



2023 ASBC Research Council Grantee

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Project Title: “Hop Creep-Causing Enzymes: Characterization and Elucidation of their Origin”

Project Intro: Over the past decade, dry hopping has become a standard technique for producing aromatic beers. However, the process also transfers unwanted compounds from hops to the beer, such as dextrin-hydrolyzing enzymes that result in the production of fermentable sugars (Kirkpatrick et al., 2019). Refermentation of beer has undesirable consequences including increased alcohol content and over-production of CO₂, which can lead to serious quality issues post-packaging (Kirkpatrick & Shellhammer, 2018). Recently, Cottrell’s (2022) study suggested that the enzymes are endogenous to hops since no diastatic activity could be associated with hop-related microorganisms. On the other hand, Teraoka et al. (2021) claimed that the enzymatic activity during dry hopping is related to microorganisms present in hops. This hypothesis was reinforced by a Young et al. (2023) study which suggested that pathogenic microorganisms, especially fungi, might be the source of enzymes causing hop creep. Consequently, there is still a lack of information on whether enzymes responsible for hop creep are derived from hops or from microbial origin. This study aims to investigate the hop proteome to determine the presence and origin of enzymes, including those that influence the quality of dry-hopped beer. For the first time, the extracted enzymes will be analyzed using Liquid Chromatography – Mass Spectrophotometry coupled with a Mass Spectrophotometer (LC-MS/MS) to evaluate whether the proteins are endogenous to the hop plant or associated with the hop microbiome. Further insights into the hops’ proteome may be revealed.

Project Objectives:

1. Identification of microbial species present in seeded and unseeded hops by metagenomic analysis and their diastatic activity.
2. Physicochemical characterization of hop creep-causing enzymes.
3. Hop enzyme identification via proteomics.