ON THE DYNAMICS OF THE REDOX POTENTIAL DURING ”IN RED” WINE MAKING

CONSIDERAȚII PRIVIND DINAMICA POTENȚIALULUI REDOX ÎN CURSUL VINIFICĂRII „ÎN ROŞU“

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Abstract. *Evolution of the redox potential during “in red” wine making from grapes of two autochtonous, black sorts – Fetească neagră and Băbească neagră – has been followed. Qualitatively, the dynamics of the process does not differ from that of the “in white” wine making; more precisely, the redox potential first evidences an oxidative tendency, followed by a reductive one. Pressing causes no significant modification in the subsequent development of the redox potential. However, quantitatively, a drastic reduction of the period over which the pomace follows the oxidative tendency, alongwith the orientation towards the reductive one, should be mentioned. Even if the oxidative tendency is biochemically supported by the preponderant glycerol biosynthesis, while the reductive one – by the ethanol biosynthesis, a physiological aspect should be also involved here, namely the homeostatic tendency of the yeast of assuring to itself an optimum redox potential of the environment: rH 25 over the duration of (aerobic) multiplication and, respectively, a rH value around 20, along the duration of the (anaerobic) fermentation. In this respect, mention should be made of the fact that, in the case of both “in red” and “in white” wine making, in the end of fermentation, rH values of 19–20 are recorded in the must–wine.*

Key words: rH, “in red” wine/making

Rezumat. *S-a urmărit evoluția potențialului redox în cursul vinificării „în roşu“ a strugurilor proveniți din două soiuri negre autohtone – Fetească neagră şi Băbească neagră. Dinamica înregistrată nu diferă – calitativ – de cazul vinificării „în alb“. Anume, potențialul redox are inițial o tendință oxidativă, urmată de una reductivă. Tescuirea mustuielii nu induce nici o modificare notabilă în evoluția ulterioară a potențialului redox. Din punct de vedere cantitativ însă, se constată restrângerea drastică a perioadei în care mustuiala urmează tendința oxidativă şi trecerea spre tendința reductivă. Chiar dacă tendința oxidativă are ca suport (bio)chimic biosinteza preponderentă de glicerol, iar cea reductivă de etanol, faptul reflectă şi un aspect fiziologic, anume tendința homeostatică a levurii de a-şi asigura un potențial redox optim al mediului: rH 25 pe durata multiplicării (aerobe), respectiv o valoare rH situată în jurul a 20 pe durata fermentației (anaerobe). În acest sens se remarcă faptul că, indiferent dacă e vorba de vinificare „în roşu“ sau „în alb“, la sfârşitul fermentației se înregistrează în must–vin valori rH de 19–20.*

Cuvinte cheie: rH, vinificație „în roşu“

INTRODUCTION

In a previous study [1] the evolution of the redox potential has been followed during ”in white” wine making, the conclusion being reached that the quite unanimously accepted idea that alcoholic fermentation is a reductive process is not wholly valid. As a matter of fact, such process involves the oxidation of glucose to ethanol, which should implicitly cause an increase of rH value. The usually observed rH decrease should be therefore attributed to the formation of compounds with a reductive-type behaviour, yet lacking the corresponding energetic availability.

The present study, devoted to the ”in red” wine making, attempts at evidencing the possible similarities or differences between the two types of wine-making processes.

MATERIAL AND METHOD

For the experiments, grapes of two autochtonous blak sorts – Fetească neagră and Băbească neagră – from the Huşi wineyard, harvested in 2007, have been utilized. They have been microwine-making separately, in 60 L containers. Daily, samples of must–wine were drawn, which were immediately preserved by freezing. Subsequently, samples were subjected to determination of redox potential, by a potentiometric method previously presented [2] with changes specified in [1]. Redox potential was expressed through the rH parameter, according to Clark’s relation:

$$rH = \frac{E_h + 0.058 \cdot pH}{0.029}$$

where: E_h – the determined redox potential (in Volts) + the standard potential of the normal hydrogen electrode at working temperature [3]. If, in principle, the method has been applied in the reported form, from an instrumental point of view an automatic data acquiring system was added. The authors thank this way to Mr. Viorel Creangă from TVR Iaşi, the manufacturer of the system and of the afferent program and from whom those interested can obtain further details (+40740133658, jo_branch@yahoo.com).

RESULTS AND DISCUSSIONS

The obtained data, presented in table 1, were graphically represented in figure 1 (Fetească neagră), respectively figure 2 (Băbească neagră).

Table 1

The obtained experimental data

Time (days)	rH		Time (days)	rH	
	Fetească neagră	Băbească neagră		Fetească neagră	Băbească neagră
0	21.05	26.50	11	22.49	22.00
1	26.31	26.64	12	22.24	21.33
2	28.98	23.06	13	19.855	20.88
3	20.795	24.51	14	19.93	21.98
4	25.85	24.90	15	20.02	21.15
5	21.33	24.84	16	20.02	20.365
6	22.94	21.86	19	19.645	19.85

7	22.46	23.21	22	20.14	21.015
8	21.78	20.52	25	20.69	18.755
9	20,01	22,12	28	17,81	19,50
10	20,37	22,50			

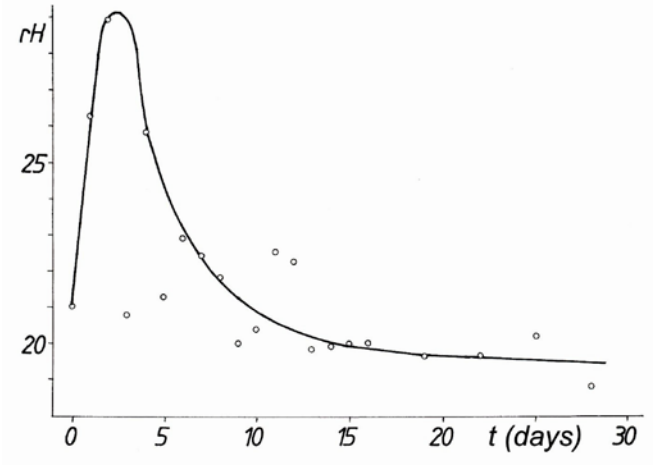

Fig. 1. Dynamics of rH' values at Fetească neagră

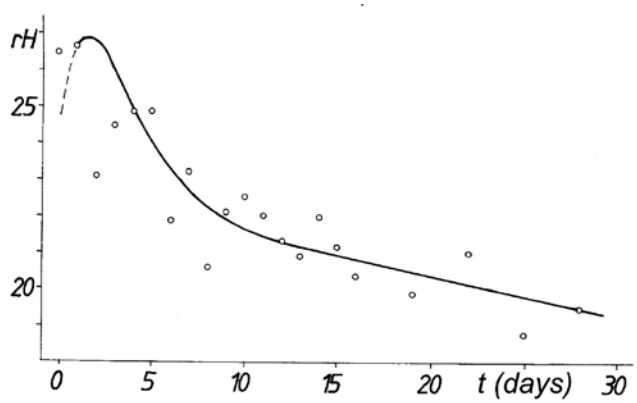

Fig. 2. Dynamics of rH' values at Băbească neagră

A first remark/observation reffers to a larger spreading of the experimental data than for the "in white" wine-making, natural/explainable if taken into account the poorer homogenization of vintage compared to the must. Namely, the redox potential has at first an oxidative tendency, followed by a reductive one. Pressing the vintage (t = 5 days) does not induce any significant change in the subsequent evolution of the redox potential. But, quantitatively, a drastic reduction of the period in which vintage follows the oxidative tendency and the passing to the reductive tendency were noticed. We explain this by the contact between must and air, therefore by the more intense multiplication tendency of

the yeast, implicitly the fast reach of the maximum redox potential (1-2 days). This fact is better highlighted for the Fetească neagră sort (fig. 1).

Even though the oxidative tendency has as a (bio)chemical support the preponderant glycerol biosynthesis, while the reductive one by the ethanol biosynthesis, as detailed in [1], this fact also reflects a physiological aspect, namely the homeostatic tendency of yeast to ensure itself an optimum redox potential of the environment: rH 25 during the (aerobe) multiplication, respectively a rH value around 20 during (anaerobe) fermentation. In this respect, it is noticed that, no matter if we refer to "in red" or "in white" wine-making, at the end of fermentation rH values of 19–20 in must–wine are registered.

The recorded dynamics does not differ – qualitativelly – from the case of "in white" wine-making. (fig. 3 [1]).

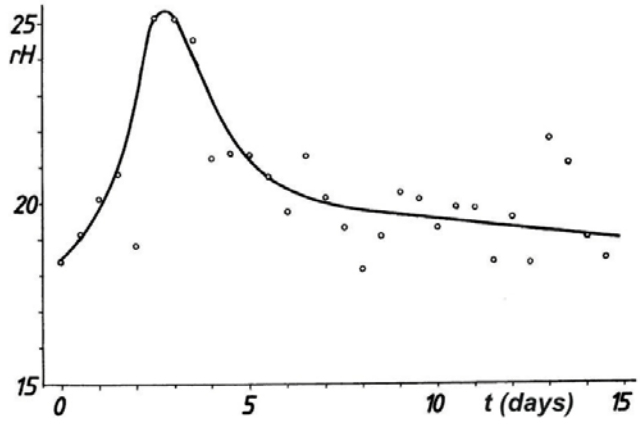

Fig. 3. Dynamics of rH' values at "in red" wine-making

CONCLUSIONS

The evolution of redox potential during "in red" and that during the "in white" wine-making do not differ qualitatively, but the oxidative period, at the end of which the redox potential reaches the maximum, is drastically shortened.

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