Website address:
https://www.biooekonomie-bw.de/en/articles/news/bacteria-can-determine-the-flavour-of-wine

Bacteria can determine the flavour of wine

What is the connection between biotechnology and wine production? The answer is that there are more than 150 yeasts currently on the market that are used to influence the fermentation and hence the quality of wine. Enzyme preparations optimise the different steps in wine production. Dr. Jürgen Sigler from the State Institute of Viticulture and Oenology (WBI) is working on the development of biological methods to improve the flavour and taste of wine. Over the last few years, Sigler and his team have also looked at lactic acid bacteria and the effect they have on biological acid degradation.

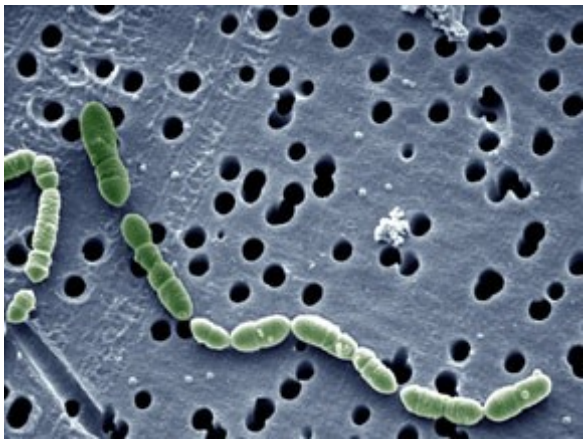
Gutedel grapes
© Alex Anlicker

Grapes occasionally contain a large quantity of acid, such as malic acid, which gives white wines a rather lively character. In contrast, red wine has to be soft and round, which means that too much acid counteracts the desired mild taste. For this reason, winemakers have always used natural lactic acid bacteria to convert malic acid into lactic acid, which reduces the acidity of the wine and improves

its flavour. However, not many winemakers know that lactic acid bacteria also degrade citric acid. If this reaction takes place in an oxidative environment, i.e. without oxygen, then diacetyl is generated. Diacetyl is a substance that tastes of butter or yoghurt and gives the wine an undesired "lactic taste".

No butter no unwanted bacteria

“Winemakers wishing to use lactic acid fermentation need to know a few things,” said Dr. Jürgen Sigler, head of the Department of Oenology at the State Institute of Viticulture and Oenology in Freiburg (WBI). A winemaker should not conserve new wine with sulphur dioxide too early on in the process. This kills the fine yeast which then continues to float on the surface of young wine after fermentation and after the first decanting. The normal job of fine yeast is to turn an oxidative environment into a reductive one. As long as the yeast remains active in the new wine, it does not convert citric acid into diacetyl. Therefore, a winemaker is well advised to ascertain exactly when malic acid has disappeared from the wine. But he should also wait until all the citric acid has been degraded before adding sulphur dioxide.



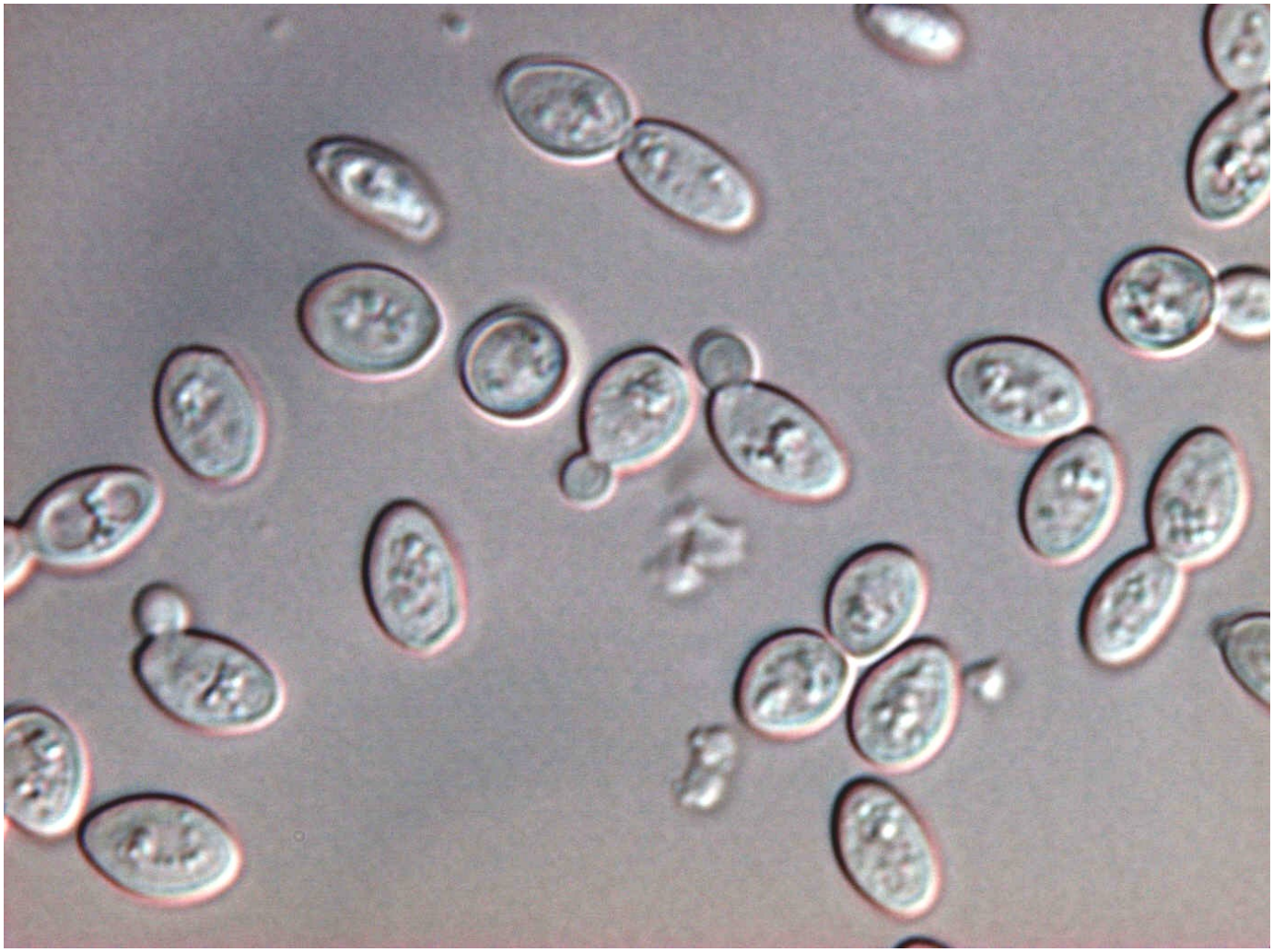
Electron microscope image of Oenococcus oeni lactic acid bacteria

"Nowadays, the majority of winemakers no longer rely on spontaneous acid degradation," said Wolfgang Schupp, cellar master at the Oberbergen cooperative cellar in the Kaiserstuhl area near Freiburg. "We have been using controlled acid degradation for more than 30 years." Nowadays, there are one or two dozen bacterial strains that are available for this purpose. These strains have two advantages. The natural bacterial flora of the wine develops very slowly; after fermentation it takes about 30 days for a sufficient number of lactic acid bacteria to develop. This does not suit the winemakers. "Also, the natural fermentation flora of the wine consists of many unwanted bacteria that could destroy the wine," said Sigler. Schupp also uses lactic acid bacteria for the production of white wines. The use of lactic acid bacteria depends on the acid content of the vintage. "Modern investigation equipment enables us to precisely control the progress of acid degradation," said Schupp. "The quality of wine has increased enormously since the 1970s due to the use of biotechnological methods."

Combating mould

The microbiologists at the WBI examine whether for example the new preparations have any use or not. How do these preparations affect fermentation, what is their preferred temperature and pH? Which bacterial strain is best for which grape variety? And most importantly, what will the wine taste

like? In future, lactic acid bacteria may prove to have another advantage. Rainfall levels could well increase during the summer, thus causing vast quantities of grapes to go mouldy. The mould not only destroys valuable biomass, but also produces sulphur-binding substances such as pyruvate. Winemakers need to add more and more sulphur. The permitted limit of sulphur additions is often reached very quickly and the insufficiently sulphured wine turns bad. “Our experiments have shown that lactic acid bacteria degrade pyruvate before they start to degrade malic and citric acid,” said Sigler. The use of lactic acid bacteria might therefore also eliminate pyruvate; this would be an advantage for winemakers who could then avoid reaching the permitted limit of sulphur additions so early on in the process, thus making it easier to stabilise the wine.



Yeast cells under the light microscope

The use of lactic acid bacteria is not yet standard practice. This is in contrast to pure culture yeasts of which over 150 different strains are available on the market. Each strain is best suited to a specific variety of grape. "There are 'farmhorses' and 'racehorses' among the yeasts," said Sigler, explaining that the 'farmhorses' need very few nutrients, but the wine produced using such yeasts is of average quality. The 'racehorses' require twice as much nitrogen for fermentation, but they create a real bouquet of pleasant flavours. Sigler and his team are testing which yeasts are best suited for which grape varieties and what conditions the yeasts require during the fermentation process. The region's winemakers regularly contact Schupp and his colleagues for up-to-date information on the latest products.

Only one thing counts

Besides yeasts, several enzyme preparations are available. These include pectinases, enzymes that are able to degrade the cell wall. “We use these enzymes in cases where it is necessary to dissolve the colour from the skin of the grapes,” said Schupp. Optimised pectinase products have recently appeared on the market: “The new enzymes have what is known as glucosidase side activity,” said Sigler. “This means that these enzymes are also able to cleave sugars.” This is important because many flavours and aromas, for example terpenes, are bound to sugar structures in the grape cells. The use of such enzymes releases the flavours and give wines their typical grape variety bouquet.

All biotechnological wine production methods have one thing in common: they enrich the taste of the wine. And that is what is most important.

Further information:

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