.3390/molecules27020479.
2. Human Metabolome Database. https://hmdb.ca/ (accessed 2023-07-12).

Acknowledgements

This project could not have been completed without Citrus College and the author's mentors at Oak Crest; Joseph Spong and Amalia Castonguay.

Alternate Text

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