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Physicochemical changes in Shiraz grapes dried in a controlled environment

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ABSTRACT

The dehydration of grapes to make wine, in controlled environment and with variance in temperature and humidity, began to be studied with greater emphasis recently for some grape varieties, due to the proven effects of the highest concentration of phenolic compounds and decreased the amount of water in the wort. Physiological standpoint of increasing the phenolic compounds is beneficial due to its antioxidant and anti inflammatory, and make an important role in the quality of wines. Postharvest dehydration in order to adequate levels of sugar, resulting in constant changes after harvest, note a positive development in the wine and grape flavor. The aim of this study was to evaluate postharvest changes in grapes after partial dehydration in a controlled environment. The grapes used were the kind of Shiraz, grown in the city of São João da Boa Vista, São Paulo, the drying process was adapted into a cold chamber for the drying process and a forced air tunnel to form a fixed bed flow of air perpendicular. To obtain the desired temperature is installed a set of finned RTDs nominal power of 2400 W, a system controlled by PWM (pulse width modulation). Treatments consisted of a control (initial condition) and the combination of dehydration temperature (37.1 C) and air velocity (1.79 ms-1). To analyze the final quality of the analyzed concentration of soluble solids (Brix) and concentration of phenolic compounds (gallic acid mg per 100 g of must). Statistical analysis was performed by applying an ANOVA followed by Tukey's test for comparison of means. The treatment cause a significant increase in the concentration of phenolic compounds, which indicates the effectiveness of the method and since the concentration of polyphenols is an indicator of quality wines and to produce this compound also has a great importance to health. The soluble solids were not different after dehydration (increase of 0.20 ° Brix), this may be due to the late harvest product causing potential is reached sugars. It can be concluded that there were physical and chemical changes in the product subjected to dehydration and they showed their beneficial from the point of view of winemaking.

Keywords: Wine, Postharvest, Dehydration, Control, Solids soluble, Shiraz, Brazil.

1. INTRODUCTION

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Dehydration of grapes for wine making, on the inside and with the variation of temperature and humidity, began to be studied with greater emphasis recently for some varieties tested due to the effects concentrations of phenolic compounds increasing and reducing the amount of water in wort. From the physiological standpoint increasing phenolic compounds is beneficial because of its anti-inflammatory and antioxidant properties and plays an important role in the quality of wines.

In order to play sugar, dehydration postharvest changes consistent results in post-harvest, thus obeying a positive development of the flavor of the wine and grape.

Studies of the effects of drying grapes for wine making, today is based not only on the biological stability of the product, but greatly increase the possibility of the concentration of chemicals in the bay, especially phenolic compounds, as well as reducing water must fermentation, thereby reducing energy costs for evaporation (Bellincontro et al., 2004; Constantini et al., 2006; Moreno et al., 2008).

With the advancement of science and technology, are proposing new methods of dehydration, the equipment development and drying systems. Methods other than spray drying, sublimation, vacuum or forced air, there is still osmotic dehydration method has been widely used in the transformation and processing of certain tropical fruits (El-aouar & Murr, 2003; Dionello et al., 2009).

The biochemical changes that occur in the grapes during wilting are induced by the endogenous metabolism of grapes results in modification of the quality of wine. However, drying at ambient conditions expense, time consuming and brought other problems such as contamination by fungi and bacteria. The study of the drying process at low temperatures (10, 15, 20 and 25°C) and relative humidity ranging from 53, 75 and 95% significantly reduces the time required for water evaporation, achieving higher concentrations of sugars , decreasing the risk of Botrytis cinerea, which affects the quality of wines.

Was shown to undergo dehydration grapes suffer significant changes in the concentration of sugars, which involve volatile compounds, phenolic compounds and enzyme activity, but is controlled way, these changes bring the final product quality (Lerma et. al., 2012; Rolle et al., 2012). However, there is the need to control the variables affecting the process of heat and mass transfer (temperature, flow, humidity) so that benefits are achieved both from a physiological point of view as food safety by eliminating the risk of fungal growth and thus pollution, for example, ocratoxin (Bellincontro et. al., 2004; Mencarelli et. al., 2006).

The objective of this research is identify physicochemical changes in Shiraz grape berries destined to winemaking subjected to partial drying in controlled environment.

2. MATERIAL AND METHODS

The experiment was conducted in the laboratory of thermodynamics and energy (LTE) and the laboratory of post-harvest technology (LTPC), both located in the Faculty of Agricultural Engineering of the State University of Campinas (FEAGRI - UNICAMP), Campinas -SP. Analyzed shiraz fruit grow grapes (Vitis vinifera L.) in the region of São João da Boa Vista, São Paulo, harvested in the month December 2012.

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Treatments consisted of a temperature and airflow (T: 37.1 ° Qar: 0.53 $m^3.s^{-1}$). The drying process consisted of a cooling chamber and forced air tunnel adapted for forming a fixed bed with a flow of air perpendicular to obtain temperature and the drying process is installed a set of resistance thermometers fins forming a 2400 W power controlled by a PWM system.
Were evaluated: Mass Loss (%) performs dynamic weighing of fruit during the drying process determined by a balance installed inside the drying chamber and recorded by monitoring software in compiled ® LABWIEW soluble solids (º Brix), using a handheld refractometer Atago, polyphenols expressed in mg.100 g^{-1} galic acid grape wort. The physico-chemical analysis were performed before and after drying.
Statistical analysis was performed by applying an ANOVA followed by Tukey's test for comparison of means, then used multivariate statistical analysis.
The method used was the method of principal component analysis (PCA) reduces the dimension of a multivariate data set using mathematical procedures (deterministic) and can determine the physical parameter that is influenced more by chemical partial dehydration.

3. RESULTS AND DISCUSSION

The results of the physico-chemical characterization in the grapes before and after application of treatments for soluble solids, expressed as a percentage of Brix and polyphenol content are shown in Table 1.

Table 1. Physico-chemical characterization and analysis of variance for the soluble solids concentration and polyphenol content in grapes.

Variable / Treatment	Polyphenols	Soluble Solids
Control	915.33 b	18.53 a
37.1ºC	938.00 a	18.76 a
Mean	926.66	18.64

* Means followed by the same letter do not differ in the level of confidence of 95% compared to baseline.

The range studied showed no significant increase in the SS is justifiable due to the product being harvested at their peak ripeness, thereby reducing the potential maximum concentration of this component in the product studied.
Also observed a significant increase in contraction of the polyphenols in the product due to the drying process can be explained both increases due to ripening, which involves during fruit ripening occurs thermal change accelerates metabolism causing fruit senescence and rapid changes in their physical and chemical characteristics - in the case of grapes, can also be seen as a technique used to manipulate the product is still in the field.
As reported and by Guerra Zanus (2003) is controlled ripening permanence of field groups still attached to the plant, so that the vapor pressure deficit on the surface of the

berries in connection with the addition of air to the effect of ambient temperature causes wilt berries, CSS and higher polyphenol content in the crust.
Phenolic content results ranged from 940.00 to 1167.33 mg.100 g^{-1} galic acid grape wort, the significant effect of the treatment is possibly associated with the fact that the temperature of interrupting or breaking the shell pectin molecules , which phenolic compounds present therein to be released (Vedana et al. 2008).
The following are the results of statistical analysis, carried out using a multivariate analysis of the main components, from the physicochemical parameters of the analyte, with the aim of analyzing the parameter is more important during the dehydration process (Figure 1).

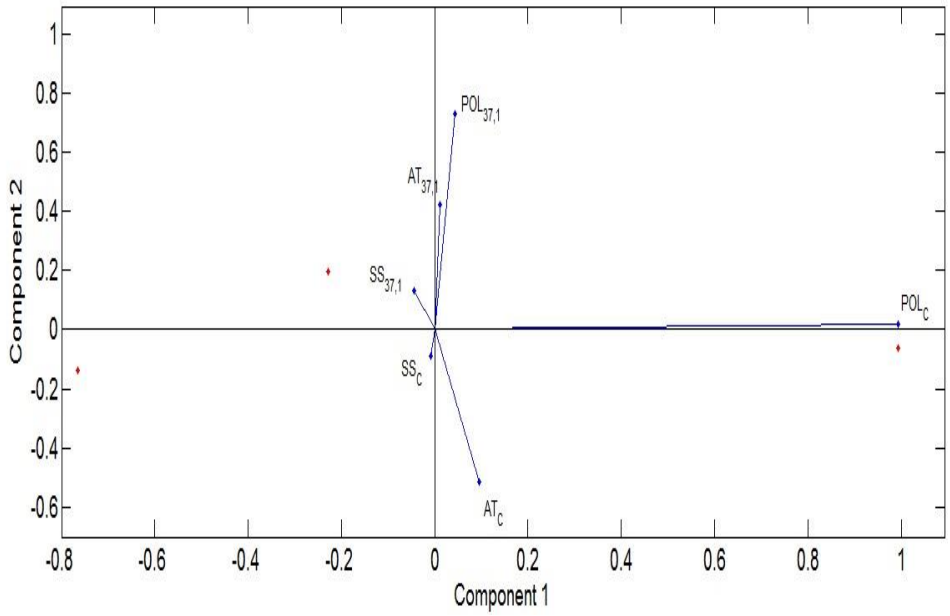

Figure 1: Relationship between principal component 1 and principal component 2 for physico-chemical variables (SS, phenolic compounds and acidity).

We note that the variables studied representing more physicochemical changes after dehydration is concentration of phenolic compound (POL37.1 ° C) with a correlation of 0.99 for changes after dehydration. This indicates the potential for dehydration use in controlled environments for processing wine grapes.
However, according to Hawk et al. (2007), grape skin anthocyanins are phenolic compounds which also have temperature that the main element to cause its degradation. The authors suggest that the processing temperature condition was standardized grape and maintain around 45 ° C is able to maintain the stability of anthocyanin without causing a reduction in phenolic content.
Although the use of higher temperatures provide an increased rate of heat and mass transfer, that is, less time for the product to lose the desired amount of water, the results

show that the drying is carried out under conditions health can be performed in a controlled temperature environment, the same results for changing physical chemistry and CSS polyphenol content when drying is carried out at high temperature.
The effects observed in this study are similar to those reported in the literature where the fruit research for demonstrating industrial processing after reducing the humidity of the product, which may further soluble solids value, higher concentration of stability chemical and microbiological (Azeredo and Jardine, 2006).

4. CONCLUSIONS

In all physicochemical parameters evaluated were the changes observed with a better parameter is phenolic compounds concentration which have a high health benefit, characterizing the efficiency of the drying temperature for dehydration Shiraz grape for processing.

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