IOWA STATE UNIVERSITY
Food Science and Human Nutrition

IOWA STATE UNIVERSITY
Center for Crops Utilization Research

Honors Poster Presentation
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Analysis of Flavor Compounds in Aronia Berries over Ripening

Objectives

- To identify and quantify various flavor compounds in aronia berries
- To observe how these flavor compounds change over ripening
- To learn more about flavor chemistry and how volatile flavors are analyzed in a sample

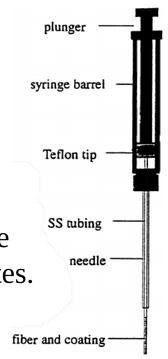
Introduction

Chokeberries, or more commonly, aronia berries (Aronia *melanocarpa*, Viking cultivar), are an up-and-coming fruit with high antioxidant content and a very dark color. They are grown all over the world, including Iowa. Because of their high amount of antioxidants, they have been touted as a "superfruit" and have begun popping up on store shelves. Identifying and quantifying their flavor compounds throughout ripening can help us understand what kinds of flavors exist in aronia berries and how they change over maturation. This can also help us determine optimal harvest time. Studies have identified volatile compounds in aronia berries before, but this study hopes to look at how these compounds change over ripening.

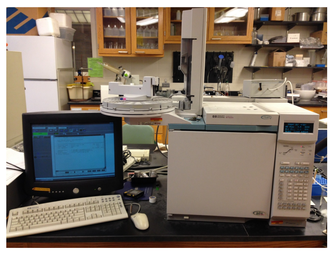
Materials and Methods

Sample Prep: Over the span of a month of harvest dates, samples were pulled every 3 days. 150 g samples were collected and thawed in the refrigerator, then juiced and stored in the refrigerated until ready to be used.

Isolation and Analysis of Flavor Compounds: The volatile compounds were isolated using solid phase micro-extraction (SPME) techniques. Juice samples were poured into a headspace bottle, a stir bar was placed in, and the bottle was capped. Each Sample was held at 40°C and constantly stirred while The fiber was exposed to the headspace for 40 minutes. Then the sample was desorbed for 3 minutes into the GC.



Mass Spectroscopy: The same procedure as above was used for sample preparation, flavor compound isolation and oven conditions. Volatile compounds were identified based on GC-Mass Spectrometry (GC-MS).



Results

Table 1. Compounds and Retention Times of Aronia Juice

Retention Time (s)	Compound	Odor
1.45	ethanol	Sweet
5.11	3-penten-2-one	Fruity and fishy
7.45	hexanal	Grass
13.9	benzaldehyde	Almond, burnt sugar
15.06	6-methyl-5-hepten-2-one	Green, fatty, citrus
19.19	nonanal	Fat, citrus, green
22.96	β-cyclocitral	Mint
25.35	Theaspirane	Honey, green, woody
25.84	Theaspirane (different isomer)	Honey, green, woody
30.5	β-ionone	Seaweed, violet, flower

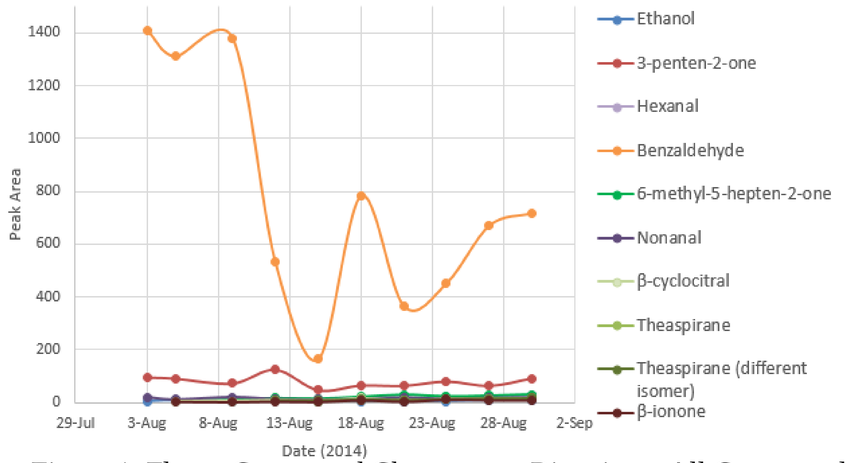


Figure 1. Flavor Compound Change over Ripening – All Compounds

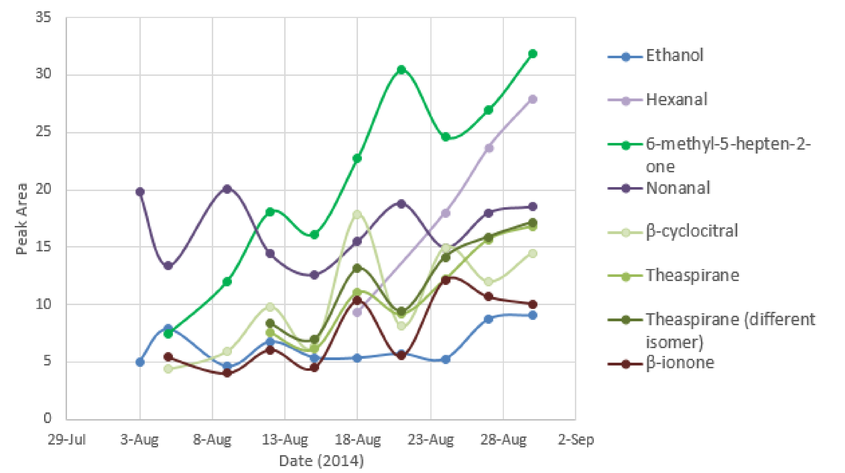


Figure 2. Flavor Compound Change over Ripening – Minor Compounds

Discussion

Ten major aronia berry flavor compounds were studied in this project but there are many more. Some fruits, such as strawberries, have hundreds of flavor compounds that have been identified. However, only a fraction of those contribute to aroma and taste. This study attempted to use a sniffer port to characterize the aromas as they came through the GC. However, these berries were almost three years old and likely had lost many volatile flavor compounds. Fresh berries would have been ideal for the study.

Flavor compounds form through enzymatic and non-enzymatic processes. These processes increase as growth slows down because the cells of the plant are no longer putting all their energy into growing and can redirect their energy to producing secondary metabolites. At the end of ripening, there is an increase in several flavor compounds, most of which are terpenoids. Terpenoids contribute to many of the aromas in fruits and other plants. The increase in the compound hexanal, which is a short-chain aldehyde, may have come from the degradation of lipids in the cell membranes of cells. Overall, these compounds contribute to the green, woody, and flowery aroma of aronia berries.

Conclusion

Of the ten compounds identified and quantified in aronia berries, all of them either increased throughout ripening or stayed constant. Flavor compounds seem to peak at the end of August, which aligns with previous studies that show that the sugar/acid ratio is also optimal at the end of August. This gives the berries their best balance of sweetness, acidity, and flavor. Knowing when aronia berries are at their peak can help farmers know when to harvest them and understanding how their flavor compounds evolve is an important step to discovering more about this burgeoning fruit.

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