

Mutation threatening high-quality brewing yeast identified

29 June 2016

Biologists at Hiroshima University, located in the historic sake brewing town of Saijo, have identified the genetic mutation that could ruin the brew of one particular type of yeast responsible for high-quality sake. The research was part of an academic-government-industry collaboration involving the National Institute of Brewing (Japan), the Asahi Sake Brewing Company (Niigata), the Brewing Society of Japan, The University of Tokyo, The University of Pennsylvania, and Iwate University.

Two types of sake considered especially high-quality are called daiginjo-shu and junmai-daiginjo-shu and are often made using the [yeast](#) K1801. Different brewing yeasts, whether for beer, wine, or sake, create different tastes in the final product due to factors such as how they make the sugar-to-alcohol conversion and the by-products that they release as part of many biosynthesis pathways.

A previously identified mutation in K1801 is a desirable change that makes the yeast produce high amounts of ethyl caproate, the chemical that acts as the major flavor component of many varieties of high-quality sake and creates a fruity taste.

A different mutation, newly identified by this research team, is potentially devastating for brewers because it causes a defect in how the yeast grows and divides. The risk of a ruined brew from this potentially dysfunctional yeast is a liability for industrial-scale sake production, where consistent production with stable quality is essential for brewers.

The research team confirmed that K1801's two mutations are not functionally related by performing genetic experiments, chemical analysis, and computer-assisted microscopic visual inspection of the yeast cells using a software program called CalMorph.

A genetically engineered version of K1801 that had normal growth but maintained high production of ethyl caproate was also built and used to brew sake in the laboratory.

Dai Hirata, PhD, from Hiroshima University is last author of the research paper and has training and experience as a sake taster, serving as an official judge at sake evaluation events.

"Our small-scale brew indicated that this version of the yeast without the growth-related mutation should maintain the high quality expected of daiginjo-shu," said Hirata.

However, the Japanese market will not accept sake made from genetically modified yeast. The next step for the research team is to begin screening potentially thousands of K1801 yeast cells until they can find a natural mutant with only the desirable mutation.

The quality of sake comes in-part from the amount of the rice husk, the outer shell responsible for giving un-processed rice its brown color, that has been polished off before the rice is used for brewing. Daiginjo-shu is made from highly polished rice with over half of the husk removed and is usually brewed for a long fermentation period at a low temperature compared to standard sake brewing before it is filtered and bottled. K1801 does not produce a foamy layer while brewing, meaning it requires less physical labor for brewers during the cleaning process between batches. An additional valuable attribute of K1801 is the low amount of total acids it produces as it brews, which creates the smooth taste of its sake.

More information: Tetsuya Goshima et al. Identification of a mutation causing a defective spindle assembly checkpoint in high ethyl caproate-producing sake yeast strain K1801, *Bioscience, Biotechnology, and Biochemistry* (2016). [DOI: 10.1080/09168451.2016.1184963](https://doi.org/10.1080/09168451.2016.1184963)

Provided by Hiroshima University

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