A Comparative Analysis of Cold Brew Coffee Aroma Using the Gas Chromatography–Olfactometry–Mass Spectrometry Technique: Headspace–Solid-Phase Extraction and Headspace Solid-Phase Microextraction Methods for the Extraction of Sensory-Active Compounds

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INTRODUCTION & AIM

Coffee is widely consumed for its aroma, flavor, and caffeine content, leading to the exploration of new preparation methods, such as cold brew (CB). This cold extraction technique is known for its smooth and fresh taste, with lower acidity and bitterness, and higher caffeine content due to prolonged extraction times.

The study aimed to develop a method to identify volatile compounds in CB that contribute to its aroma and sensory profile. Gas chromatography with olfactometry and mass spectrometry (GC-O-MS), along with headspace extraction methods, were used for a more precise characterization of these compounds
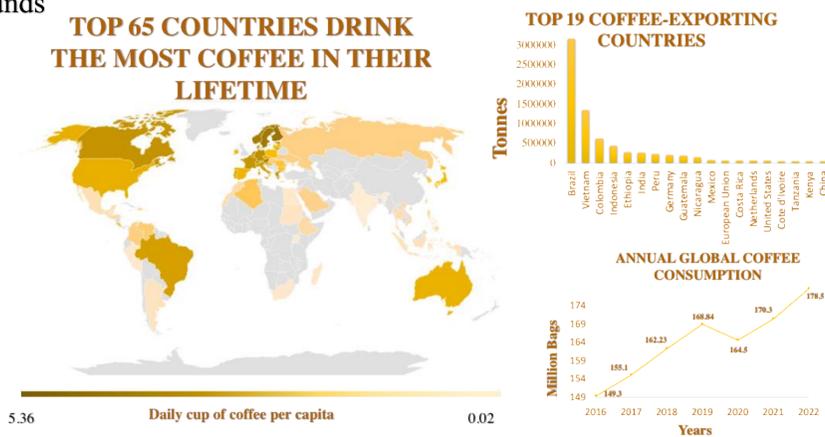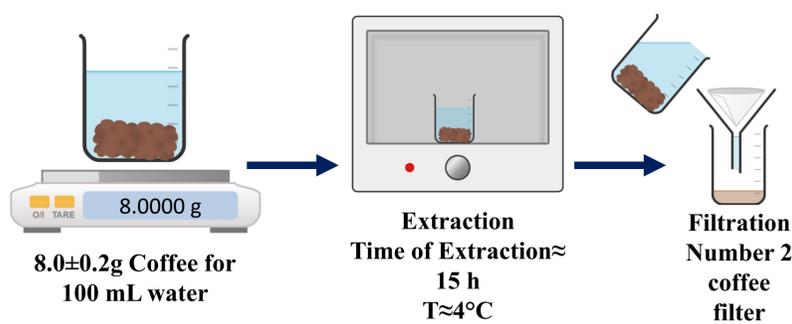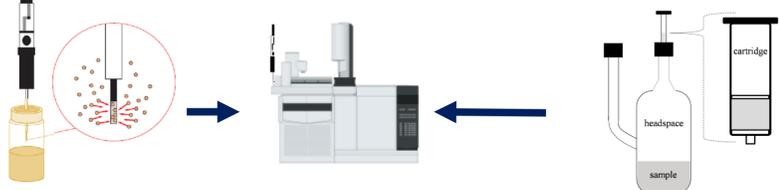

Figure 1. Coffee Consumption and Export Trends

METHOD

Cold Brew Coffee Preparation

8.0±0.2g Coffee for 100 mL water

Extraction Time of Extraction≈ 15 h T≈4°C

Filtration Number 2 coffee filter

Sample Preparation

GC-O-MS

Training

Table 1. Chromatographic Conditions

Column Information		Oven Program		
Name	DB-FFAP column	Temperature °C	Rate (°C/min)	Time
Length (m)	60			
Internal Diameter (mm)	0.25	50	3	3,1
Film Thickness (µm)	0.25			
Equipment Information		150	7	36,43
Equipment	GC-O-MS			
Model	Trace 1300 chromatography system	240	0	51,29
Manufacturer	Thermo Fisher Scientific			
Olfactory Port Type	ODP2, Gerstel, Mülheim, Germany			

RESULTS & DISCUSSION

Table 2. Optimized conditions for each aroma extraction method.

HS-SPME Optimal conditions	
Extraction Time	50 Mins
Conditioning Time	5 Mins
Sample Volume	6 mL
SPME Fiber	DVB/PDMS/CAR

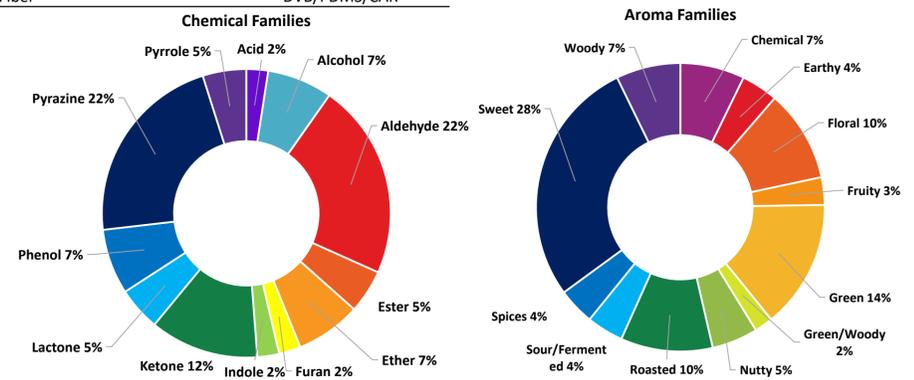| HS-SPE Optimal conditions	
Elution solvent ratio	dichloromethane/methanol (95/5)
Extraction Time	6 h
Purge Gas Flow	80 mL/Min

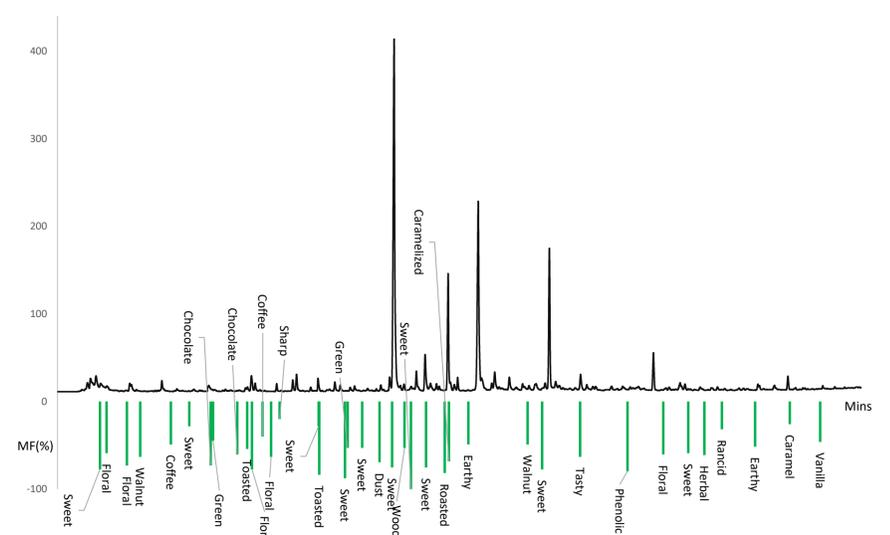Figure 2. Proportions of chemical and aroma compound families identified in Cold Brew.

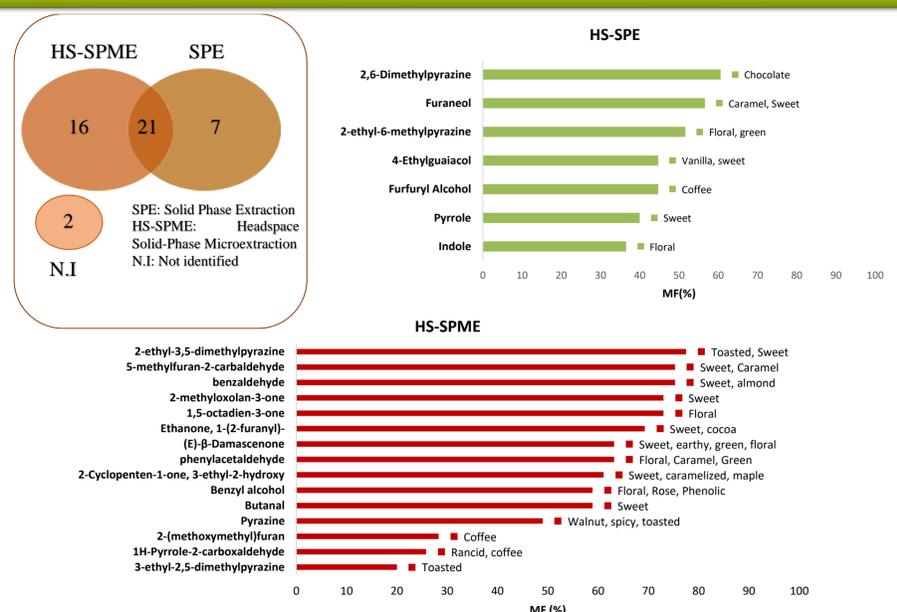Figure 3. Olfactogram obtained through GC-O-MS with modified frequencies.

CONCLUSION

Figure 4. The most important compounds for the aroma of Cold Brew in each extraction method

FUTURE WORK / REFERENCES

We are currently investigating how coffee varieties, different roast levels, and qualities affect the final aroma of Cold Brew coffee