**Yeast: The Brewer’s Untapped Resource**

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**Saccharomyces cerevisiae, yeast, fermentation, fungus**

**Abstract**

For over 200 years, brewers yeast (*Saccharomyces cerevisisae*) has been the go-to yeast for many types of fermentation, most notably beer. With the craft brewing market growing and with there only being one commonly used yeast, the fear of uniformity is encroaching on brewers everywhere. The hunt for uniqueness in an overwhelming market is a driving force to find new and exciting yeast that provide complexity, and a better overall experience for the drinker. Brewers have begun implementing spontaneous fermentation, which is how alcohol was produced before the discovery of *S. cerevisisae*, in order to create a local flavor known as terroir. Yeast are responsible for a great majority of the flavors and aromas found in beer, wine, and cheese due to the yeast’s ability of producing esters and phenols as byproducts. The possibilities are endless, and we have only tapped into one single strain, *Saccharomyces cerevisisae.*

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**Introduction**

In recent years, the demand for craft alcoholic beverages has been on the rise. With an enormous 4,269 craft breweries [1] in operation in the United States alone, breweries are not going anywhere anytime soon. However, despite the huge volume of craft breweries there is only one commonly used, readily available yeast strain

responsible for ethanol fermentation and that is, *Saccharomyces cerevisisae*, or more widely known as brewers yeast. Louis Pasteur isolated this yeast strain over 200 years ago from a brewery in Europe and it has been used relentlessly ever since. In a time where breweries are trying to be unique with their craft, they are restricted by the yeast strain that everybody else is using. Thus, hindering the amount of uniqueness they each can have. There are hundreds of thousands of yeasts living on just about everything, and we have only truly researched and isolated one. The flavor variations could be endless. Yeast, when undergoing anaerobic fermentation, metabolize sugars (glucose, maltose, maltotriose, etc…) and this metabolic process creates carbon dioxide (reason for carbonation in beer) and ethanol. During the fermentation process, the yeast also produce esters and phenols, which contribute a huge amount to the overall flavor and aroma of the finished beverage. Different yeast could mean different esters, phenols, and an overall imparted flavor characteristic on the finished product.

**Recent Progress**

Fermentation of foods and beverages in the past provided safety and peace of mind to the consumer back before proper storing and sanitation techniques were invented. It is easy to understand why, because many regard it (*Saccharomyces cerevisisae*) as one of the most resourceful eukaryotic models for genetic engineering [2]. But, in todays times, when we are not as dependent on fermentation for safety, we use it solely for flavor and enjoyment. This article sheds light on the lack of yeasts used in the industry and how the lack of complexity is soon to follow. The authors of the article used wine fermentation and the wine industry’s popularity of ‘terroir’ (a specific local flavor at a moment in history) as an example to show the huge amount of diversity that is being offered in that market right now. The wine industry is getting more complexity through the use of spontaneous fermentation. Spontaneous fermentation, simply means there was no yeast ‘pitched’ into the must (unfermented wine), but rather the winemakers allow the natural yeasts growing on the grape skins (*Hanseniaspora uvarum, H. vineae, H. guillerimondii, H. clermontiae, H. opuntiae*) to inoculate and to ferment the wine. This allows for a bigger diversity of wild yeasts and different characteristics that they each naturally come with, creating a deeper more complex overall experience. Of course, there are hundreds of other yeasts growing on grapes at any given time, and these yeasts could variate from place to place, but these five yeasts were just a few of what was present on their samples at the time of inoculation.

 The authors conducted a similar experiment, this time with beer fermentation. They inoculated three different ‘worts’ (unfermented beer) to see if the yeast type, and yeast variety had any impact on the finished product. The first wort was inoculated with a single yeast strain (*Saccharomyces cerevisiae*), the second with mixed strains (they did not mention the mixture, this experiment could be improved with that knowledge), and

the third with a ‘consortia’ of different strains (again, the strains were not given to us). On a blind test, according to their data, the single strain had the least flavor complexity and the consortia had the most flavor complexities.

 Many craft breweries are hiring yeast specialists to not only monitor the growth and the pitching rates, but also to harvest and isolate new strains of yeast to try to incorporate into beer fermentation. Scientists are also starting to recognize the importance and the enormous abundance of esters and phenols in beer. *Sacharomyces cerevisiae* is able to produce over five hundred different flavor and aromatic compounds [3] and that is just one yeast strain. This recent discovery of the contribution yeast has on overall flavor and aroma has sparked a lot of attention recently to such an extent that it created an amendment to the Reinheitsgebot, or German Beer Purity Law. The German Beer Purity Law is the national law created in 1516 [4] that restricted the ingredients for beer to being only water, barley, and hops. However, within the past 20 years the Law was changed to include yeast as a fourth ingredient. A great example of the flavor potential of yeast is in a traditional German Hefeweizen (wheat beer) where one of the esters produced by the yeast is isoamyl acetate, and this ester is responsible for the iconic ‘banana’ flavor present in this style.

**Discussion**

The article, Yeast Diversity and Native Vigor for Flavor Phenotypes [2] does a good job at creating a reference point for other scientists to improve upon and it also brings to light a topic that people were complacent about for two hundred years. However, some of the experiments in the article seemed rushed and not carefully documented, for example: not listing the multiple strains present in the beer inoculation. This knowledge would improve future scientists from having to redo the same experiment all over. That being said, the careful approach the authors take to describing the various flavor phenotypes present in *Saccharomyces cerevisiae* is impressive, because the topic has been overlooked for so long. In the past, people that were in the brewing industry, desired the freshest malts, freshest hops, the cleanest water, all while putting yeast on the back burner. Beer is nothing without the yeast and it is exciting to see advancements and interests for the single celled organisms.

**References**

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