Comparative Analysis of VOCs in local Utah Whiskey by Yeast Strain and Charring Level via GCMS

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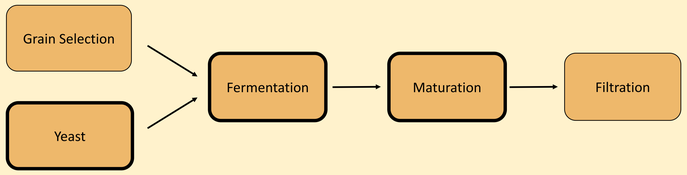
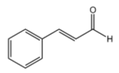
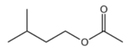
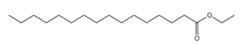
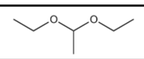
Poster #:

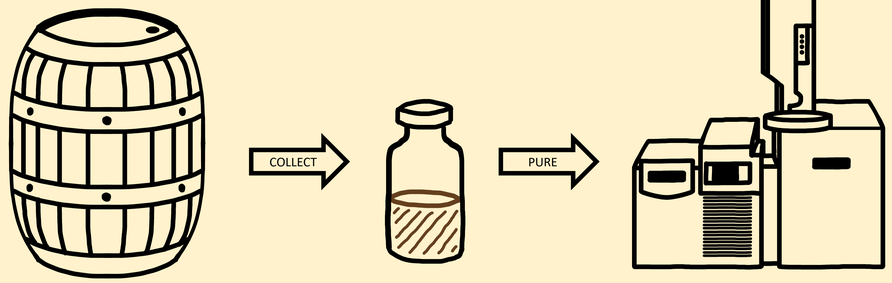
Introduction

Dented Brick is a local Salt Lake City distillery which makes a variety of spirits, including American Rye Whiskey. This whiskey is produced by the process below. The aging process, or maturation, is a crucial step in the overall development of the color, aroma, and flavor profile of whiskey. American Whiskey is traditionally aged in oak casks, as this wood interacts with the distillate during the maturation process to produce the signature whiskey flavor profile. Furthermore, different yeast strains can produce unique compounds, leading to variations in amount and type of flavors in the final product. These VOCs can be identified and analyzed using a method of gas chromatography-mass spectrometry (GC-MS) from whiskey samples provided by Dented Brick Distillery. Samples included three different charring levels of 2, 3, and 4 with two yeast strain types. Samples were run in triplicate and averaged to reduce noise in the analysis.



Expected Compounds

Expected Compounds	Chemical Structure
Ethyl Acetate	
Cinnamaldehyde	
Vanillin	
Isopentyl Acetate	
Furfural	
Ethyl Palmitate	
1,1-Diethoxyethane	



Method

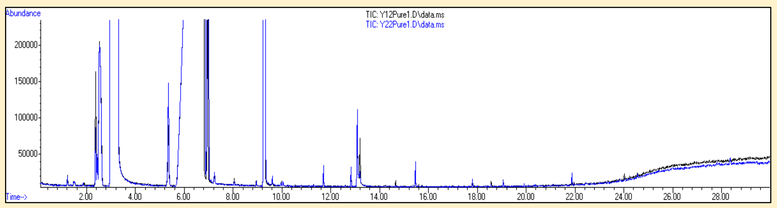
Control	Value
Inlet Mode	Split, 25.0:1
Inlet Temperature, C	240
Gas	He
Pressure, psi	16.05
Initial Oven, C	40
Ramp 1, C, C/min, hold (min)	240, 5, 5
MSD, C	220

GCMS Specs

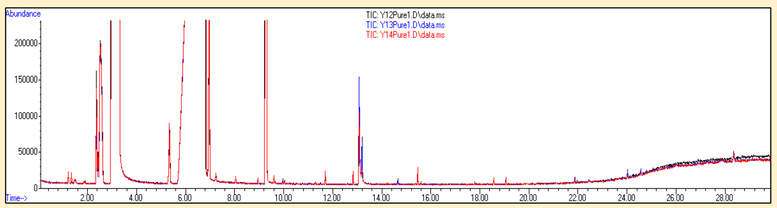
Instrument	Type
GC System	6850
Auto Sampler	6850
VL MSD	5975C, EI
Column	DB-WAX UI
Column Parameters	25 m x 0.2 mm x 0.2 μm

Results

Name	Confidence	Δ Char?	Δ Yeast?
Ethyl Acetate	High	X	X
2-methyl-1-propanol	High		X
1,1-Dioethoxyethane	High	X	
3-Methyl-1-butanol	High		
Acetic Acid	High	X	
Furfural	High	X	X
Methanol	High		
1-propanol	High		X
Ethyl Caprylate	High		X
5-methyl-2-furancarboxaldehyde	High	X	X
1-Butanol	Medium		X
Isopentyl acetate	Medium		X
Ethyl Caproate	Medium		
1,1-diethoxybutane	Medium		
Ethyl Caprate	Low		X
Phenylethyl Alcohol	Low		X
Ethyl Palmitate	Low		X
5-hydroxymethyl-2-furancarboxaldehyde	Low	X	X
Cis-3-Methyl-4-octanolide	Low		



Above: A chromatogram overlay of the first run for Char Level 2s of Yeast 1 and Yeast 2.



Above: A chromatogram overlay of the first run for Char Level 2, 3, and 4 of Yeast 1.

Conclusion

Preliminary evidence suggests that the variation of charring and yeast strain impacts amount or even the presence of a compound. While certain compounds such as isopentyl acetate (56% higher in Yeast 2, comparing Char 1 averages) and furfural (66% decrease in char, 57% lower in Yeast 2) are impacted by yeast and both yeast and charring respectively, there are other compounds that suggest a non-linear relationship such as 1,1-diethoxyethane. As each sample was ran three times to obtain an average, further runs are needed to establish statistical significance. Furthermore, certain compounds known to be in Whiskey such as cinnamaldehyde and vanillin were not present in any run. Continued research will utilize solid-phase microextraction (SPME) fibers to conduct trace analysis.

Acknowledgements

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