

## USE OF MALT IN WINE PRODUCTION

## USO DE MALTE NA PRODUÇÃO DE VINHO

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### Abstract

*The use of dry malt extract was proposed in this study as nutritional complementation of the yeast in wine alcoholic fermentation, aiming for the creation of a new alcoholic beverage to be added to the market called “MalTED Wine”. Two kinds of grape wines were synthesized: The malted wine (consisting of grape pulp, water, dry malt extract and white sugar) and a regularly supplemented wine (consisting of grape pulp, water, white sugar and synthetic nutrients) for comparative purposes. The result was an acid, slightly salty and dry beverage. Its acceptance was higher than that of another commercial dry wine, attenuating the possibility of the acceptance of the beverage. Furthermore, its pH and alcoholic strength are in the acceptable range for consumption (3.50 and 12.6° GL, respectively) and its mineral content is 62.5% higher than that of the regular wine, having then a highly nutritive beverage. The addition of this beverage to the market of alcoholic beverages can mean a higher variety and profit in this branch of the market, and can also contribute for healthier diets.*

**Palavras-chave:** cevada; fermentação alcoólica; malte; vinho.

## 1 – Introduction

The global market of wines moves around US\$ 100 billion each year, starring the European Union as the main producer (FERREIRA, 2009). In the international scenery, the Brazilian viticulture occupied in 2007 the 17<sup>o</sup> place on area cultivated with grapes and the 19<sup>o</sup> place on production, according to the data from the Food and Agriculture Organization of the United States (FAO). In 2010, Brazil managed to export 10.18 million liters of table wine with the value of US\$ 5.30 million (MELLO, 2011).

Table wines, which represent about 80% of national wines, are prepared with American and hybrid grapes, of strong and fruity flavors, which are conquering their space in the market and represent growing perspectives (MELLO, 2002).

The preparing of the wine happens through a process of alcoholic fermentation, in which fungi are used, such as the *Saccharomyces cerevisiae*. During that process, the yeast needs a number of nutrients so it's able to synthesize the necessary enzymes for the alcoholic fermentation. Besides that, some salts are usually involved for this purpose, such as phosphorus, sulfur, copper, iron, potassium, zinc and sodium, and also some vitamins. Therefore, those nutrients have to be added to the must so that a better fermentation efficiency can be achieved (AQUARONE at al., 2001; FILHO, 2005).

According to White (2010) a must prepared with only malt contains in your composition most of the auxiliary nutrients for the yeast during the alcoholic fermentation. That way, there's the possibility of having diverse benefits on the usage of malt extract as nutritional complementation on the production of wines. One of the possible benefits is the substitution of synthetic nutrients, such as magnesium sulfate and ammonium phosphate, for the malt extract that, for being rich in nutrients, can result in a better productivity. Furthermore, due to the fact that the malt extract is highly nutritive, the aging of the wine will be more effective, since it will have a bigger concentration of free radicals in the must, which will be quelated by the tannins more efficiently.

On the same hand, part of the sugars present in the malt extract are complex sugars, promoting the decrease of the speed of the fermentation, since the yeast takes longer to break this kind of sugar. As a final result, the aroma of the wine will be more strongly preserved in comparison to the traditional fermentation of simple sugars, which includes high temperature rates and elevated concentration of CO<sub>2</sub>.

About the organoleptic properties, the malt confers peculiar flavors and aromas, promoting organoleptic properties to the malt added wine distinct from that of the standards commonly attributed to regular wines, which means the possibility of the creation of a new fermented beverage to be added to the market.

All in all, the present work is about the use of malt as a nutritional compliment in the production of wine, as well as the comparison of the properties of the obtained product with that of a wine of chemically supplemented must.

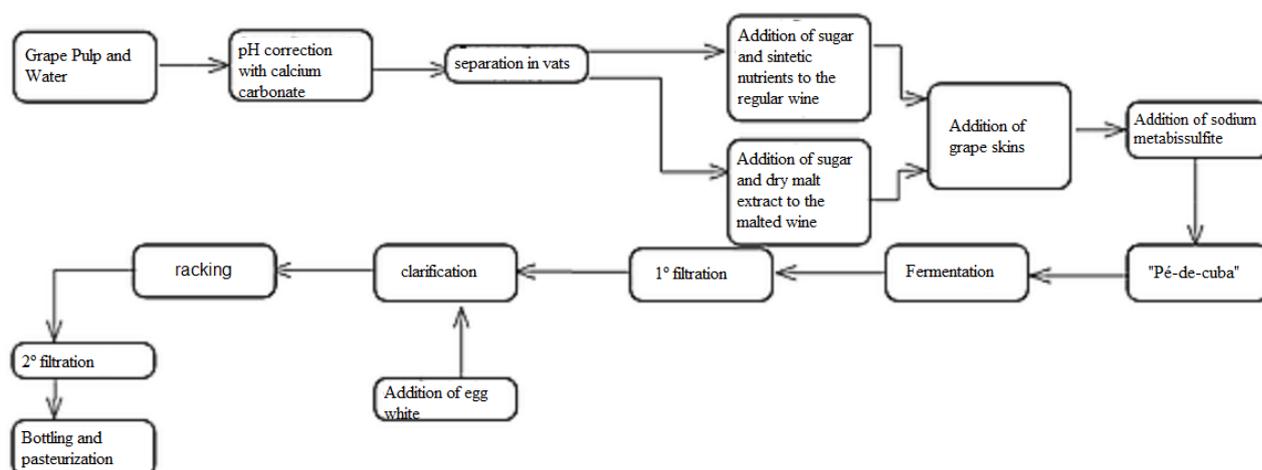
## **2 – Materials and methods**

The experiments embraced in this work were performed in the Biotechnological Processes Laboratory (LPB) in the Department of Chemical Engineering (DEQ) in the Center of Exact Sciences and Technology (CCET) of the Federal University of Sergipe (UFS).

### **2.1 – Development of the must**

The must utilized in the fermentative process was prepared with grape pulp and water on a 1:1 proportion and previously squashed grapes, totaling 10 L of must. The pH was corrected with calcium carbonate until the pH range of 4 to 5 was achieved. The initial °Brix of the must was 7. 0.2 g.L<sup>-1</sup> of sodium metabisulfite were added to the total volume of the must. After 24 hours, the volume of the must was divided into 2 glass vats of 5 L, one of them had 1.157 g of white sugar, 0.5 g of magnesium sulfate and 5 g of ammonium monophosphate added to the must (supplemented wine), and the other one had 570 g of white sugar and 863 g of dry malt extract added to it (malted wine), both vats achieved °Brix 25. The quantity of malt to be studied in the development of the wine was determined in a previous study. The steps done in the process of the development of the wines are shown on Figure 1.

Figure 1 - Stages of the elaboration of the supplemented wine and the malted wine



Source: own authorship (2014)

## 2.2 – Inoculation

The inoculation of the musts occurred with previously adapted *Saccharomyces cerevisiae* commercial yeast. The first flask contained 1.25 g of yeast in 250 mL of must. After 24h, the volume of the first flask was transferred to a second flask containing 500 mL of the must. After 24h, the second flask was then added to the main fermentation vat. The process of inoculation was done separately for each must.

## 2.3 – Fermentative process

The fermentation was studied through the analysis of °Brix, alcohol percentage (v/v) and biomass (mg/mL) of wine samples in regular amounts of time during the process. The determination of the °Brix was done with a refractometer of the brand Reichert, model R<sup>2</sup> mini, while the ethanol analyzes percentage were performed via the use of an ebulliometer of the brand Tech Vision. The biomass analyzes were performed through the centrifugation of 10 mL of the fermented and the resulting biomass was determined via difference of dry weight.

The fermentative process was finished when the variation of °Brix reached  $\leq 0.2$  values. After that, for the clarification of the fermented product, it was added 0.37 g of NaCl and 75 mL of egg white to it. After 24h, the solids decanted and the wines were siphoned, filtered with hydroponic cotton, bottled and pasteurized at 55°C during 30 minutes. Posteriorly, the wines were stored under refrigeration ( $8 \pm 3^0\text{C}$ ) for stabilization. The parameter of Productivity (P) was determined for the processes under study through the Equation (1), as proposed by Oliveira et al. (2011).

$$\text{Productivity} \left( \frac{\text{g}}{\text{L}} \cdot \text{h} \right) = \frac{Q_{\text{exp}}}{t} \times 100 (\%) \quad \text{Eq.1}$$

Where:

$Q_{\text{exp}}$  = Experimental concentration of ethanol;

$t$  = Fermentation time (h)

## 2.4 – Physicochemical analyzes

The physicochemical analyzes performed for the obtained final products, supplemented wine and malted wine, embraced fixed, volatile and total acidity, pH, °Brix, final alcoholic contents, reducing sugars and total reducing sugars, total solids, humidity and ashes. All physicochemical analyzes followed the methodologies described on “Manual de Métodos Físico-Químicos para Análise de Alimentos” from the Adolfo Lutz Institute, 2005.

## 2.5 – Sensory analysis

The malted wine was subjected to a sensory analysis together with a commercial table dry wine of the brand “Canção”. The sensory analysis was performed with fifty non-trained wine tasters, consisting of employees, public servers and students of the Federal University of Sergipe. Each taster received the commercial wine, the malted wine, crackers and mineral water. The samples were presented individually, coded with numbers of three algorithms and served to each taster together with the forms for evaluation. The utilized forms for the sensory analysis of the products were evaluated with items (appearance, aroma, viscosity, flavor and global impression) that consist of a hedonic scale of 9 points, starting with “I didn’t like it at all” (1) to “I liked it very much” (9). The products were also evaluated about the purchase intent, composed of a hedonic scale structured of 7 points: “I would always buy it” (7), “I would very frequently buy it” (6), “I would frequently buy it” (5), “I would occasionally buy it” (4), “I would rarely buy it” (3), “I would very rarely buy it” (2), “I would never buy it” (1).

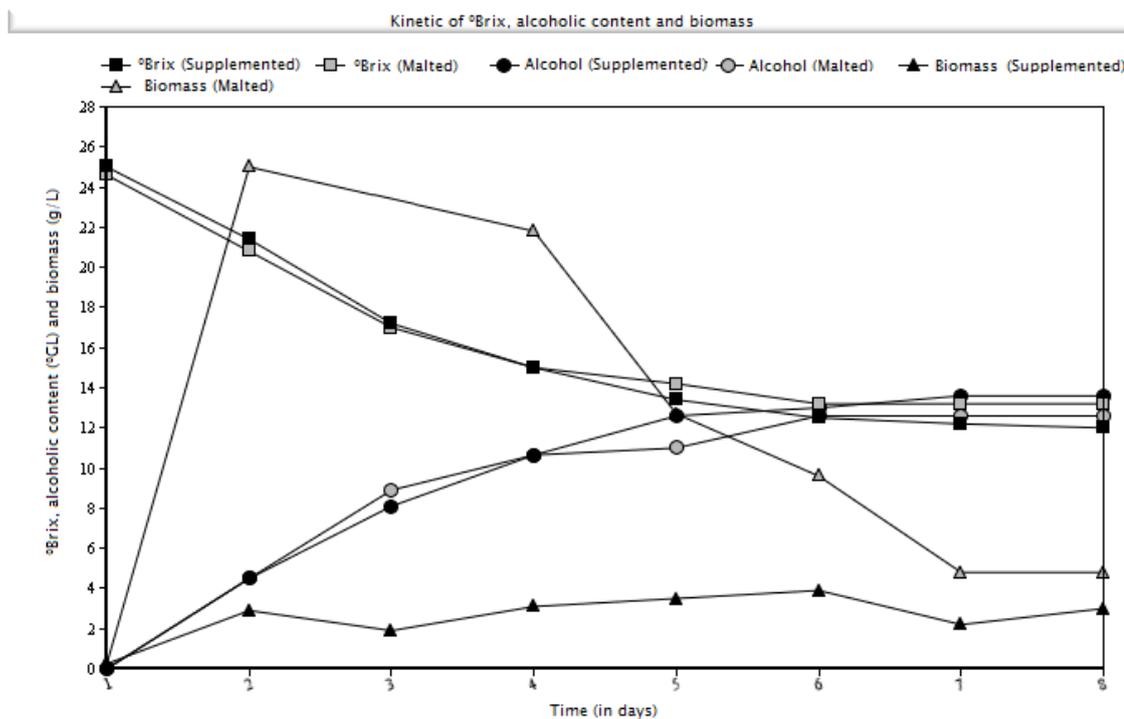
## 3 – Results

On Figure 2 are shown the obtained results for the measured parameters during the fermentation of the regular and malted wine. The data shows that the decay of the °Brix during the fermentation happens in a similar way for both wines, indicating that the nutritional complementation performed in the malted wine does not affect the development of the yeast and the

sugars are normally consumed. That can also be confirmed with the values obtained for biomass, where in the fermentative process of the malted wine the growing of the biomass was way stronger than that of the process of the regular wine.

Studies performed by Teramoto et al., 1993 show the use of malt in the production of rice wine, where the fermentative process showed itself as way more efficient with the presence of the barley malt. The barley malt strongly influences the composition of the must, since it provides to the yeast not only fermentable sugars, but also vitamins, complex sugars and lipids (COZZOLINO et al., 2014). The composition of the must, together with the conditions of the fermentation and the lineage of the yeast, not only affects the process of ethanol production, as well as the production of aromatic compounds, which will denote the quality of the final product (SAERENS et al., 2008).

Figure 2 - Kinetic parameters evaluated during the alcoholic fermentation of the supplemented and malted wine.



Source: own authorship (2014)

Despite the differences in the composition of the musts show different biomass values, the data obtained for ethanol are the same in both produced wines. Such values are verified through the Productivity of the supplemented and malted wine, which reached values of 51.81% or 0.51 g.L<sup>-1</sup>.h<sup>-1</sup>.

On Table 1 are shown the data obtained in the physicochemical analyzes with the two wines,

where, analyzing the different values on acidity, it's possible to verify that the malted wine is a more acidic product than the supplemented wine, even though the values of pH are alike for both products. The quantity of solids and ashes was greater in the malted wine due to the composition of the malt being richer in nutrients.

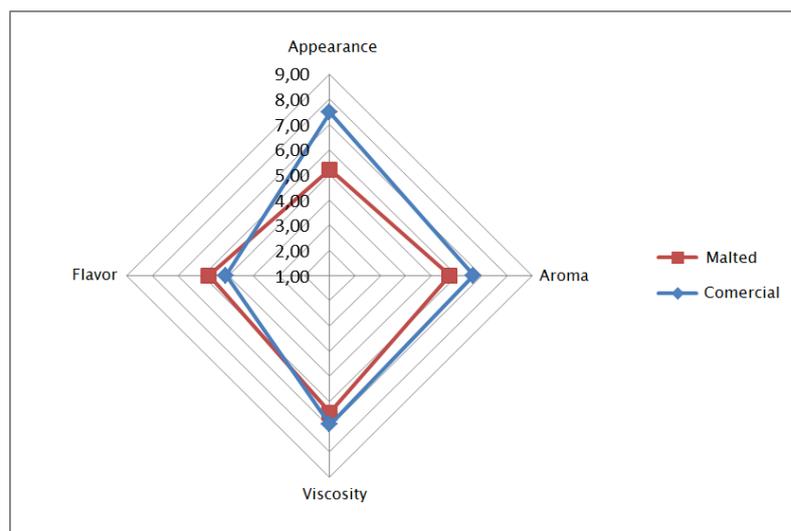
Even though the values of °Brix (Table 1) was rather close in both wines, the sensory analysis showed that the malted wine possesses a dry flavor and the supplemented one a soft and sweet flavor. The average values obtained in the sensory analysis (Figure 3) confirm that the flavor was the item with the best judgment for the malted wine, and the remaining items, such as appearance and aroma, need to be improved with some adjustments in the process. The purchase intent of the malted wine indicated that 22% of the analysts would buy the product and 32% would occasionally buy it, and only 18% declared that they would never buy the product. Therefore, the produced malted wine obtained an acceptance superior than 50%.

Table 1 – Results of the physicochemical analyzes of the supplemented and malted wines

<b>Physicochemical Parameters</b>	<b>Supplemented</b>	<b>Malted</b>
Total Acidity (mmol.L <sup>-1</sup> )	59.00	140.00
Fixed Acidity (mmol.L <sup>-1</sup> )	54.00	132.16
Volatile Acidity (mmol.L <sup>-1</sup> )	5.00	7.84
pH	3.61	3.50
°Brix	12.00	13.00
Alcoholic Content (°GL)	12.60	12.60
Reducing Sugars (g.L <sup>-1</sup> )	32.62	50.80
Total Reducing Sugars (g.L <sup>-1</sup> )	72.20	60.16
Total Solids (g.100mL <sup>-1</sup> )	7.63	9.91
Humidity (%)	92.37	90.09
Ashes (g.100mL <sup>-1</sup> )	0.16	0.26

Source: own authorship (2014)

Figure 3 - Results of the sensory analysis of the commercial and malted wine.



Source: own authorship (2014)

#### 4 – Conclusion

After the realization of the present work, it's possible to conclude that the malt is a compound that shows itself as a potential component in the nutritional complementation of musts for the production of a new fermented grape beverage, that possesses good acceptance and own sensory characteristics. With this, future studies are necessary to improve the fermentative process to better control the parameters that more directly affect the characteristics of appearance and aroma of the malted wine.

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