

Yeasts: The soul of wine Industry

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SUMMARY

Yeasts are indispensable microbes in the wine industry. *Saccharomyces* as well as other strains of yeasts are used in wine-making as it drives the fermentation process, enhances flavor development, enables alcohol tolerance, controls and maintains consistency and carries out secondary fermentation as well. Selection of potential strains is crucial to produce good quality wine.

INTRODUCTION

The ability of yeasts to ferment alcohol to produce wine is a well-documented fact since ages. Traditional winemakers selected yeast strains based on different characteristics like fermentative ability, fermentative kinetics at ambient temperatures, lower acetic acid production and tolerance to high-concentration of alcohol and Sulphur dioxide. Modern vintners on the other hand follow newly emerged criteria to select yeast strains for winemaking such as different pigment formation to improve wine colour such as anthocyanin, vitisins and vinly phenolic pyranoanthocyanins, facilitating colloidal stability, the ability to enhance aroma via synthesis of volatile compounds include esters and alcohols, adequate production of off-flavors and absence of β -glucosidase activity. *Saccharomyces cerevisiae* is well known for transforming grape sugars into alcohol by utilizing small amounts of "N" compounds. Non-*Saccharomyces* strains have also been identified and used in wine preparation. With the advancement of molecular techniques detecting of improved strains of Yeasts that contain colour, aroma, structure and other characteristics have become easier in the recent past. Quality control and human safety should be made a priority while selecting yeast strains for wine making.

Importance and Use

Factors which contribute to selecting yeasts as the best candidate for winemaking are:

Fermentation: The fundamental fermentation process that occurs during winemaking is started and completed by yeast. Yeasts transform the carbohydrates of grape juice into alcohol and carbon dioxide during fermentation. Wine production depends on this transformation since it affects the alcohol concentration and fizz of the output. The fermentation rate, wine quality and stability of the resultant wine depends upon the strain of the yeast that is inoculated.



Flavor development:

Wine flavor depends on yeast and other wine-related microbes. Throughout the fermentation process, yeast synthesizes a variety of flavoring substances like esters, alcohols, carbonyl compounds, sulfur-related compounds, volatile acids, and phenol. These substances support the wine's aroma, complexity, and nature. Different wine flavors allow winemakers to create a wide range of wine styles. Flavor is the output of synergetic relationship developed between the grape and the yeast. Numerous cultivars of grapes contribute characteristic aroma that add distinctiveness of the wines produced. Many biosynthetic pathways and other factors play an important role during the formation of the aroma. Synthesis of flavor compounds depends on various factors such as quality of grapes, their cultivars and soil, ripeness of the grapes, yeast strain used in the fermentation, pH, and temperature during fermentation. Flavor compounds produced by yeast include

Esters: Ethyl acetate, Isobutyl acetate, Ethyl butyrate, Isoamyl acetate, Hexyl acetate.

Higher alcohols: Aliphatic alcohols- Propanol, Isoamyl alcohol, Isobutanol, and active amyl alcohol.
Aromatic alcohols- 2-phenyl ethyl alcohol and tyrosol.

Carbonyl compounds: Acetaldehyde, diacetyl

Volatile acids: Acetic acid, propionic acid, hexanoic acid, octanoic acid

Volatile phenols: Ethyl phenols, vinyl phenols

Sulfur compounds: Hydrogen sulfide, Methanethiol, Ethanethiol, S-methyl thioacetate.

Alcohol tolerance: Yeast strains selected for wine production are able to survive at higher alcohol concentrations. Strains used for wine preparation have been evolved to withstand approximately 12–16% alcohol level and ensure the fermentation process lasts until the majority of the sugar is consumed. Several genes present in yeast are involved in up-regulation and down-regulation, metabolism, protein trafficking, ionic homeostasis, and lipid metabolism to tolerate higher alcohol concentrations during fermentation.

Temperature control: Yeasts are sensitive to extreme levels of temperature. The optimum temperature required for wine preparation is 25°C to 30°C but also capable to ferment at lower temperatures. Winemakers manage the fermentation temperature to ensure optimal yeast activity and maintain a balance between desired flavor production and the prevention of excessive production of undesirable flavors.

Clarification and stabilization: Removal of insoluble compounds and impurities suspended during wine preparation prior to bottling is processed through clarification and stabilization. After the fermentation process, yeasts tend to settle at the bottom of the fermentation containers by forming lees. Sediment developed after fermentation can aid in the clarification and stabilization, which helps to absorb unwanted chemical compounds and contaminants produced during fermentation, resulting in purified and highly stable wine. Vintners leave the wine on the lees to enhance flavor development or perform fining and filtration to get purified wine.

Control and consistency: Specific yeast strains are controlled by winemakers to achieve consistency during wine preparation. *Saccharomyces* and non-*saccharomyces* strains have different fermentation speed, temperature tolerance, flavor production, fermentation characteristics, and aroma production. Winemakers select suitable strains to perform well at specific temperature and produce desired wine styles in the required quantity.

Secondary fermentation: Secondary fermentation is known as malolactic fermentation. In most cases, malolactic fermentation is carried out by lactic acid bacteria. This fermentation depends on various factors like pH, temperature, time, etc. yeast can affect the different factors responsible for successful secondary fermentation.

CONCLUSION

Yeasts play a vital role in winemaking. Selecting desired yeast strains to enhance the quality, stability and safety of wine depends on several factors such as ecology, chemistry, molecular composition and other physiochemical properties. Different selection techniques are implemented to avoid the effect of undesirable toxic compounds produced by yeast strains. Both production and quality maintenance can be achieved through the proper selection and utilization of specific strains.

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