EJEAFChe
Electronic Journal of Environmental, Agricultural and Food Chemistry

ISSN: 1579-4377

ELIMINATION OF ALCOHOL BY VACUUM DISTILLATION IN RIBEIRO AND ALBARIÑO WINES

Álvarez E. *, Álvarez S., Cancela M. A., Maceiras R., Táboas R.

*Department of Chemical Engineering, University of Vigo. ETSEI. Spain. E-mail: ealvarez@uvigo.es

KEYWORDS

Vacumm distillation, wine, ethanol.

ABSTRACT

In this work some tests of alcohol elimination by vacumm distillation in white Galician wines, concretely in "Ribeiro" and "Albariño", have been carried out. The influence of operation variables: pressure, operation time and initial volume were studied. Values of alcoholic reduction higher than 90 % were obtained for the two wines.

INTRODUCTION

Galicia is Autonomous Community which counts on wines of great reputation, as national level as international, and in which the elaboration of the wine is not only an industrial process, since it is a part of its culture. Of native wines, the most known ones are the white wines, "Ribeiro" and "Albariño".

Both wines are prestigious, white, aromatic variety grapes that produce young balanced wines, typical, fresh (due to a moderate acid content) and with an intense fruity and oral aroma. In Galicia, these variety are authorised in the Appellations of Controlled Origin Monterrei, Ribeiro, Valdeorras, Rias Baixas and Ribeira Sacra, producing prestigious wines[(1)] In these Appellations of Controlled Origin other wines are produced in a similar manner, using this variety mixed together with other autochthonous varieties (Loureira, Treixadura, Caiño, etc.) resulting in wines that also have a strong personality. These varieties, both as a grape and as a wine, has been the objective of previous studies[(2-5)].

The Albariño and the Ribeiro are young wines of not very elevated alcoholic graduation, their consumption would be restricted to certain groups that, for diverse reasons, cannot ingest alcoholic drinks. The wine elaboration with a minimum content of ethanol would allow to arrange in the market of a product of great acceptance, mainly between those people – hepatic and renal ill, pregnant women, ex-alcoholic or simply people who by reasons for security (taxi drivers or bus drivers) or for health (low diets in calories), etc. - that cannot enjoy a good wine due to their high ethanol content. The partial or total dealcoholization of wines to obtain low alcoholic drinks seems a good choice for market expansion, and to improve the problem of excess wine that the enological industries suffer spain[(6)].

The most common industrial process to obtain dealcoholized wines involves high temperature semipermeable films (inverse osmosis[(7)] and dyalisis), distillation, cryoconcentration, fluid extraction and absorption on porous surfaces[(8-9)] At the time of elaborating this new product we must look for a method that extracts the greater amount of possible alcohol, respects the naturalness and the genuineness of all its

components, maintains the organoleptic characteristics[10-12] unalterable (colour, flavour and aroma) and that, in addition, it has the greater yield from an economic point of view. On the matter several techniques exist, vacuum distillation has been choisen in this work. The main advantage to use this method is that they allow us to work to ambient temperature, guaranteeing the non-appearance of the bacteria that produce undesirable acids in the wine.

This paper studies the ethanol elimination in different wines with the purpose of optimizalizing a technique of ethanol separation of spirit drinks using the vacuum distillation.

MATERIALS AND METHODS

A vacuum distillation system VACUUBRAND PC510, with a diaphragm pump MZ 2C and a controller CVC 2", connected to desiccator has been employed (Fig. 1). This system permits to work at pressures between 17 and 40 mm Hg, i.e., between the vapour pressures of water and ethanol at 20 ºC, respectively. The employed raw materials were two kinds of white wine, "Albariño" belonging to the D.O. "Rías Baixas" in the province of Pontevedra, with an initial alcoholic graduation of 11.5 % vol. and two"Ribeiro" wines belonging to the D.O. "Ribeiro" in the province of Orense with an initial alcoholic graduation of 10 % vol. the first and 10.5 % vol. the second.

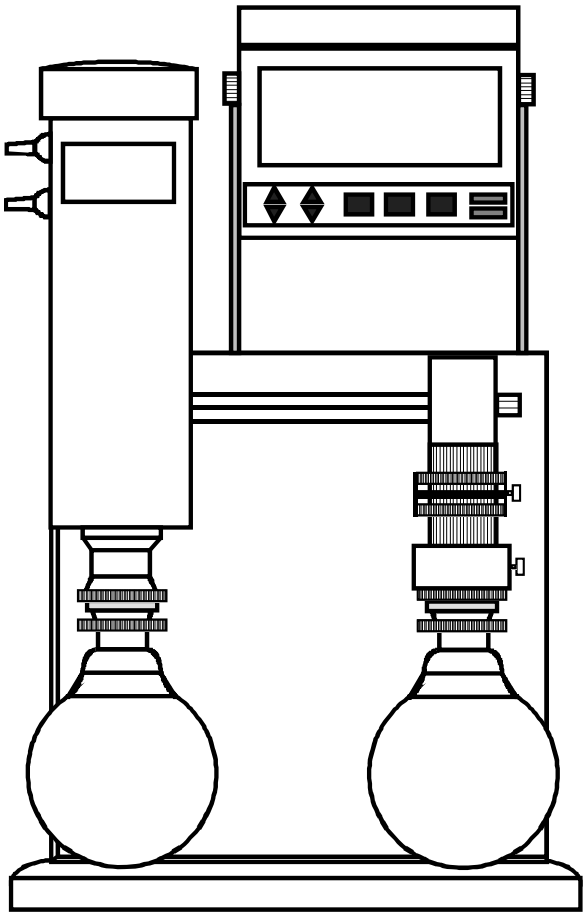

Figure 1. Vaccumm pump system.

An alcohometer is used to analyze the contained in alcohol. It is constituted by a complete distillation equipment and densimeter. In the distillation equipment is introduced 250 mL of wine and 250 mL of water. The alcoholic graduation is analyzed with the densimeter from the obtained product.

In this process an initial known volume is introduced into the desiccator and vacumm is made. Different samples are removed at different operation times for analyzing its contained in alcohol. The experiments were repeated at different pressures, from 18 mm Hg to 35 mm Hg, time of operation, from 400 to 3200 min, and initial volume, from 700 to 2000, to determine the best conditions to obtain the desirable product.

RESULTS AND DISCUSSION

The first analyzed variable in this process was the pressure. In table I it is shown the obtained results at different pressures for two samples. It is observed that the alcoholic reduction is higher when the pressure decreases. Due to this, we have worked at the lower pressure (18 mm Hg).

Table I. Comparison of % obtained alcoholic reduction at different pressures.

Sample	Time (min)	Pressure (mm Hg)	% Alcoholic Reduction
1	30	29	3.0
	60	22	11.0
2	30	24	7.6
	60	18	31.5

On the other hand the influence of time was studied. It is necessary take into account to the worked time is the addition of operation and stabilization time; the last one is the necessary time to get the required pressure. In table II it is observed that when the operation time increases, the % alcoholic reduction increases, too.

Table II. Comparison of % obtained alcoholic reduction at different operation times.

Pressure (mm Hg)	Stabilization Time (min)	Operation Time (min)	% Alcoholic Reduction
18	240	180	23.0
18	240	990	37.0

The last variable to consider was the initial volume and it was observed that the alcoholic graduation decreases when the initial volume increases (table III).

Table III. Comparison of % obtained alcoholic reduction at different initial volume.

Pressure (mm Hg)	Time (min)	Initial Volume (mL)	% Alcoholic Reduction
18	1600	710	81.0
18	1600	2000	50.0

For the "Albariño" wine, it is observed that the alcoholic reduction percent increases with the time and it depends on the initial volume (table IV). These two variables are relationship because it is necessary more time to obtain the same alcoholic graduation when the initial volume of the experience is higher and this causes a higher loss of volume. In addition, when the initial volume is constant, it is observed that the lost volume percent increase with the time.

Table IV. Results for "Albariño" wine at 18 mm Hg.

% Lost volume	Initial Volume (mL)	Time (min)	Operation Time (min)	% Alcoholic Reduction
12.5	1000	495 575 695	375 75 60	30.4 41.7 49.6
20.0	750	600 1865	420 1260	40.9 93.9
20.0	1500	240 336 431 526	90 90 90 90	11.30 13.91 17.39 25.22
20.4	1200	650 1856	540 1200	24.3 71.3
39.0	1000	1810 2746	1570 926	74.8 95.7

The results for the two "Ribeiro" wines indicate that the alcoholic reduction percent depends on the time and the initial volume. It is observed that this percent increases with the time. On the other hand, we can say it is needed a higher time to obtain the same alcoholic graduation if we increase the initial volume of the experience and this causes a higher loss of volume. In addition, when the initial volume is constant, it is observed that the lost volume percent increase with the time (table V, table VI).

Table V. Results for the first "Ribeiro" wine at 18 mm Hg.

% Lost volume	Initial Volume (mL)	Time (min)	Operation Time (min)	% Alcoholic Reduction
18.7	1200	420	180	23.0
		1326	900	60.0
		1446	90	69.0
25.2	2000	1230	990	37.0
		1600	360	50.0
		2570	960	69.0
		2930	330	80.0
		3186	250	90.0
29.6	710	1530	1410	81.0
30.1	930	1260	1020	63.0
		1755	405	85.0
30.7	1450	1157	900	43.0
		2574	1410	85.0
		2703	120	87.0

Table VI. Results for the second "Ribeiro" wine at 18 mm Hg.

% Lost volume	Initial Volume (mL)	Time (min)	Operation Time (min)	% Alcoholic Reduction
25.2	1400	450	60	31.4
		1920	1350	82.9
		2020	90	85.7
28.9	1400	1260	1140	67.6
		2798	1530	90.5
44.3	1400	4430	4310	100.0
46.4	1400	2850	2640	89.5
		4335	1470	100.0

CONCLUSIONS

In view of the results, we can conclude that the alcoholic reduction percent depends on three variables: pressure, time and initial volume. This reduction is higher when the pressure and the initial volume decrease and the time increases.

We obtain similar results for both wines. On the one hand, the alcoholic reduction percent increases with the time and this variable is relationship with the initial volume because it is necessary more time to obtain the same alcoholic graduation when the initial volume of the experience is higher and this causes a higher loss of volume. On the other hand, if we maintain the initial volume, it is observed that the lost volume percent increase with the time.

The wine was tasted by some expert people and with respect to the organoleptic characteristics; it was observed that the aroma and the colour are practically the same and the flavour changes.

Finally, for the "Albariño" wine an alcoholic reduction of 95.7 % was obtained and for the "Ribeiro" the values were 90.0 % for the first and 100.0 % for the second.

REFERENCES

1. S.C. Dieguez, L.C. Lois, E.F.Gomez, M.L.G.de la Peña. Aromatic composition of the Vitis vinifera grape Albariño, *Lebensm.-Wiss. U.-Technol*. 36, 585-590 (2003).

2. S. Cortés. Determinación de monoterpenos, ácidos y azúcares para la optimización de la fecha de vendimia. Tesis de Licenciatura, Universidad de Vigo, Spain (1997).

3. E. Fernández, S. Cortés, M. Castro, M. Gil, M.L. Gil. Distribution of free and glycosidically bound monoterpenes and norisoprenoids in the skin and pulp of Albariño grapes during 1998 maduration. In Aline Lonvaud Funel (Ed.), *Oenoligie 99. 6 Symposium International d'Oenolologie*. Bordeaux (pp. 161-164). Paris Tec&Doc (1999).

4. L. Carballeira, S. Cortés, M.L. Gil, E. Fernández. Determination of aromatic compounds, during ripening, in two white grape varieties, by SPE-GC. *Chromatographia*, 53, S350-S355 (2001).

5. M. Gil. Influencia del sistema de conducción sobre la composición de la uva Albariño.Tesis de Licenciatura, Universidad de Vigo, Spain (2000).

6. E. Gómez-Plata, J.M. López-Nicolás, J.M López-Roca, A. Martínez-Cutillas. Dealcoholization of wine. Behaviour of the aroma components durinf the process. *Lebensm.-Wiss. U.-Technol*. 32, 384-386 (1999).

7. M. López, S. Álvarez, F.A. Riera, R. Álvarez. Removal of alcohol from apple cider by reverse osmosis. *4 European Congress of Chemical Engineering*, Granada, Spain (2003).

8. U. Schobinger, P. Durr, R. Waldvogel. *Verfahren zur Herstellung von alkohol freiem oder frucktwein*, International Patent WO/02723 (1982).

9. M. Christmann. Calories reduced juices. Processing possibilities, dealcoholization of beverages. *Flüs Obstanbau*, 53, 396-402 (1986).

10. J.W. Aiken, A. Noble: Comparison of the aromas oak and glass-aged Cabernet Sauvignon wine, *Am J Enol Vitic* 35, 196-199 (1984).

11. M. Dekker: *Volatile Compounds in foods a beverages.* (1991).

12. D. Delteil: Caractères organoleptiques des vins rouges méditerranéens, *Vignevini* 10, 39-43 (1995).