EXPERT PAPER

Effects of pectolytic enzyme treatments on white grape mashs of *Smederevka* on grape juice yields and volume of lees

Kiro MOJSOV[1], Jugoslav ZIBEROSKI[2], Zvonimir BOZINOVIC[2], Meri PETRESKA[3]

[1]University "Goce Delcev" Stip, Technological-Technical Faculty, Krste Misirkov bb, 2000 Stip, Republic of Macedonia
[2]Ss. Cyril and Methodius University, Faculty of Agricultural Sciences and Food, Aleksandar Makedonski bb, 1000 Skopje, Republic of Macedonia, (e-mail ziberovskij@zf.ukim.edu.mk)
[3]Ministry of Agriculture, Forestry and Water Economy, Leniniva 2, 1000 Skopje, R. Macedonia

Abstract

The aim of this work was to evaluate the effect of the use of pectolytic enzyme treatments on white grape mashs of Smederevka on grape juice yields and volume of lees. White grape mash from Smederevka were macerated for 4 hours at 18 to 20oC with addition on one commercial pectolytic enzyme preparation (Vinozym Process, Trenolin Mash DF, Rohavin LX). After maceration, the pomace was removed, and each musts are pour into the funnel and collect musts. Results of trials showed increased on free run juice yields by 7,12% and drastic reduction in the volume of gross lees by up 47,3% compared with control trials. Increase juice yields and reduction volume of gross lees, leading to a higher volume of clear must, and this in the more produced wine and on end the more profit.

Key words: pectolytic enzymes, free run juice yields, volume of lees, *Smederevka*

Utjecaj pektolitičkih enzimatskih tretmana na količinu samootoka i taloga u masulju grožđa *Smederevka*

Sažetak

Cilj ovog rada bio je odrediti efekt upotrebe pektolitičkih enzimnih tretmana smjese bijelog grožđa Smederevka na prinos soka i zapreminu ukupnog taloga. Smjesa bijelog grožđa Smederevka bila je macerirana 4 sata na 18-20oC sa dodatkom jednog komercijalnog pektolitičkog enzimskog preparata (Vinozym Process, Trenolin Mash DF, Rohavin LX). Nakon maceracije, čvrsti ostaci se otstranjuju, a svaka šira se prebacuje inkom i sakuplja u rezervoare. Rezultati opita pokazali su povećan prinos samotoka do 7,12% i drastično smanjenje ukupne zapremine taloga do 47,3% uspoređeno sa kontrolnim probama. Povećan prinos soka i smanjena zapremina ukupnog taloga, vodi u veću proizvodnju vina i na kraju više profita.

Ključne riječi: pektolitički enzimi, prinos samotoka, zapremina taloga, Smederevka

Introduction

Smederevka is an important white grape for Macedonia. It is capable of producing high quality white table wines in this country. Although the composition of the grape depends on its variety, the soil and the climatic conditions, there is little variation in the actual cell structure of the plant. Pre-fermentation enzyme maceration or scin contact with added enzyme besides aroma release, increase juices yields and eases

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pressing and filtration operations (Haight G. and Gump H., 1994; Ganga et al., 2001). Grape skin cell walls are a physical barrier on this aroma and juice diffusion. As pectic polysaccharides play a major role in cell walls rigidity they are the main limiting factor. To the main polysaccharide chains other shorter or longer, straight or branched, saccharide chains are attached. The pectic enzymes play an important role in braking down grape pulp and skin cells and are able to split those chains and saccharide bonds between the chains (Whitaker, 1984). Enzymes cannot act on grapes if they are whole. Therefore, grapes should always be crushed before enzymes are added to enhance extraction. By weakening the cell walls of the pulp and hydrolyzing the soluble pectin, the enzymes in white grape maceration facilitate juice release and thus ingrease the free run juice yield, which avoids excessively harsh pressing (Brown R. and Ough S., 1981; Ribereau-Gayon et. al., 2000). First of all, as the must is less viscous thanks to the degradation of pectins and other cell wall components such as cellulose, hemicellulose, and pressure applied to the grapes can be lower. Therefore, keep musts cool (15-16oC) and allow to stand overnight, so that suspended material will fall to the bottom. The clear must is then racked from the lees. Enzyme treatments on musts reduce viscosity and speed up settling and ensure efficient sediment compaction. This may take 24 hours or longer to settle, but the resulting quality is worth the wait. The aim and importance of the research were benefits of pectolytic enzyme treatment on white grape mashs from Smederevka, such as improve yields of free run juice, reduction volume of gross lees and the more produced wine and on end the more profit.

Materials and methods

Commercial pectolytic enzyme preparations

In this study were used for laboratory trials three commercial macerating pectolytic enzyme preparations with corresponding quantities suggested of producer:

- Vinozym Process, Novozymes A/S, Bagsvaerd, Denmark; Dose: 4 g/100 kg grapes
- Trenolin Mash DF, Erbslöh Geisenheim AG, Geisenheim, Germany); Dose: 2 mL/100 kg grapes
- Rohavin LX, AB Enzymes GmbH, Darmstadt, Germany; Dose: 3 mL/100 kg grapes

and for industrial trials used one commercial pectolytic enzyme preparation (Trenolin Mash DF, 2 mL/100 kg grapes) along with controls with no added enzyme.

These enzyme preparations are derived from cultures of Aspergillus niger which is a species accepted as G.R.A.S. (Generally Recognized As Safe), (Canal-Llauberes, 1993).

Grape samples for laboratory trials

The white grape cultivar Smederevka (Vitis vinifera), cultivated in the Ovce pole vineyard, the Povardarie region, Republic of Macedonia, were harvested at optimal maturity (2009 vintage), at 170-190 g L-1 sugar, 6.0-7.0 g L-1 total acids, and pH from 3.0 to 3.2, and transported to the private winery “Imako Vino” Stip, Republic of Macedonia.

Grape samples for industrial trials

The white grape cultivar Smederevka (Vitis vinifera), cultivated in the Veles vineyard, the Povardarie region, Republic of Macedonia, were harvested at optimal maturity (2009 vintage), at 180-200 g L-1 sugar, 6.0-7.0 g L-1 total acids, and pH from 3.0 to 3.2, and transported to the private winery “Tristo” Veles, Republic of Macedonia.

Vinification. Juice yields and volume of lees

The grapes were weighed, destemmed, crushed and divided in 5 liters plastic reservoirs for laboratory trials, and for industrial trials were placed in a stainless steel fermentor (4 t.). All laboratory treatments were performed in triplicate and industrial in duplicate. White grape mash made from Smederevka were macerated for 4 hours at 18 to 20oC with addition on one commercial pectolytic enzyme preparation without additions of SO2 and selected yeast. Control laboratory trials were in all same with experimental trials only whitout added pectolytic enzyme preparation. The enzyme preparations were first diluted to a 10% solution using cool, clean water, and added corresponding quantities (suggested of producer) to the freshly crushed

grapes. At the "no-enzyme addition" (control trials) were added an equal amount of dejonized water as a replacement for the enzyme additions. The contents of each reservoir were stired thoroughly. After maceration the pomace was removed and each must are pour into the funnel and collect musts in 5 liters plastic reservoirs (3 for enzyme treatments musts and 1 for control must (no-treatment)(juice yield). In each reservoir are add 30 ppm SO2 and are keept musts cool (15-16oC) and allow to stand overnight, so that suspended material will fall to the bottom. After this are measure volume of lees from each reservoir. In each must (reservoir) are add yeast (Saccharomyces cerevisiae) NEUTRE SC (Lallemand), (200 mg/kg grapes) at ~25 oC to completion of fermentation.

Materials and procedure to measure free run juice yield.

Cheesecloth (two squares to fit funnel); Funnels (2); Glass or plastic reservoirs, 8 to 10 lit., (2); Graduated cylinders, 1000 mL or bigger (1); Spatulas or spoons (2);

The Cheesecloth are place in a funnel and the funnel into glass or plastic reservoir. The grape mash of each plastic reservoir (5 kg) are pour into the funnel and collect filtrate (free run juice) in glass or plastic reservoir. The amount of free run juice (filtrate) collected are measure with graduated cylinders and it is free run juice yield.

Materials and procedure to measure volume of lees.

Funnel (1); Glass or plastic reservoirs, 5 liters(4); Graduated cylinders, 1000 ml or bigger (1);

After maceration each must are pour into the funnel and collect musts in 5 liters plastic reservoirs (3 for enzyme treatments musts and 1 for control must (no-treatment). In each reservoir are add 30 ppm SO2 and are keept musts cool by 15oC to 16oC and allow to stand overnight, so that suspended material will fall to the bottom. After this are measure volume of lees from each reservoir.

Results and discussion

With enzymes, winemakers can enhance aroma and improve throughput of their white wines, as well as increase profits by increasing yields. Enzymes are very popular in white wine making since extraction and clarification of the must is difficult due to the presence of pectins extracted during winemaking. High viscosity and the cloud particles are kept in suspension. Enzymes also help with reducing viscosity, releasing free-run juice easily, and faster release of juice during pressing. In Table 1 are given results of free run juice yields obtained with pectolytic enzyme treatments on white grape mashs of Smederevka and contol trials "no-enzyme addition". Obtained results are of laboratory trials (5 kg grapes). In Table 1 it can be seen that pectolytic enzyme treatments on white grape mashs of Smederevka gives increased on free run juice yields by 4,62% to 7,12% compared with non-treated mashs of control trials. Pectolytic enzyme preparation Trenolin Mash (7,12%), Rohavin LX (5,52%) and Vinozym Process (4,62%). In Table 2 are given results of free run juice yields obtained with pectolytic enzyme treatment (Trenolin Mash) on white grape mash of Smederevka and contol trial "no-enzyme addition". Obtained results are of industrial trials (1220 kg grapes). In Table 2 it can be seen that pectolytic enzyme treatment on white grape mash of Smederevka gives increased on free run juice yield of up 6,56% compared with non-treated mash of control trial. The results of investigated on the effect of pectolytic enzyme treatments on white grape mash of Smederevka have average been greater yields of free run juice than untreated. The obtained results were in agreement with previously published data but of other winegrapes (Brown R. and Ough S., 1981; Rogerson et al., 2000; Haight G. and Gump H., 1994; Harbord et al, 1990).

Table 1. Effects of pectolytic enzyme treatments on white grape mashs of Smederevka on free run juice yields. Laboratory trials: 5 kg grapes

Enzyme preparations	Average L(a)	% of grape weight	Increase yield%
Vinozym Process (4 g/100 kg grapes)	2.430 ± 0.025	48.60	+ 4.62
Trenolin Mash DF (2 mL/100 kg grapes)	2.555 ± 0.022	51.10	+ 7.12
Rohavin LX (3 ml/100 kg grapes)	2.475 ± 0.026	49.50	+ 5.52
Control - no added enzyme	2.199 ± 0.038	43.98	0

aValues represented in the table are averages of results of three separately conducted experiments±SD*
*SD- standard deviation

Table 2. Effects of pectolytic enzyme treatments on white grape mashs of Smederevka on free run juice yields. Industrial trials: 1220 kg grape. Private winery "Tristo" Veles

Enzyme preparation	Average L (a)	% of grape weight	Increase yield%
Trenolin Mash DF (2 mL/100 kg grapes)	631 ± 9	51.72	+ 6.56
Control-no added enzyme	551 ± 11	45.16	0

aValues represented in the table are averages of results of two separately conducted experiments±SD*
*SD - standard deviation

Table 3. Effects of pectolytic enzyme treatments on white grape mashs of Smederevka on volume of lees. Laboratory trials: 5 liters musts, 30 ppm SO_2, cool by 15°C to 16°C and allow to stand overnight

Enzyme preparations	Volume of lees L(a)	Lees volume reduction vs Control%
Vinozym Process (4 g/100 kg grapes)	1.0 ± 0.05	47.3
Trenolin Mash DF (2 mL/100 kg grapes)	1.2 ± 0.05	36.8
Rohavin LX (3 ml/100 kg grapes)	1.3 ± 0.05	31.5
Control - no added enzyme	1.9 ± 0.1	0

aValues represented in the table are averages of results of three separately conducted experiments±SD*
*SD - standard deviation

In Table 3 it can be seen that pectolytic enzyme treatments on white grape mashs of Smederevka gives drastic reduction in the volume of gross lees by up 47,3% compared with non-treated mash of control trial. Pectolytic enzyme preparation Vinozym Process (47,3%), Trenolin Mash (36,8%) and Rohavin LX (31,5%). Enzyme treatments on musts speed up settling and ensure efficient sediment compaction (Höhn et al., 2005; Trepo, 2008). The clear must is then racked from the lees without problems.

Conclusion

Increase free run juice yields by 7.12% and drastic reduction in the volume of gross lees by up 47.3% compared with non-treated mashs of control trials, this makes the application of the pectolytic enzymes in wine industry. By increasing juice yields and reduction volume of gross lees, leading to a higher volume of clear must, and this in the more produced wine and on end the more profit.

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