Non-targeted metabolomic approach as a tool to evaluate the chemical and volatile profile of sparkling wines fermented with autochthonous yeast strains

A. Rizzuti, **M. Tufariello**, V. Gallo, P. Mastrorilli, L. Palombi, B. Musio, V. Capozzi, F. Grieco

Politecnico di Bari

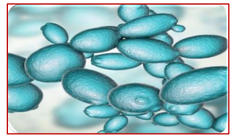
Consiglio Nazionale delle Ricerche ISPA ISTITUTO DI SCIENZE DELLE PRODUZIONI ALIMENTARI

IFAC

Aim

The ***Champenoise*** method is based on "in bottle" refermentation usually driven by few commercial strains belonging to the ***S. cerevisiae*** species. In this study, the impact of selected **autochthonous yeast strains** on the chemical profile of sparkling wines (SW) has been evaluated through non-targeted metabolomic approach based on **HPLC-HRMS** and **GC-MS** techniques. The HPLC-HRMS/GC-MS **correlation analysis** was permitted to draw a map that constitutes a useful tool to monitor the different patterns of aroma release operated by the indigenous strains.

Methods

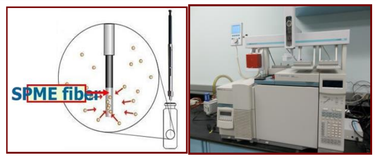


The autochthonous ***S. cerevisiae*** strains employed were previously selected [1] and deposited in the ITEM Culture Collection of the CNR-ISPA (www.ispacnr.it/collezioni-microbiche). The commercial *S. cerevisiae* DV10 (Lallemand, USA) was used as control.

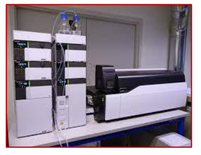
Production of sparkling wine was made using the **traditional method** [2].

Chemical analyses

WineScan Flex was used to determine the principal chemical parameters of SW

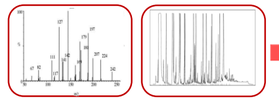


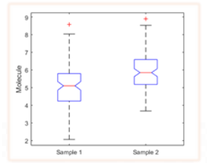
The volatile profile was analyzed using **SPME-GC/MS** [3].



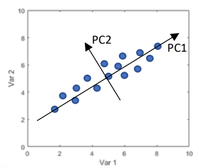
HPLC/High Resolution Mass Spectrometry analysis [4],

Statistical analyses

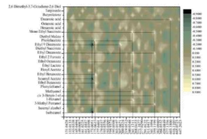




ANOVA analysis



Principal Component Analysis



Correlation Analysis

Results

Volatolomic Profile

- A total of **26 volatiles** belonging to higher alcohols, esters, terpenes, acids, were identified;
- **Quantitative differences** of the above compounds were detected in the produced wines;
- The selected strains produced **higher concentrations** of **esters** (ethyl and acetate), **alcohols** such as 2-phenylethanol and lower values (<400 ppm) of higher alcohols compared to the wine produced with the control yeast;
- Moreover, the SW produced with selected yeast showed a **low volatile acidity** (<0.3 g/L), high glycerol content, a **good phenolic and acid profile** that influences the foam stability and the sensorial quality (body, bitterness and astringency);
- The Figure 1 shows the score plot reporting, for each sample, the Mean Standardized Concentration (MSC) as a function of the number of volatiles (NV) (reported in percentage) with a concentration higher or equal to the mean. This scatterplot allowed bettering outlining the differences among the samples that on the plane of the three PCs are clustered. **ITEM 9518, 17294, 14077, 9520 samples** differ from both the control and other samples by a **higher number of volatiles** in concentration above the mean.

HPLC-HRMS results

- 61 compounds belonging to several metabolite classes were identified;
- HPLC-HRMS analysis showed that **DV10** sample was characterized by high values of **gluconic acid** that adversely affects wine foamability, while lower concentrations of this molecule were detected in sparkling wines produced by the other strains selected in Apulia region. In particular, samples **9518, 14077** and **17294** showed a high content of polysaccharide that promotes a better foam stability and improves the sensory quality.
- A **HPLC-HRMS/GC-MS correlation analysis** (Fig.2) was performed and permitted to obtain a map that constitutes a useful tool to monitor the different patterns of aroma release.
- Finally, this contribution provide information to modulate the quality of regional sparkling wines from minor autochthonous grape varieties using selected microbial resources.

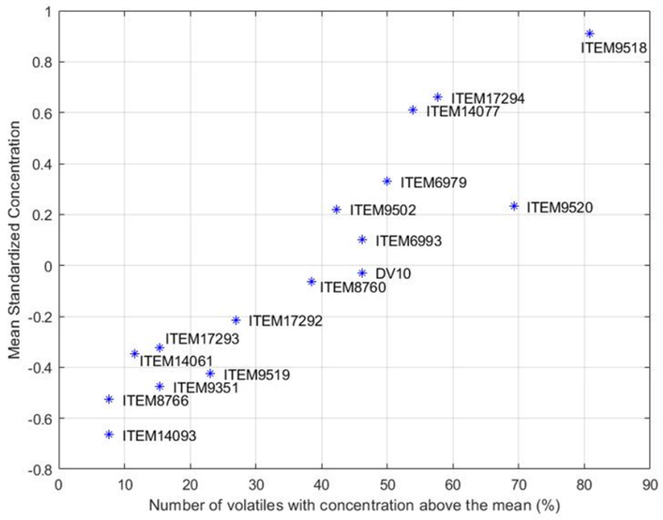


Fig.1: Mean value of the standardized concentration of the 26 compounds as a function of the percentage of compounds whose concentration is higher or equal to the average one.

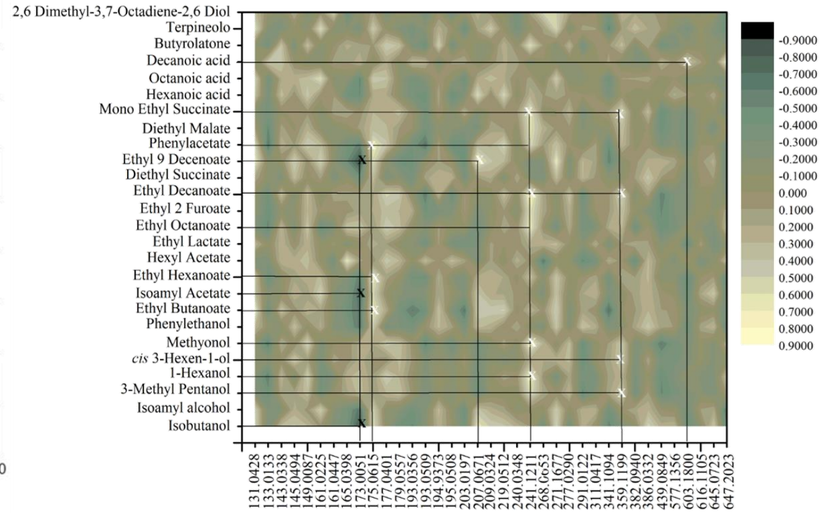


Fig.2: Plot resulting from the HPLC-HRMS and GC-MS correlation analysis applied to sparkling wine samples.

References

[1] Grieco et al. (2011). https://doi.org/10.1007/s13213-010-0091-7
[2] Garofalo et al. (2018). https://doi.org/10.1016/j.ijfoodmicro.2018.07.004
[3] Tufariello et al. (2019). https://doi.org/10.1016/j.lwt.2019.03.063
[4] Rizzuti et al. (2015). https://doi.org/10.1016/j.foodcont.2021.108099