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Yeast Derivatives for Precision Oenology: Emerging and Sustainable Application for Wine Production

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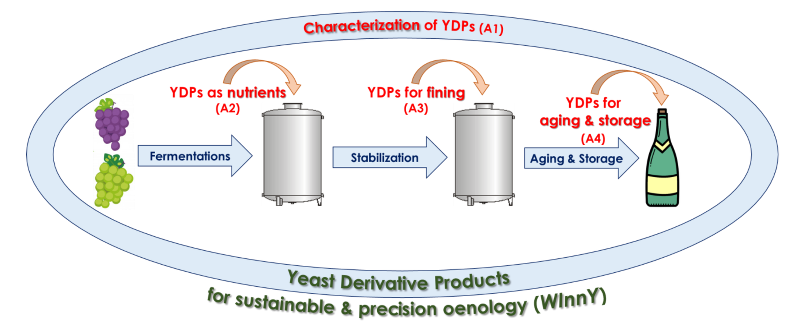
Introduction

This poster describes 4 activities of the PhD project previously presented [1]:

- A1) Characterization of yeast derivative products (YDPs)
- A2) YDPs as source of nutrients for the fermentations
- A3) Improvement of wine stabilization in a sustainable perspective
- A4) Exploitation of YDPs for wine aging



This PhD project is cofunded by Dal Cin Gildo S.p.A. (D.M. 352)

A1) Characterization of YDPs

• *Materials and methods:*

28 commercial YDPs (inactivated yeasts [**IY**], yeast hulls [**YH**], yeast autolysate [**YA**], yeast extracts [**YE**] and mannoproteins [**MP**]), were characterized in terms of:

- Glutathione (**GSH**) and cysteine (**Cys**) (UPLC-UV)[2];
- Readily assimilable nitrogen (**RAN**) (enzymatic assays);
- **Antioxidant** capacity (DPPH assay)[3].

• *Results and discussion:*

YDPs	cys (mg/g)			GSH (mg/g)			RAN (mg/g)			Antiox. (mM Trolox/g)		
	Average	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.	Average	Max.	Min.
Inactivated Yeasts	0,08 *a*	0.10	0.00	2,08 *a*	4.88	0.00	8,12 *ab*	14.72	3.48	7,30 *a*	10.28	0.39
Yeast hulls	0,04 *a*	0.04	0.04	0,08 *ab*	0.13	0.04	4,58 *a*	6.10	3.06	1,42 *a*	2.51	0.32
Lysate yeasts	0,49 *b*	1.20	0.08	1,98 *a*	4.74	0.09	9,29 *ab*	14.92	6.60	11,48 *b*	19.03	2.52
Yeast extracts	0,52 *b*	1.11	0.11	2,40 *a*	8.99	0.08	12,97 *ab*	21.69	5.35	28,06 *c*	44.31	16.42
Mannoproteins	0,027 *a*	0.16	0.00	0,83 *b*	4.98	0.00	6,44 *ab*	15.62	1.39	9,88 *b*	17.21	2.08

Table 1. Average, minimum and maximum concentrations found in YDP classes for each parameter considered. Different letters indicate significant difference (Kruskal-Wallis test, $p<0.05$)

- GSH and Cys were detected in concentration **lower than 10 mg/g** (Table 1), positively correlated to antioxidant capacity.
- **High variability** in RAN content was found, also within the YDP belonging to the same class.
- A relatively **high antioxidant capacity** was found in YE being significantly higher than the other YDPs.

A2) YDPs as source of nutrients for the fermentations

• *Materials and methods:*

6 YDPs selected by means of A1 were added in **Riesling must** (40 g/hL) prior the inoculation of active dry yeast (ADY) (*S. cerevisiae*) and during the **rehydration** of ADY [4]. Fermentations kinetics were monitored through **weight loss**. Wines were then characterized in terms of **volatile compounds** (GC-MS) (analysis on-going).

• *Results and discussion:*

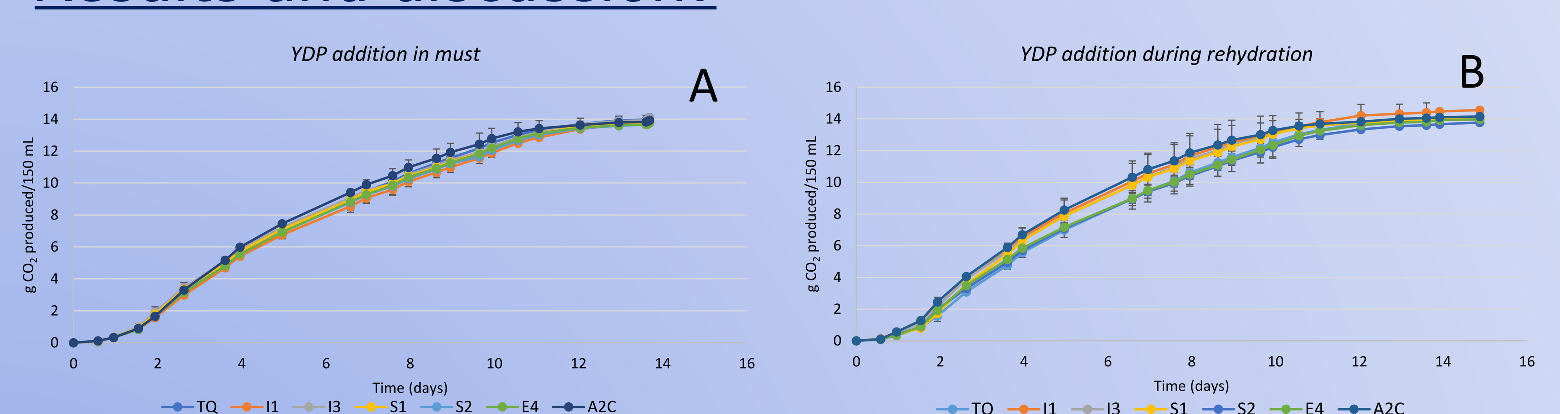


Figure 1. Fermentation kinetics with YDPs addition in (A) must and (B) during rehydration of starter yeast.

- **No difference** in fermentation kinetics with YDPs addition in must was revealed (Figure 1A).
- On the contrary, the addition of YDPs during ADY dehydration led to a **slightly increase** of fermentation rate after 5 days for I1, I3, S1 and A2C (Figure 1B).

A3) Improvement of wine stabilization in a sustainable perspective

• *Materials and methods:*

YDPs were screened for tartaric, protein and color **stabilization**. A Pinot Noir rosè wine was employed for **protein** stabilization trials (ΔNTU=54,39) , a Traminer wine was used for the **tartaric** stabilization trials (MCO=89.5 µS), and a young Cabernet Franc was used for **color** stabilization trials. The tartaric and protein stability was tested after 1, 8 and 14 days of contact. The Cabernet Franc was maintained at 25°C for 8 weeks, the **CIELab** coordinates were determined. YDPs were added in all cases at 40 g/hL.

• *Results and discussion:*

- Only some **MPs** were effective for tartaric stabilization already after 24 hours of contact (data not shown).
- Protein stabilization was only partially achieved through the use of certain **IYs** and **MPs** (data not shown).
- **ΔE** parameter showed that many **IYs** and **YAs** can lead to relevant changes in color (Table 2).

YDP	ΔE
I1	12.33
I3	10.93
I2A	1.07
I2B	1.11
I4	11.01
I5	10.81
I6	11.06
I8	11.50
I7	11.51
S1 1	1.82
S2	0.73
E1A	0.68
E1B	0.59
E2	1.28
E3	2.86
E4	3.75
MP1	0.99
MP2	0.48
MP3	0.69
MP4	0.93
MP5	6.68
MP6	1.57
A1	11.83
A2A	12.73
A2B	11.73
A2C	12.23
A3	11.96
A4	11.10

Color difference noticeable
Color difference easily noticeable
Color difference strongly noticeable
Different colors

Table 2. ΔE assessed vs. the wine sample without YDPs.

A4) Exploitation of YDPs for wine aging

• *Materials and methods:*

Experimental **tirage** was carried out on Pinot Noir rosé base wine using **4 YDPs** (30 g/hL) selected through an **accelerated aging trial** (50±2° C for 15 days, YDPs addition 40 g/hL). As control, the same wine with YDPs added were maintained at 4±2°C. After the incubation, the antioxidant capacity of the wines was assessed (**DPPH assay**) and a **tasting** was performed. The sampling of sparkling wines is expected every 6 months; antioxidant capacity and volatile compounds (GC-MS) will be determined (activity on-going).

• *Results and discussion:*

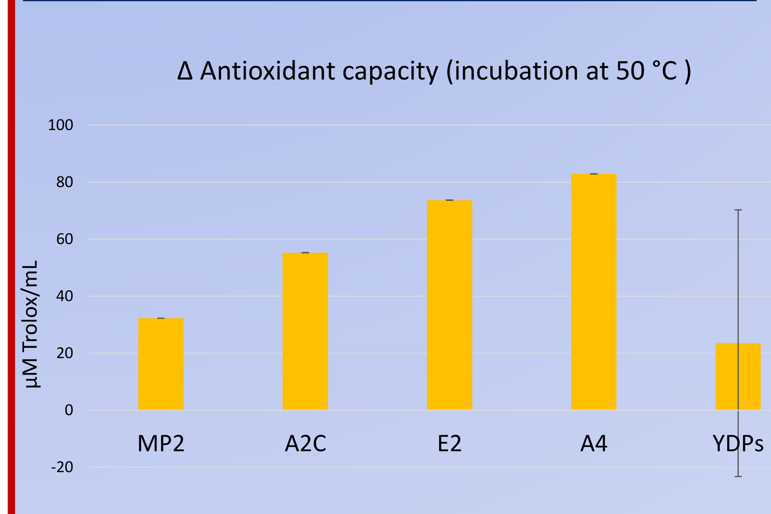


Figure 2. Difference of antioxidant capacity between samples with and without YDP addition at 50°C. Data related to 4 YDPs employed in tirage are shown and the average value of all YDPs assayed.

- **Relevant differences** of the antioxidant capacity were found after storage in the presence of YDPs (Figure 2).
- The wines added with YDPs were judged **sensorially better** than those without YDPs.
- Four YDPs showed the best sensory characteristics (MP2, A2C, E2, A4) and they were employed in the **tirage trials**.

Conclusion

- The positive impact of YDPs on fermentation kinetics may be due not only to RAN, but to **other compositional characteristics**, such as lipids and vitamins.
- Further studies are necessary to evaluate YDP addition as nutrient considering **different concentrations added** and **different musts.**
- Certain YDPs can be useful in **tartaric, protein and color stabilization.**
- An increase of the **antioxidant capacity** can be obtained by using YDPs.

Bibliography

[1] Altomare A (2023) Yeast Derivatives for Precision Oenology: Emerging and Sustainable Application for Wine Production (WInnY). In Proc.s of the 27th Workshop on the *Developments in the Italian PhD Research on Food Science, Technology and Biotechnology*, Portici (Italy), 13-15 September, 2023.

[2] Tirelli A, *et al.* (2010) Determination of reduced cysteine in oenological cell wall fractions of Saccharomyces cerevisiae. J. Agric. Food Chem. 58, 4565–4570.

[3]Fracassetti D, et al. (2020) Impact of cooking on bioactive compounds and antioxidant activity of pigmented rice cultivars. Foods 2020, 9, 967

[4] Soubeyrand V, et al. (2005) Formation of micella containing solubilized sterols during rehydration of active dry yeast improves their fermenting capacity. J. Agric. Food Chem. 53, 8025-8032