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Development of biological and monitoring tools for improving energy efficiency and sustainability in winemaking

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INTRODUCTION

The energy consumption is a key factor that affects the environmental performance of the vinification phase (Iannone et al., 2015), which can even contribute up to 93% of the total impact (Vázquez-Rowe et al., 2012). In particular, the temperature control during fermentation significantly impacts the energy demand of wineries. Studies reported that the use of different *Saccharomyces* strains, able to perform an efficient fermentative process also at temperatures higher than the winery standard, allows to obtain an energy saving during winemaking. In this context, the influence of temperature on yeast metabolism has to be carefully considered as criteria for strain choice in order to safeguard wine composition (Nardi, 2020) and assure energy saving.

A further aspect of interest for the wine industry is the current trend to reduce the use of chemicals to meet the demands of consumers, who are increasingly interested to the health aspects of food. In this context, the winemaking sector is constantly searching for methods that can reduce the use of the compound traditionally used in winemaking, the sulphur dioxide (SO_2). One of the most interesting current trends is the use of wine by-products, such as stems or grapevine shoots, grape seeds, or stems, because of their richness in antioxidant and antimicrobial compounds. Wine waste could be an alternative source to obtain natural antioxidants, which are considered more safe in comparison with synthetic antioxidants (Arvanitoyannis et al., 2006).

Activity/ Months		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
A1)	***Selection of Saccharomyces cerevisiae strains for energy saving during fermentative stage.***																								
	1a) Growth tests at different temperatures.																								
	1b) Laboratory-scale fermentations with the selected yeast strains.																								
A2)	***Biological tools to improve sustainability during wine fermentation.***																								
	2a) In vitro evaluation of antimicrobial activity of natural compounds extracted from winery waste products as alternative to sulphites.																								
	2b) Laboratory scale fermentations by using natural compounds as alternative to sulphites.																								
A3)	***Development of a low-cost system for monitoring temperature and energy parameters during fermentation.***																								
A4)	***Pilot-scale fermentation trials.***																								
A5)	***Thesis and Paper Preparation.***																								

OBJECTIVE

Identification of biological tools suitable to contribute to energy saving and circular economy principles in the wine sector.

RESEARCH ACTIVITY

Selection of *Saccharomyces cerevisiae* strains for evaluating influence of temperature on fermentative behaviour

Evaluation of antimicrobial activity of natural compounds extracted from winery wastes against wine yeasts

Development of a low-cost system for monitoring temperature and energy parameters during fermentation

Pilot-scale fermentation trials

FINAL RESULT

✓ Identification of: starter yeast strains capable of good fermentation activity without strict temperature control and natural compound to be used in winemaking as an alternative to sulphur dioxide to produce high-quality wine with a reduce sulphite content

✓ Optimization of a prototype hardware and software system for measuring fermentation temperature and to optimize energy consumption in the winery

REFERENCES

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