

Column Chromatography and GC-MS Analysis of Ghanaian Home Remedies

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Abstract

This research project is a continuation from the previous semester where Ghanaian home remedies were analyzed to see what compounds are in them that contribute to their healing capabilities. The specific unknown that was further analyzed is the sample that describes curing manpower and low sperm count. Column chromatography and GC-MS were used for this process, which gave favorable results such as D-Allose, Acetaminophen derivatives, and Palmitic acid. All of these compounds have some form of identifiable healing property which is likely to appear as this is a home remedy. Further analysis of the spectra and tweaking of the procedure will need to be done due to time constraints.

Introduction

For this research project, a Ghanaian home remedy was analyzed through the column chromatography and GC-MS. The home remedies come from native plants from Ghana that are dried and crushed up before being consumed through teas or just straight up ingestion. For the remedy that this unknown is supposed to treat is manpower and low sperm count.

The techniques used for this experiment was column chromatography, which is the separation of compounds and molecules in a mixture through their polarity, and GC-MS, which individually separates these compounds through polarity and boiling point. A few different methods of running the column was conducted where the best method was determined through the data gathered from the GC-MS.

Procedures

• Column Preparation

- Column was rinsed with piranha solution (50:50 of Concentrated Sulfuric Acid and 30% Hydrogen Peroxide)
- About 50 grams of silica gel was weighed and mixed with methanol to form a slurry solvent
- Slurry solvent was packed into the column and left to settle
- Additional methanol was added to ensure that column does not dry out
- Sand was washed in methanol 2-3 times before being added on top of the settled silica in the column.

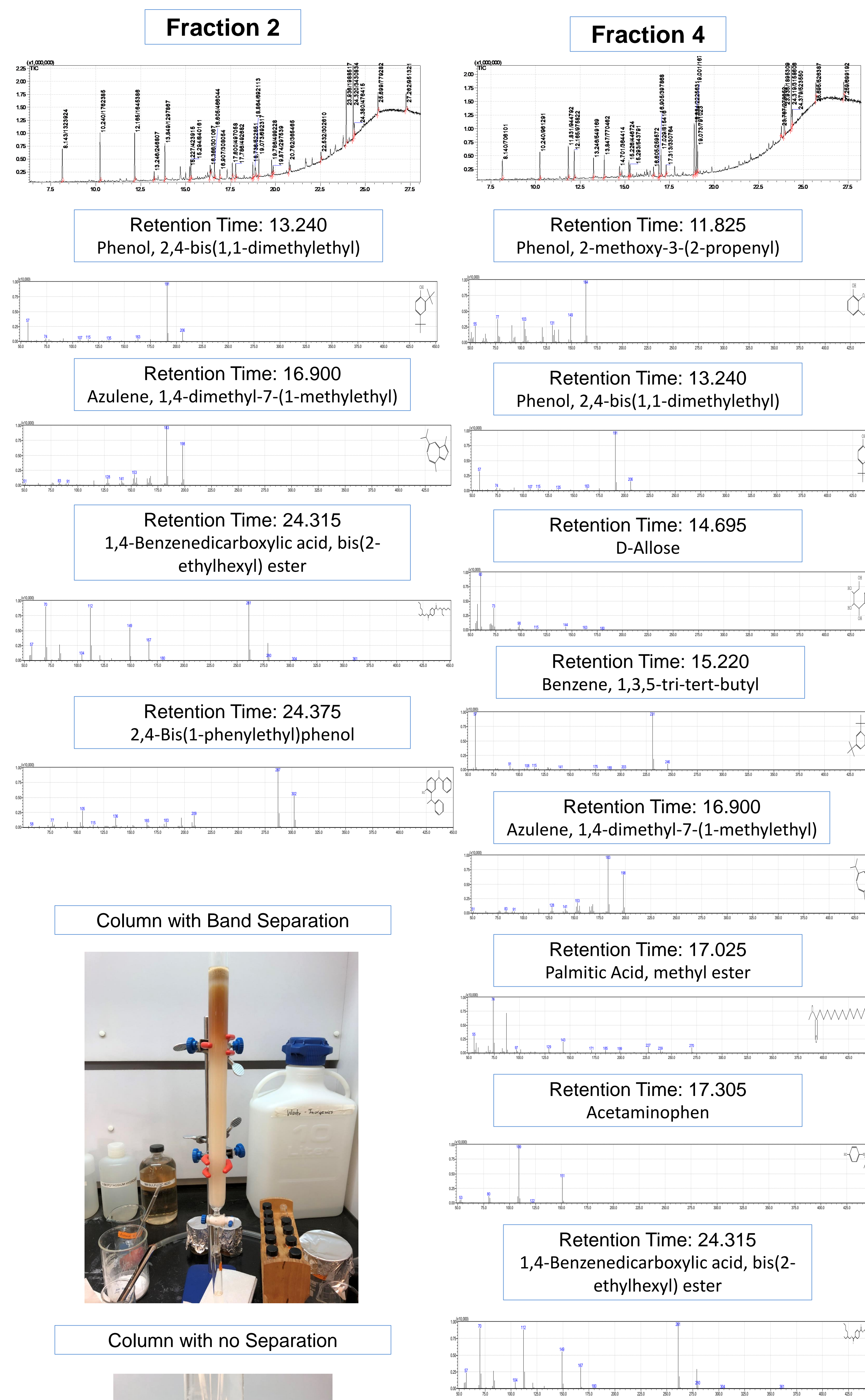
• Sample Preparation

- About 2.00 grams of sample was weighed in Analytical balance
- Sample was extracted with 20 mL of methanol
- About 2 mL of methanol extracted sample was filtered and added to the column using a syringe.

• Running the Column

- Column was flushed with methanol until the liquid ran clear
- Solvent layer was lowered until just above the sand layer where sample was added
- The sample was allowed to drain into the sand layer while ensuring that the sand does not dry
- Additional methanol was added, and the column was allowed to run while periodically adding more methanol
- The bands were collected until nothing came off

GC-MS Spectra of Samples



Results/Conclusions

Column chromatography was the technique used in this research as it is a purification method that separates the compounds of interest into their own package. Many different methods regarding running the column was done, which included running a heptane column and then switching to acetone as the solvent. These other methods did not provide fruitful data thus the first column's data turned out to be the best.

The MS gave a chromatogram with many peaks that were deemed real by the instrument; however, many of these are silicates coming from the silica gel used in the column. Nevertheless, there were many real peaks that the instrument detected in addition such as D-Allose, Azulene, Palmitic acid, and Acetaminophen. These compounds do show some type of healing property when looking at literature.

Fraction 4 shows many of these peaks of interest like D-Allose which appears at 14.695 minutes. This compound is known as an anti-oxidant for the body, which makes sense to appear in this sample as teas are known to be natural anti-oxidants. Azulene appears at 16.900 minutes for both Fractions 2 and 4 and is more commonly known for being a dye. However, since the MS cannot differentiate, it is likely that this is Azulene oil because the samples color was brown. This oil treats for inflammation and redness of skin along with the property of acting as a moisturizer.

In addition, Fraction 4 appears to contain Palmitic acid at 17.025 and Acetaminophen at 17.305. The Palmitic acid showing up in the MS, which is a saturated fat that can appear in nature, so it is not unsurprising whereas acetaminophen appearing indicates that it could be a major player in providing health benefits. However, the MS detected this as a derivative of acetaminophen so it along with the other compounds could be the major players in treating manpower.

The phenolic compound showed at 11.825 which when comparing to other fractions shows to have an equal match to Eugenol is another anti-oxidant and provides antibacterial properties. Other compounds found in Fraction 2 such as 2,4-Bis(1-phenylethyl)phenol and 1,4-Benzenedicarboxylic acid, bis(2-ethylhexyl) ester could be present due to the area that they were grown in and what compounds were present in the soil. Finally, Phenol, 2,4-bis(1,1-dimethylethyl) which appears at 13.240 minutes for both Fraction 2 and 4 is known to also be an anti-oxidant as well as protect against Trimethylamine in the human body.

Future Work

- Tweaking of experimental procedures to eliminate silica residue from showing in GC-MS column
- Further analysis of spectra fractions as well as comparing similar compounds from each spectra to identify real peaks
- Running the second unknown sample that treats ulcers and stomach pain
- Possibly running samples on LC-MS and other instruments such as ¹HNMR and FTIR
- Alumina column could be another method used to get better separation
- Employ a gradient elution by starting with a nonpolar solvent and switching over to higher eluent strengths

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