Kinetic investigations of the Gewürztraminer volatile organic compounds and color at different temperatures and pHs

Gewürztraminer is a well-known wine famous for its aroma profile, which is characterized by rose petals, cloves, lychees, and other tropical fruit notes. It is cultivated worldwide, including the Trentino Alto Adige region located in northern Italy, especially in the Tramin zone, and it has long been studied trying to understand what the most characterizing volatile aroma components are [1-4]. The terpenes (geraniol, cis rose oxide, citronellol, and linalool) are between the major responsible for the characteristic floral aroma of this cultivar's grapes and wines. Throughout the winemaking and storage, acid-catalysed rearrangements take place producing cyclic and hydroxylated forms of the above terpenes, which generally have minor perception thresholds and so the wine's floral aroma character decreases [5]. It has been demonstrated that the temperature and pH strongly influence these reactions, however their kinetics are not studied in detail.

The first aim of this work was to develop and validate a fast, modern, sensitive, selective, robust, and comprehensive protocol for the quantification of primary, secondary, and tertiary wine volatile compounds by using solid-phase extraction (SPE) cartridges for the sample preparation and a fast GC-MS/MS for analysis [1]. Second aim was to apply this protocol and study the kinetics of the reactions occurring on the Gewürztraminer wine volatile compounds during its storage at various temperatures and pHs. In parallel also
the colour of the wines was monitored by using the CIELAB method. The produced method gave us the possibility to measure 64 aroma compounds, with big importance in wine science, by using fewer organic solvents, having short chromatographic run, and increasing specificity and sensitivity due to the MRM MS-mode used.

The results of the second part of the study, demonstrated the behaviour of volatile aroma compounds, with their absolute concentrations. The investigated reactions included the degradation of the linear terpenes (linalool, geraniol, nerol, etc), the ethyl esters of fatty
acids and volatile phenols on the one hand; and the formation of the cyclic terpenes (1,4-cineole, 1,8-cineole, terpineol, etc), the norisoprenoids (e.g. TDN and safranal) and the diprotic organic acids esters on the other hand.

In conclusion, we developed a modern protocol for the analysis of the wine aroma compounds and we underlined some key characteristics that a winemaker should take in consideration in the Gewürztraminer production and aging/storage.

References

1. Carlin, S.; Lotti, C.; Correggi, L.; Mattivi, F.; Arapitsas, P.; Vrhovsek, U. "Measurement of the effect of accelerated aging on the aromatic compounds of Gewürztraminer and Teroldego wines, using a new SPE-GC-MS /MS protocol" Metabolites 2022, 12(2), 180.

2. Versini, G. Sull'aroma Del Vino "Traminer Aromatico" o "Gewürztraminer." VIGNEVINI 1985, 12, 57–65.
3. Guth, H. Identification of Character Impact Odorants of Different White Wine Varieties. J. Agric. Food Chem. 1997, 45, 3022–3026.
4. Román, T.; Tonidandel, T.; Larcher, R.; Celotti, E.; Nicolini, G. Importance of Polyfunctional Thiols on Semi-Industrial Gewürztraminer Wines and the Correlation to Technological Treatments. Eur. Food Res. Technol. 2018, 244, 379–386.
5. Slaghenaufi, D.; Ugliano, M. "Norisoprenoids, Sesquiterpenes and Terpenoids Content of Valpolicella Wines During Aging: Investigating Aroma Potential in Relationship to Evolution of Tobacco and Balsamic Aroma in Aged Wine." Front. Chem. 2018, 6.

Authors: Carlin Silvia[1], Lotti Cesare[1], Rapaccioli Attilio[1], Mattivi, Fulvio[1,2], Trenti Gianmaria[3], Vrhovsek Urska[1] and Arapitsas Panagiotis[1,4]

[1]Metabolomics Unit, Research and Innovation Centre Edmund Mach Foundation, Via Edmund Mach 1, 38010 San Michele all' Adige, Italy
[2]Department of Cellular Computational and Integrative Biology, University of Trento, Via Sommarive 9, 38123 Povo, Trento, Italy
[3]Winery, Edmund Mach Foundation, Via Edmund Mach 1, 38010 San Michele all'Adige, Italy
[4]Department of Wine, Vine and Beverage Sciences, School of Food Science, University of West Attica, Ag. Spyridonos str, Egaleo, 12243 Athens, Greece.

***corresponding author:** silvia.carlin@fmach.it

Keywords: fastGC, accelerated aging, storage, terpenes, Cielab