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Phenolic compounds of Moroccan red press wines: Influence of fining agents and micro-oxygenation treatments



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ABSTRACT

To improve the sensory quality of Moroccan red press wines, press wines were separately submitted to micro-oxygenation and three fining agents (gelatin, Polyvinylpolypyrrolidone (PVPP) based formulation and pea protein) treatments at the winery Château Roslane, Morocco. The results showed that each treatment has a distinct behavior in relation with interactions and precipitation monomeric flavan-3-ol and fractions apparent and total condensed tannins. The fining agent corresponding to the vegetable protein has a greater affinity with the fraction of oligomeric condensed tannins with apparent aDP: 3.2. However, gelatin and PVPP based fining agent have an affinity with the catechin and epicatechin as well as with the fraction of polymeric tannins (apparent aDP: 6.6). For the structural parameters of proanthocyanidins, no significant differences were found out in global aDP and percentage of prodelphinidin between the different treatments. The global percentage of galloylation appeared slightly affected, while the global percentage of oxidized proanthocyanidins increased (9%) significantly (P < 0,05) for micro-oxygenation treatment, unlike the fining agent has basic vegetable protein has decreased 36% the percentage of oxidation. For the Saliva Precipitation Index (SPI) and sensory analysis, the greatest reduction of SPI, bitterness and astringency was observed for both basic PVPP and vegetable protein fining agents.

1. Introduction

In the traditional red wine making process, the press wine constitutes 13–17% of red wine production (Vivas, 2007). It is collected after pressing of solid parts (seed and skin) of grapes pomaces after the end of alcoholic fermentation and before malolactic fermentation. Several types of press wine are collected: the more there is pressure, the more colorful, astringent, bitter and rustic the wine will be (Renouf & Murat, 2012). The technique of pressing allows the extraction of high levels of pigments that are responsible of one of the most appreciated characteristics of these wines (deep purplish red color). In controversy, it also tends to over-extract tannins, leading to excessive astringency and bitterness (Vivas, 2007; Renouf & Murat, 2012). The improvement of the quantity of running wine via its blending with press wine requires

greenness, high level of turbidity and instability of color. In many cases, press wine grows separately; however, it is blending with free running wine at the end of winemaking stage (Renouf & Murat, 2012). Bitterness and astringency are two important attributes of wine flavor. Several authors (Lea, 1990; Peleg, Gacon, Schlich, & Noble, 1999; Vidal et al., 2003) reported that wine bitterness and astringency are due to tannins quantity and structures (molecular size and degree of galloylation), The perception of the astringency of condensed tannins seems increasing with tannin size and degree of galloylation (Vidal et al., 2003) which confers their ability to complex with proteins, probably because they have more interaction sites (Baxter, Lilley, Haslam, & Williamson, 1997; De Freitas & Mateus, 2001). Several studies have been devoted over the forty last year's to the qualitative and quantitative analysis of phenolic

compounds by means of the major modern techniques but the

the improvement of the quality of the latter (Trione & Martinez., 2001). Indeed, the blending process is delicate because the press wine contains undesirable phenolics, astringency vectors and

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analysis of tannins (proanthocyanidins) remains difficult due to their polymeric nature. Indeed, the determination of the quantitative and qualitative characteristics of tannins (subunits composition and mean degree of polymerization) proceeds by a chemical depolymerization prior to analysis by liquid chromatography. Owing to their antioxidant properties, tannins undergo oxidation in the course of wine making and wine aging, which results in the formation of additional linkages, either between different polymeric chains (intermolecular bonds), either within two subunits of the same polymeric chain (intramolecular bond) (Mouls & Fulcrand, 2015). These oxidative bonds are hard to break and resist to the chemical depolymerization under the reaction conditions. This results in an extended hump under the peaks of the chromatography profile that usually passes unnoticed and the oxidized tannins are not taken into account in the analysis of tannins. Consequently, only the part of tannins that are able to cleave into monomeric units (native tannins) are identified and quantified so far. For that reason, tannin analysis gives access to the "Apparent tannins". The press wines are often richer in tannins than running wines; these tannins are frequently perceived as harsh. To overcome this negative effect, press wines need an indispensable phase of maturation, during which the structures of tannins are modified. This maturation phase may be associated with micro-oxygenation and/or aging on lees. The latter improves wine mouth feel by oxidative polymerization of tannins and/or by the coating of tannins by yeast polysaccharides. Alternatively, protein-based fining agents (gelatin, casein ...) can be used to quickly remove the fraction of the more aggressive tannins (Sarni-Manchado, Deleris, Avallone, Chevnier, & Moutounet, 1999). The various proteinbased fining agents can behave differently, depending on their composition, their origin and their preparation condition (Cosme, Ricardo-da-Silva, & Laureano, 2008). More recently, some proteins of vegetable origin have also been investigated as possible wine fining agents (Marchal, Marchal-Delahaut, Lallement, &

Jeandet, 2002). The main objectives of this work were to compare the effects of micro-oxygenation and of three types of fining agents (gelatin, PVPP -formulation and pea protein) on the bitterness and astringency of the corresponding red press wines after treatment, and on the structural characteristics of their proanthocyanidins. For that purpose, the wines were fractionated by low pressure chromatography into three main fractions (monomeric, oligomeric, and polymeric flavan-3-ols).

2. Materials and methods

2.1. Materials

A pneumatic type of wine press (Bucher Vaslin) is used for the elaboration of press wine. A system of micro-oxygenation (Visio 6) and a disk stack centrifuge RE50V (8000 Tr/min) were used in this experiment.

2.2. Winemaking

In 2014–2015 vintage. After the end of the alcoholic fermentation, the grape pomace of grapes *Vitisvinifera of Cabernet Sauvignon* is pressed with pressure degrees varying from 0 to 300 mbar in the cellar Château Roslane (Fig. 1). At the end of pressing, the wine is treated with clarification enzyme, centrifuged at 8000 tr/min and distributed on four tanks of 10 hL, one called control (T_0) and the others treated with some commercial fining agents: Pork liquid gelatin (T_2) at a concentration of 0.6 mL/L, Polyvinylpolypyrrolidine (PVPP) coupled with bentonite (T_3) (dose 0.8 g/L, Powders)and formulation of vegetable pea protein of, bentonite and polysaccharides (T_4) (dose 0.8 g/L, Powders). Another tank of 25 hL was used for micro-oxygenation trial (T_1), the air being delivered at 60 mL/L/month until the beginning of malolactic fermentation. The fining agent doses were chosen after performing a sensory

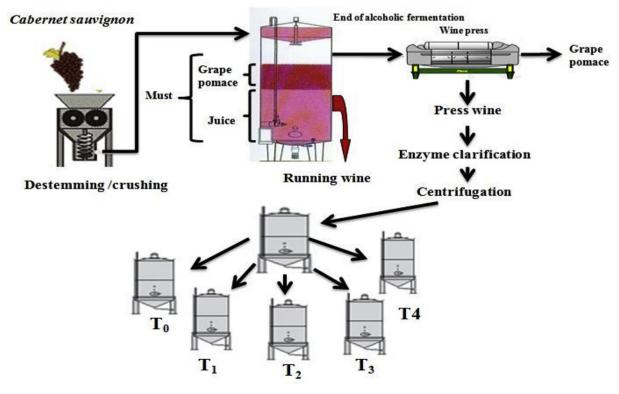


Fig. 1. Protocol of winemaking press wine Château Roslane.

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