SOLID RECTIFIED CONCENTRATED MUST (SRCM) FOR A QUALITY AND 100% GRAPE VINIFICATION

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W4W results eng_L'ENOLOGO (09-2022)AUTHORS: Riccardo Cotarella (a), Pier Paolo Chiasso (a), Nicola Biasi (a), Silvia Carlin (b), Andrea Angeli (b), Raffaele Guzzon (b), Luciano Groff (b), Andrea Panichi (b), Urska Vrhovsek (b), Maurizio Cambrea (c), Veronica Vallini (c), Fulvio Mattivi (b,d).[1]

After the EC approval of the SRCM in oenological applications, Naturalia supported a research project, called "Wine for Wine" - for a 100% winemaking from grapes -, in collaboration with the Edmund Mach foundation of San Michele all'Adige and with the contribution of the Wine Research Team, whose purpose was to identify the technological pluses of the SRCM in comparison to the traditional liquid RCM in winemaking practices.

The study reported below was published in L'ENOLOGO of September 2022.

The advantages of ENRICHMENT with SRCM

To solve the problem of increasing the sugar content of grape must, in the areas of central and northern Europe, sucrose (the common cooking sugar) has always been preferred, since, unlike must, it does not communicate to the wine notes unrelated to those of the vinified variety. However, it constitutes a foreign substance to grapes, which is a negative factor for the image of wine. The use of sucrose for enrichment is prohibited in Italy, as well as in other countries of the Mediterranean area, where the Rectified Concentrated Must (RCM) is approved. RCM is a must deprived of all substances other than sugars and concentrated, but still not able to match crystalline sucrose from the point of view of purity, stability and practicality. This study shows that these limits have been overcome with the development of the Rectified Concentrated Must in crystalline form (SRCM).

A first experimental plan[2] involved the analysis of the profile of volatile compounds in different samples of RCM and SRCM and in still wines added with RCM and SRCM. The enrichment tests were carried out using Müller Thurgau variety wines from 3 wineries (FEM, Vivallis and Mezzolombardo), for the Schiava variety the wines from 2 wineries (Mori Colli Zugna and Riva) while for Trebbiano Toscano and Sangiovese the wines from a producer (Antinori and Frescobaldi respectively).

The samples were analyzed in triplicate with the SPME technique in headspace and injected into a two-dimensional gas chromatograph coupled with a mass spectrometer. The analyzes focused on those wines that it was possible to maintain in a state of direct comparability, in separate tanks and the same oenological conditions, until the moment of sampling.

The analysis of the aromatic profile of various samples of liquid RCM shows the presence of some tracer compounds of the "varietal" type, present in the grapes of origin - such as cis and trans furan linalool oxides, rose oxide, vitispirans, TDN (1,1,6-trimethyl-1,2-dihydro naphthalene, which could give rise to negative notes, from hydrocarbon / kerosene) - or "process markers", produced following the heating of the must - such as acetylfuran, furfural and 5-methylfurfural.[3,4,5]

[1] a) Wine Research Team. Orvieto (TR); b) Fondazione Edmund Mach. San Michele all'Adige (TN); c) Naturalia Ingredients s.r.l. Mazara del Vallo (TP); d) Università di Trento. San Michele all'Adige (TN)-ITALY

[2] Naturalia Ingredients: per vinificare 100% da uva. L'Enologo n.11 – Novembre 2020.

[3] Wang, Y.; Rodolfo Juliani, H.; Simon, J. E.; Ho, C.-T. Amino acid-dependent formation pathways of 2-acetylfuran and 2,5-dimethyl-4-hydroxy-3[2H]-furatone in the Maillard reaction. Food Chem. 2009, 115 (1), 233–237.

[4] Mendes-Pinto, M. M. Carotenoid breakdown products the—norisoprenoids—in wine aroma. Arch. Biochem. Biophys. 2009, 483 (2), 236–245.

[5] Winterhalter, P.; Schreier, P. C13-norisoprenoid glycosides in plant tissues: An overview on their occurrence, composition and role as flavour precursors. Flavour Fragr. J. 1994, 9 (6), 281–287.

On the other hand, the aromatic profile of SRCM appeared much cleaner with the sole presence of traces of beta-damascenone, a compound that always brings very appreciated fruity / floral notes and with extremely low olfactory thresholds.[6]

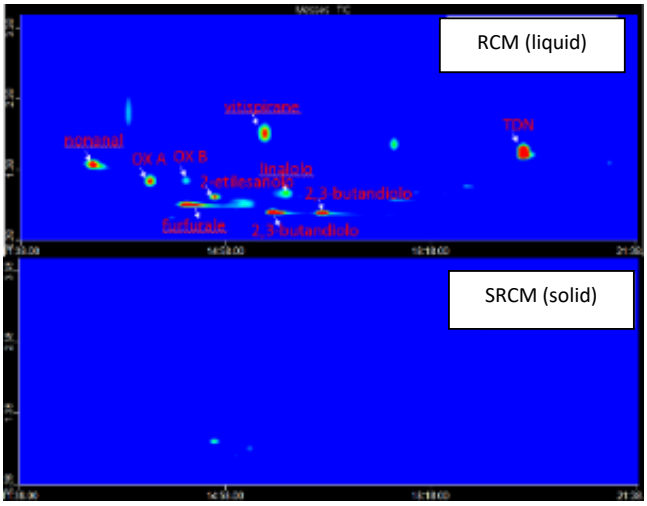

Figure 1: SPME (Solid Phase Microextraction) Analysis of the Volatile Compounds Profile of Liquid and Solid MCR Sample

These differences in aromatic profile are confirmed in wines enriched with RCM or SRCM and are manifested in sensory analysis: in wine pairs in which statistically significant differences are highlighted, those enriched with SRCM are generally preferred because they are judged to be finer and more elegant. The aromatic compounds can in fact alter the organoleptic profile of the finished product in which the RCM is used and in some cases they can determine olfactory perceptions of sensorial relevance, interfering with the final quality of the wines, especially in the case of high quality and PDO and PGI wines.

Figure 2 shows two examples of sensory analysis performed on Nosiola and Schiava wines enriched with liquid RCM and SRCM. Nosiola wines enriched with SRCM are recognized as more intense and therefore preferred to those enriched with liquid RCM. Similarly, Schiava wines enriched with SRCM are fresher and more harmonious.

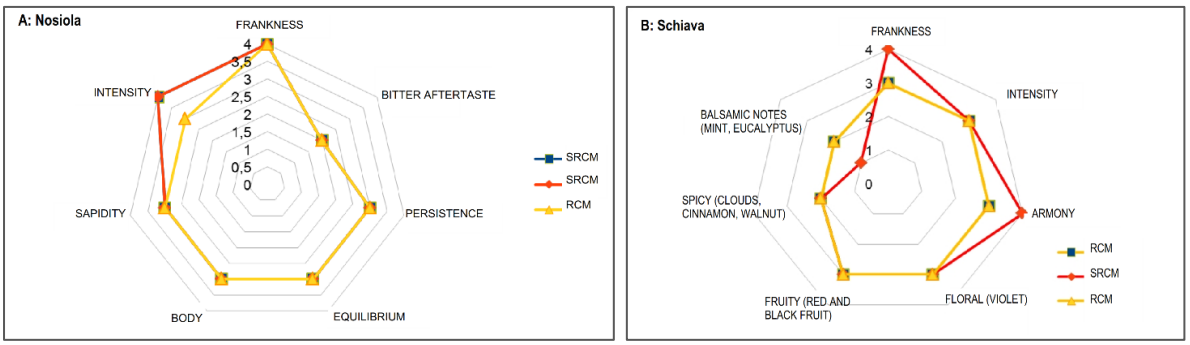

Figure 2: Example of sensory evaluation motivating the preference in the case of wines enriched with SRCM vs. RCM. A: Nosiola sensory analysis. Significant difference: the majority (19 out of 23) of tasters distinguishes the different sample (RCM); samples enriched with SRCM are recognized as more intense and therefore preferred to the sample enriched with liquid RCM. B: Schiava sensory analysis. Significant difference: All the tasters distinguish the different sample (SRCM); the sample enriched with SRCM is more pleasant.

[6] Pineau, B.; Barbe, J.-C.; Van Leeuwen, C.; Dubourdieu, D. Which Impact for β- Damascenone on Red Wines Aroma? J. Agric. Food Chem. 2007, 55 (10), 4103–4108.

The SRCM in terms of PURITY

The winemaking process can be considered as a complex ecosystem in which the microbial population evolves as the phases of the production cycle vary. The study of this microbial ecosystem has led to a growing awareness of the role of microorganisms in the production of quality wines and the control of the microbial population during winemaking is necessary to prevent possible alterations of oenological origin. Monitoring and prevention primarily involve the complete characterization of the raw materials involved in the production flow, including the additives and adjuvants allowed in the production of wine. The adjuvants or oenological additives could in fact convey their own microflora, with the risk of this interfering with the winemaking process. The risk is even higher when the addition is late compared to the fermentations that characterize the first steps of winemaking.

Rectified Concentrated Musts in the traditional liquid form are considered substantially stable, given the very high sugar concentration (> 61.7 ° Brix) and the consequent low water activity. Except in sterilized and aseptically packaged products, it is however reasonable to hypothesize the presence of a contaminating and latent microbial flora, still endowed with a residual biological activity that could give rise to a proliferation in favorable environmental conditions (ie. Reduction of the sugar concentration in solution by precipitation of part of the sugars, dilution in must or wine, ...). This potential problem can be avoided by using the rectified concentrated must in solid form (the SRCM).

As part of the "Wine4Wine" project, the Edmund Mach Foundation[7] subjected to microbiological analysis, according to the OIV reference methods, a large number of samples of RCM and SRCM, from different origins and from different vintages. An abundant microbial population was observed in liquid RCM samples. The yeasts, present in almost all the samples, attest to an average concentration higher than 4 logarithmic units. The concentration of lactic bacteria, present occasionally, records peaks greater than two logarithmic units. There are also occasional isolations of acetic bacteria and molds (Figure 3).

SRCM samples, on the other hand, are substantially free of microbial contamination potentially harmful to the quality of musts and wines in which they can be used.

Particularly relevant is the fact that the analyzes were carried out on SRCM samples stored for several months in production areas and therefore subject to possible environmental contamination: the absence of microbial load therefore does not only testify to the original purity of the product, but also the microbiological stability during storage probably due to the very low water activity of the preparation and the absence of impurities that could act as a source of sustenance for microbial forms of both environmental and oenological origin.

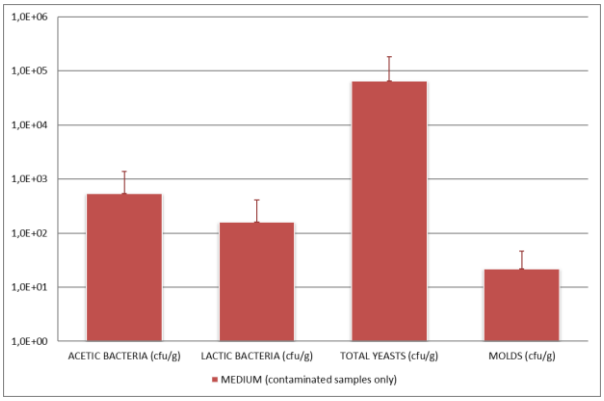

Figure 3: Results of the microbiological analysis (expressed as the population mean) of 35 RCM samples in the years 2016-2017

[7] Guzzon R., Carlin S., Mattivi F. (2018). Zucchero d'uva cristallino, due anni di sperimentazione. VVQ, (5): 102-105.

Benefits of SPARKLING with SRCM

The sparkling process is considered one of the noblest and most advanced practices of modern enology and especially in quality sparkling wines an organoleptic perfection is required which can only be guaranteed by the use of sugars with a high degree of purity.

For this reason, RCM in its traditional liquid form is often considered qualitatively inferior to crystalline sucrose. The use of RCM can in fact bring to the wine foreign substances derived both from the heat treatment of the RCM and from the grapes of origin, which can alter the profile of the finished product. Furthermore, in sparkling wines the use of sucrose in the refermentation phase is also allowed in Italy and in those countries of the Mediterranean area where its use in still wines is prohibited.

As part of the W4W project, in the years 2016-2017 and 2018, some wines were made with the classic method, starting respectively from the Spergola variety (native vine of Emilia-Romagna) and Negramaro (Puglia), 3 Trentodoc sparkling wines (100 % Chardonnay) and 2 sparkling wines from Emilia-Romagna (Chardonnay and Pinot nero). With the Charmat method, 3 Prosecco sparkling wines (Glera), 1 Lambrusco di Sorbara wine, 1 Passerina, 1 Falanghina and a blend of Trebbiano, Roscetto and Malvasia were made. All the theses made it possible to verify the result with the SRCM in comparison with the RCM and with beet and / or cane, refined or raw, sugar.[8]

The products taken into consideration are commercial products and the cellar operations for the different treatments have been kept unchanged to ensure the comparability of the theses carried out.

Lambrusco di Sorbara and Passerina wines differed from the others because one thesis involved the addition of SRCM and the other of liquid RCM. The PCA analysis makes it possible to clearly separate the two theses (in figure 4 eg Sorbara). In this case, tracer compounds are present in the finished wine, which distinguish the addition of liquid RCM: **acetylfuran, furfural and 5-methylfurfural, all higher in wines produced with liquid RCM.**

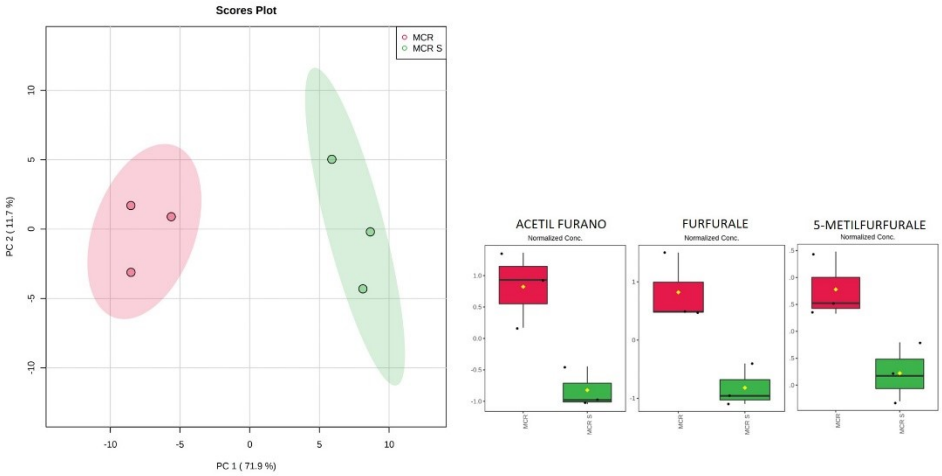

Figure 4: Analysis of the main components of the Lambrusco di Sorbara sample and some tracer compounds of the liquid RCM.

On the other hand, the analysis of the volatile component with two-dimensional gas chromatography did not lead to the observation of compounds that make it possible to distinguish wines produced with SRCM from those produced with sucrose. This result can be interpreted as a substantial equivalence of the overall profile of volatile compounds with the two types of sugars in the draft.

The sensory analyzes of the 2016-2017 wines, using the discriminated tests in pairs, showed that the samples of the different theses were always perceived as different. However, the preferences given by the tasters are not unique. As can be seen from the graph in figure 5 for a sample of Spergola and for a sample of Pinot nero and Chardonnay the panel preferred the sample with SRCM more than 60% and in the case of Pinot nero and Chardonnay we have a statistically significant difference (at least 12 preferences out of 17). It is interesting to highlight that the descriptors

[8] Esperienze di utilizzo del MCRs per una vinificazione di qualità. L'Enologo n.3 – Marzo 2021.

that have been used to motivate the preference of the added wine of SRCM are "more finesse" and "harmony" (Figure 6).

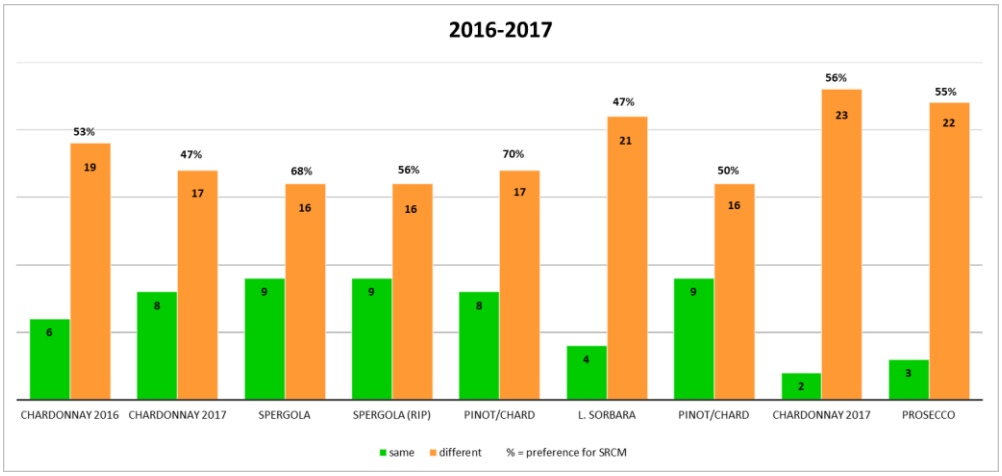

Figure 5: Sensory analysis of sparkling wines 2016-2017: Summary histogram of the preferences expressed by the panel (25 tasters)

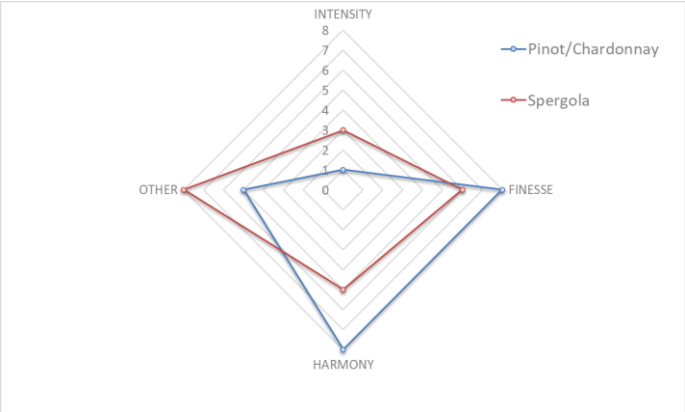

Figure 6: Graph with the descriptors that motivate the preference in the case of theses with SRCM in Pinot / Chardonnay and Spergola wines

In the sensory analyzes of the 2018 wines, the tasters used a triangular test and also in this case all the theses were well differentiated. It is then observed that in all cases the sparkling wine obtained with the use of SRCM is preferred and the preference with the highest statistical significance is for Falanghina, Trebbiano / Malvasia / Roscetto and Negramaro (Figure 7).

For the two Prosecco wines and the Falanghina variety there is no clear preference of the product added with SRCM over that produced with beet sugar. This could be attributable to the fact that both are extremely pure sugars and do not release other substances that can alter the product.

To confirm this, analyzing the evaluation forms, it is observed that the most recurring adjectives were freshness, frankness, harmony and cleanliness in favor of SRCM, especially in relation to treatments with less refined cane sugar, which, however, seems gives complexity to the product. Despite the apparent complexity given by this cane sugar, however, a preference between 82% and 90% was recorded for the product obtained with SRCM.

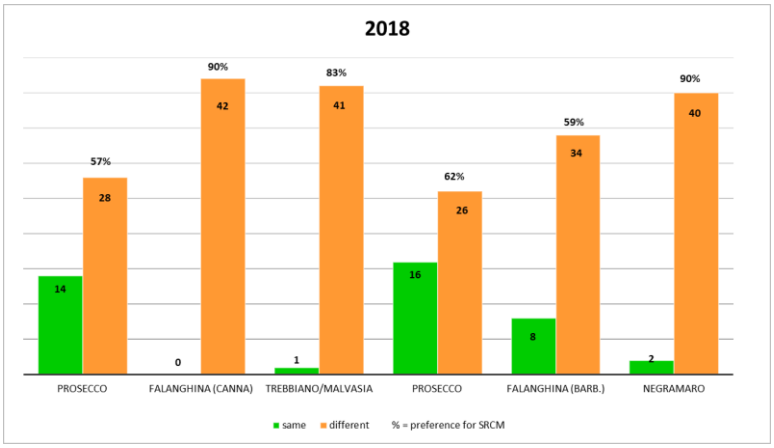

Figure 7: Sensory analysis of sparkling wines 2018: Summary histogram of the preferences expressed by the panel (42 tasters)

Conclusions

The analysis of the profile of volatile compounds did not reveal systematic differences in the aromatic profile or in the tracer compounds that allow to analytically distinguish wines produced with SRCM from those produced with beet and cane sugar. The use of crystalline sugars, free from impurities, does not add compounds to the wine that could alter its aromatic profile. From the compositional point of view, therefore, these products are chemically very similar.

Based on the sensory analysis, it can be concluded that the samples are distinguishable, with a preference present and expressed in favor of wines produced with the use of SRCM as it leads to products that are considered more frank, fine, harmonious and elegant.

The SRCM therefore appears to be a product free from contaminants, which overcomes the doubts about the possible presence of chemical and microbiological impurities associated with the traditional, liquid RCM, and which allows the production of wines and sparkling wines entirely from grapes. [9]

[9] Esperienze di utilizzo del MCRs per una vinificazione di qualità. L'Enologo n.3 – Marzo 2021.