Development of Process for Extracting Oil from Hops

Zaavan Clear, David Baden, and Grace Sullivan

Trine University: McKetta Department of Chemical & Bioprocess Engineering

Abstract

Purpose

The purpose of this project is to see if hop oil can give a brewer better control over the product quality. Hop oil could also be an additive to many different beverages, without the leftover pellet mash. The goal is to extract the essential components of hops from the cones into a liquid oil product and scale the process up for larger production quantities.

Background

Hops are an essential component to brew making. Hops are key to the aroma and bitterness of the beer. The essential components of hops for brew making are the α- and β-acids, lipids, polyphenols, and oils.

During the process of pelletizing hops, the farmer plucks the cones from the hop vines and dries them. The dried cones are then crushed in a hammermill, and slowly and continuously fed into the pelletizer. After, the pellets are packaged in Mylar bags with nitrogen, and frozen for distribution. Keeping the hops cool at 26°F keeps the essential oils and acids locked into the pellets.

Current Process and Proposed Variation

Fig. 1

Harvested

Fig. 2

Pelletizing

Fig. 3

Oil Extraction

Fig. 4

Currently, dry hop cones are sent through a hammer mill to reduce them to a powder which is sent through a pellet mill to press it into small pellets, about a quarter of an inch in diameter. These pellets are packaged under nitrogen and sent out to breweries to be used in the beer-making process.

The proposed alteration to the current process is to replace the pellet-making with an oil extraction step. The cones would be sent through an extraction process to extract the desired oils. Pure oils allow greater flexibility for both the hops supplier and the brewery. Pure oils do not require as stringent of packaging or storing conditions, making them easier to package, store, and ship. Having the oils extracted before being added to beer gives the brewery more flexibility for when they add the hops and allows for alterations after the brewing process is complete. Based on these advantages, this project sought to determine if it was economically feasible and advantageous to implement an oil extraction unit.

Extraction Alternatives

Steam

Steam distillation is widely used in many essential oil extractions, but the high temperature and water contact can alter the taste and aroma profile of the hop extract.

Solvent

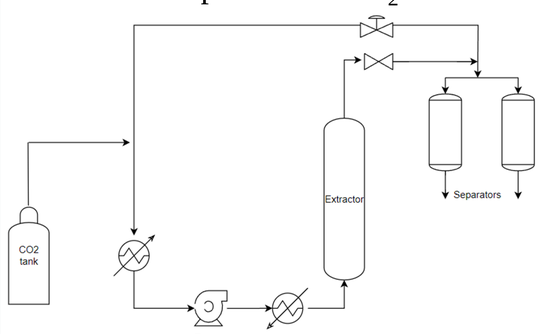
Solvent extraction is the most common and therefore the most researched and developed. Costs are lower, but great attention must be given to removing all the solvent from the final product.

CO_2

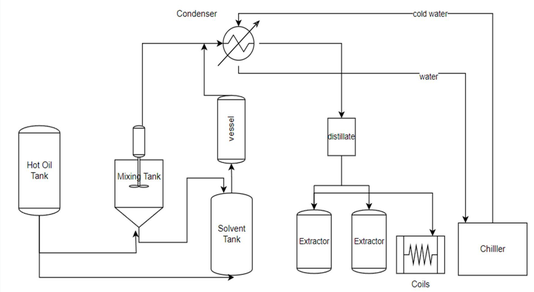
CO_2 has the advantage of operating at lower temperatures without harmful solvents. It is the most expensive option.

Flow Diagram

Supercritical CO_2

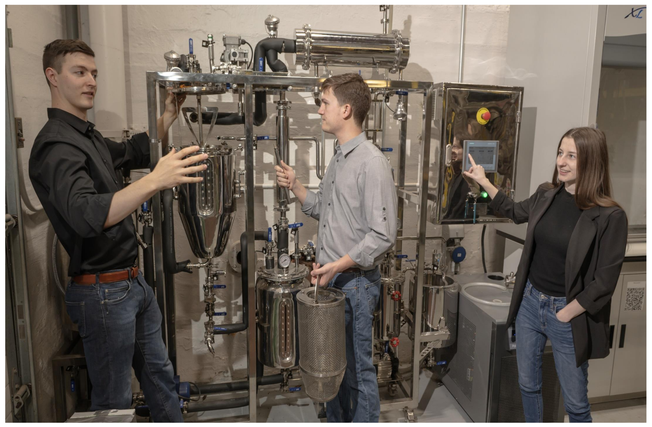


Solvent Extraction



Pricing

Unit	Price
Steam	$75k
Solvent	$75k
CO_2	$250k
Process	$7/lb



Conclusion

Third-party processing is currently the best option for a few reasons. First and foremost, it is the only economically feasible choice. Based on current production, the price of purchasing equipment is simply too high. Second, it allows exploration into the hop oil market without any capital investment.

References

[1] “Essential Oil Extraction Archives,” Cedarstone Industry. https://cedarstoneindustry.com/product-category/essential-oil-extraction/

[2] “Apeks Supercritical | CO2 Extraction Systems | Oil Extractors,” Apeks Supercritical. https://www.apekssupercritical.com/ (accessed Apr. 18, 2024).