The influence of technological treatments on physical and chemical structure of wine

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Annotation

A necessary condition for the competitiveness of domestic wine in the international consumer market is to further increase the wine quality with extension of terms of the guaranteed stability up to 1.5 years.

Gelatin and bentonite are ones of the most common purifying and stabilizing preparations, which are widely used in the practice of winemaking. In this context, it is an important task of testing imported auxiliary products of new generation and their adaptation to the domestic winemaking.

The problem of long-term stability of wine remains actual even now. To a great extent it is predetermined by quality of technological processes carried out in order to remove the reasons of prepared wine turbidity.

One of the most common types of turbidity is colloidal turbidity that is detected at low temperatures. The main reason of colloidal turbidity appearance is a presence of substances with colloidal nature or those that express significant colloidal properties. Nowadays there are a lot of means for wine stability, which are recommended to the wine manufactory for deleting colloids and prediction from colloidal turbidity. However they can provide the long-term wine stability not always.

Gelatin and bentonite are ones of the most widespread preparations in wine making which posses purifying and stabilizing properties.

Gelatin is used in the wine making for purification of wine materials and stabilizing of prepared wines mainly for reversible colloidal turbidity. In addition, gelatin gives good results in correction process of rough wine materials with large content of phenolic compositions.

The aim of research was to determine the influence of means for wine materials treatment with preparations of liquid gelatin in combination with bentonite.

Materials and methods.

The objects of research were white table wine materials and red ones. The scheme of experiment provided determination of physical and chemical characteristics of wine materials and processing them in different technological ways with the purpose to stabilize wine materials for colloidal turbidity.

First test was carried out on white table wine materials with phenolic substances in the sum of 260 mg/dm^3.

Table 1. Influence of dose of gelatin for treatment of white wine materials

Dose of gelatin, mg/dm^3	Initial turbidity, ph.n.	Test results, ph.n.	
		TA	E

Gelisol			
unprocessed wine	4,26	6,01	5,14
10	0	0,63	0,73
20	0	0,53	1,16
50	0	0,63	1,70
100	0	3,15	4,84
Aquacol			
5	0,2	1,11	0,24
10	0	7,09	0,44
20	0	1,99	2,52
Extrsa			
10	0,1	5,57	4,31
20	0	1,49	0,53
50	0	0,58	0,05
100	0	over swing	over swing
P-II			
100	0	0,68	0,73
250	0	0,92	1,6
300	0	over swing	over swing
Albumicol			
20	0	0,48	0
50	0	0,44	0
100	0	1,45	0,1
250	0	13,40	5,09
Liquid gelatin			
5	0	0,58	1,16
10	0	over swing	over swing

According to the table data the overfining doses are: for gelisola – 100 mg/dm^3, for aquacola – 10 mg/dm^3, for albumicola – 100 mg/dm^3, for liquid gelatin – 10 mg/dm^3. For air-dry preparations of gelatin the overfining doses are 100 mg/dm^3 (gelatin Extra) and 300 mg/dm^3 (domestic gelatin P- II) correspondly.

Next test was carried out on a red table wine materials Alushta in order to clarify a *overfining* dose of gelatin only.

Table 2. Influence of dose of gelatin for treatment of red wine materials

Dose of gelatin, mg/dm^3	Initial turbidity, ph.n.	Tannin test results, ph.n.	OKP test after processing, ph.n.
Gelisol			
unprocessed wine			
100	0	7,11	0,96
250	0	2,6	0,48
500	0	0,72	0,72

Aquacol			
250	0	0	115,4
500	0	0	81,1
750	0	0	-
1000	0	6,0	-
Extra			
100	1,07	11,0	53,18
250	0,97	1,92	69,72
500	0,78	0	-
P-II			
100	0	105,2	52,16
250	0	6,7	103,01
500	0	5,4	80,03
Albumicol			
100	0	0	1,92
250	0	2,2	78,63
500	0	6,9	94,02
750	0	10,3	75,83
Liquid gelatin			
500	0	0	97,96
750	0	0	72,26
1000	0	3,3	-

According to the table data the overfining doses are: for gelisol – 100 mg/dm^3, aquacol – 1000 mg/dm^3, albuminokol – 500 mg/dm^3, liquid gelatin – 1000 mg/dm^3. For air-dry preparations of gelatin the dose of *overfining* is 2000 mg/dm^3 (both gelatin Extra and domestic gelatin P-II).

From the test results it is possible to conclude that the doses of *overfining* for liquid gelatin are 500-1000 mg/dm^3, and for air-dry preparations of gelatin - 2000 mg/dm^3.

For achievement of maximum effect of *fining* process it is necessary to observe a number of rules, including the reasonable choice of gelatin and optimal scheme of processing, determination of fining substances dose through the tests and *gradual infusion them into wine*.

To speed up the purification process, and for the removal of biopolymers involved in the formation of wine turbidity, quite often debourbage is accompanied by infusion of supplemental materials into mash. Among these materials can be distinguished sorbents, flocculants and enzymes. Bentonite is the most common sorbent used for mash purification. Bentonite is entered into mash in the amount from 2 mg/dm^3 to 10 mg/dm^3, depending on content of protein in it . According to the opinion of many specialists this process helps to delete from 50% to 90 % proteins and up to 30 % polysaccharides from mash. At the same time oxidative enzymes are

deleted almost in full, that reduces tendency of wine to oxidative turbidity substantially.

Treatment of wine materials has been conducted both with liquid gelatin only and in combination with bentonite in order to stabilize wine for reversible colloidal turbidity.

The dose of gelatin for treatment of wine materials has been set as a result of realization *of same* tests. The results of these tests are given in the table 3.

As can be seen from the table of results, the optimal fining dose in combination gelatin - bentonite for treatment of white wine materials with phenolic substances in sum of 260 mgs/dm^3 with liquid gelatin preparations is from 5/1 to 5/2, with domestic gelatin is 5/2.

Table 3. Treatment of white wine materials with gelatin in combination with bentonite

Dose of gelatin, mg/dm^3 bentonit, g/dm^3	Initial turbidity, ph.n.	Test results, ph.n.	
		TA	E
Gelisol			
unprocessed wine	4,3	6,0	5,1
2,5/0,5	0	1,8	0,9
5/0,5	0	0,8	1,7
5/1	0	1,6	2,8
Aquacol			
2,5/0,5	0,1	2,0	0,5
5/0,5	0,1	2,2	2,1
5/1	0,1	0,9	0,2
Albumicol			
5/0,5	0,9	2,1	1,9
5/1	0,1	1,1	1,2
5/2	0,1	0,5	0,9
Liquid grelatin			
5/0,5	0,2	1,3	1,4
5/1	0	0,8	1,2
5/2	0,1	0,9	1,2
Extra			
5/1	0,5	2,1	0,4
5/2	0,2	1,1	0,1
10/1	0	1,1	0,1
P-II			
5/1	0,3	2,1	0,8
5/2	0	0,6	0,7
10/1	0	0,2	0,1

The results of treatment of red table wine materials with gelatin jointly with bentonite are given in the table 4.

An analysis of results testifies that the dose of liquid gelatin preparations for red wine processing has been reduced in 2,5-3 times, that proves the economy of liquid gelatin preparations in comparison with domestic gelatin.

Table 4. Treatment of red wine materials with gelatin in combination with bentonite

Dose of gelatin, mg/dm^3 and bentonite, g/dm^3	Initial turbidity, ph.n.	OKP test after processing, ph.n.
Gelisol		
unprocessed wine	7,5	70,4
10/1	0,5	2,9
20/1	0,2	0,5
Akvakol		
10/1	0,2	8,2
20/1	0	6,6
25/1	0	1,44
Albumikol		
10/1	0,5	10,8
20/1	0,5	3,4
40/1	0	over scale
Liquid gelatin		
10/1	0,2	3,9
20/1	0,2	1,7
Extra		
50/1	0	over swing
50/2	0	over swing
75/1	0,2	2,4
P-II		
50/1	1,2	over swing
50/2	1,4	over swing
75/1	1,7	3,8

The liquid forms of gelatin have a rather low gelling temperature, well dissolve in cold water, do not require heating that makes them easy to use in production. They are received as a result of hydrolysis of high molecular gelatin. Dry substances content is 10-25 %%.

But for more effective application of liquid gelatin for treatment of red wine materials the process was conducted in cold.

Table 5. Treatment of red table wine materials with gelatin in combination with bentonite in cold

Dose of gelatin, mg/dm^3 and bentonite, g/dm^3	Initial turbidity, ph.n.	OKP test after processing, ph.n.
Gelisol		
unprocessed wine	7,5	70,4
20/1	0	over swing
10/1	0	over swing
5/1	3,85	3,85
Aquacol		
20/1	5,77	11,42
10/1	14,0	17,06
5/1	3,85	1,68
Albumicol		
20/1	0	3,61
10/1	0	over s swing
5/1	0	over swing
Liquid gelatin		
20/1	0,48	0,48
10/1	0	0,48
5/1	0	1,44
Extra		
75/1	1,20	0,48
50/1	0,96	6,96
40/1	0,72	29,83
P-II		
75/1	5,77	over swing
50/1	6,47	over swing
40/1	6,68	over swing

Processing of red wine with liquid gelatin jointly with bentonite was performed at temperature +4 ... +5 º C. As can be seen from the table of results, domestic gelatin has been gelated and has not been work at low temperature. In order to conduct wine processing along with cold treatment, tests were carried out at temperature of 0 ... -4 º C. It was set the following optimal doses of gelatin (mg/dm^3) and bentonite (g/dm^3) for wine stability: liquid gelatin – 5/1, albuminokol – 5/1, gelisol – 5/1, aquacol – 10/1, Extra – 40/1. But as it was mentioned above, domestic gelatin P-II does not work at cold temperature.

Finally the choice of an appropriate gelatin needs to be a compromise between its ability to flocculate and to interact with wine tannins, it must work in the assumed conditions, and in particular in cold. At the same time a great importance plays the type of wine and the goal of processing. For example, for pink and faintly red wine a

lot of attention should be paid to preserve colour intensity. For white wine it is important to prevent overfining.

Among reasons of wine destabilization one is *excess* of heavy metals, which catalyze the oxidative processes and participate in formation of turbidities.

As a result of the researches of many authors (Rodopulo, Tyurin, Ogorodnik, Panasyuk, Ribero-Gayon) it is proved that iron in wine is in bivalent or trivalent cation forms which capable to form the relevant complexes with organic acids, phenolic substances, proteins, and polysaccharides. Over time some complexes lose their solubility that leads to wine turbidity.

According to the some scientific works (Spiess, Yatsyna, Balkuli, Naumova) there is a direct dependence between forms of iron and pH of solution. If pH increases, Fe (II) transforms in Fe (III) completely, and if pH decreases, the ratio between ionic and complex forms changes in favor of the last.

The processes of *oxidation* and rehabilitation of iron in wine play a major role in the occurrence of turbidities. The composition of wine as a rehabilitating liquid assists to maintain iron in the less oxidized form. However bivalent iron Fe (II) is stable in wine, does not form insoluble compositions, and therefore does not affect on limpidity of wine.

In contrary trivalent iron Fe (III) forms insoluble composition, causes turbidity of wine and *fall out in sediment* when its concentration reaches a certain level. Fe II does not cause turbidity of wine even at very high doses.

Complex compositions of iron particularly with organic acids have been already become a subject of a large number of researches for a long time. Experiments were performed on a model solution. Firstly a certain dose of iron was entered into model solution, then gelatin was added and after that it has been observed more efficient wine purification and formation of a flaky sediment in it. *Tanigal* was used as tannin.

In accordance with results of experiments it is possible to conclude that it is necessary to conduct a demetallization before wine processing. When influence of iron concentration on the interaction of gelatin with tannins was researched, we have found out that the mass fraction of pyrogallic hydroxyls increases with increasing concentration of iron, that testifies *a decline* in the efficiency of tannin interaction with gelatin in the presence of iron.

Literature:

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