



2022 ASBC Research Council Grantee

Principle Investigator: Callie Cole

Academic Institution: Fort Lewis College Department of Chemistry & Biochemistry, Durango, CO, U.S.A.

Project Title: Combining Sensory and Analytical Tools (HS-SPME-GC-MS) to Elucidate Hop Biotransformation and the Aroma Imparted by Hops in Beer

Project Intro:

We seek ASBC support for an undergraduate student-run analysis lab at Fort Lewis College in collaboration with Ska Brewing Company to profile the aroma constituents of novel hopped beer. Hops are the most costly and environmentally impactful raw material used in brewing. The addition of hops during brewing has been long approached through kettle or dry hopping. Neither of these approaches promotes extended interaction between yeast and hops during the fermentation process, which has been shown to encourage biotransformation: the process by which yeast chemically alter hop oil compounds. At Ska Brewing, a novel approach to hop addition is being employed; the yeast inoculation and hop addition occur simultaneously to increase the amount of time the yeast and hops are in direct contact. During fermentation, the hop oils, predominantly terpenes and sesquiterpenes, can be chemically modified by yeast enzymes. Even slight molecular structure modifications can dramatically affect organoleptic properties. We hypothesize that through study of hop varieties and the biotransformation of their oils, the brewing process involving these raw materials can be optimized for efficiency to decrease environmental impact and waste. We propose to conduct both sensory panels and Headspace-Solid Phase Microextraction-Gas Chromatography-Mass Spectrometry (HSSPME-GC-MS) analysis to profile 6 hop varieties and novel beer fermented with them to test this hypothesis. This collaboration will not only provide a fun, locally relevant analytical chemistry training for FLC undergraduates, it will allow industrial brewers in our rural community to obtain and share important chemical information on their products.

Project Objectives:

- Objective 1: Train undergraduate research students in the analytical laboratory by profiling volatiles in beverages fermented at Ska Brewing Co. produced with Sultana, Azacca, and Idaho-7 hops.
- Objective 2: Ferment novel beer samples at Ska Brewing Co. with 3 additional hop varieties (Strata, Cashmere, and El Dorado) and perform HS-SPMEGC-MS on all samples.
- Objective 3: Correlate chemical and sensory information to accurately interpret and communicate results to fellow scientists, industrial brewers, and the public. (This objective was approved by the Fort Lewis College Board of Trustees to be Dr. Cole's Spring 2023 sabbatical research).