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KINETICS OF ALCOHOLIC FERMENTATION OF SAPODILLA JUICE

Matheus D.B. Albuquerque[1*], Ruth B. Rodrigues[1], Clóvis G. Silva[1] and Julice D. Lopes[1]

[1] Federal University of Paraíba, Department of Chemical Engineering

*Email: matheus_dbernardo@hotmail.com

ABSTRACT

Sapodilla is a fast-ripening and high-sugar fruit, which favors the acquisition of fermented products. The use of sapodilla in the production of fermented drinks is one of the ways to reduce post-harvest losses and increase its value. The aim of this research is to study the kinetics of the alcoholic fermentation of sapodilla juice; with different initial concentrations of soluble solids we have evaluated the effect of this variation in the final quality of the fermentation. The methodology used consisted on the analysis of the evolution and conversion of the substrate consumed (Measured in Brix) in formed product (ethanol), measured in °GL, during the conduct of the process as a function of the fermentation time. Fermentation was obtained with 5.9 – 7.5% of alcohol, showing the viability of fermented sapodilla production.

1. INTRODUCTION

The "sapotizeiro" (Manilkara zapota) is a fruitful specie of the family Sapotaceae. It is mainly cultivated for production of fruits consumed *in natura*. The peel of the fruits is thin, and its pulp is tender and very sweet, it also contains a gelatinous substance that gives it a singular smell (Silva Júnior et al., 2014).

The adaptation of the plant is good in the whole area of Brazil; in the Northeast, it was initially cultivated in the humid mountains, where the weather is quite favorable for the development and production of sapodilla. Subsequently, it expanded to other ecosystems (Banderia et al.,2005).

Sapodilla ripens fast, and one of the ways to reduce post-harvest losses is the production of a fermented beverage, considering that the fruit contains high soluble solid contents (Oliveira et al., 2011), which is an important factor to the production of a fermented drink with a good production. The objective of this research was to study the kinetics of the alcoholic fermentation of sapodilla juice to obtain a fermented beverage.

2. MATERIAL AND METHODS

2.1. Raw material

The material was acquired in the João Pessoa city's free market (Paraíba-Brazil) in an intermediate state of maturation and carried out directly to be processed in the laboratory. The fruits were submerged in a 4% hypochlorite sodium solution during 15 minutes, and thereafter rinsed under running water.

2.2. Juice extraction

The fruits were sliced, peeled and the seeds were removed and weighed, to make the juice extraction possible. To be able to obtain a broth, a hydraulic press system with capability of 30 tons and a manual activation was used (brand SKAY). Taking into account the characteristics of the material, yet to be extracted, cotton bags were used to cover the inside part of the cylinder. When extraction was in the end, the juice was filtered into the ideal fermentation conditions.

2.3. Fermentation

The fermentation process was conducted in three bioreactors that created a variation in the initial concentrations of substrate between 15, 17, 19 °Brix. The initial conditions were controlled around the substrate concentration, the fermentative agent concentration (*Saccharomyces cerevisiae*), the temperature (°C) and a volume of one liter in each bioreactor.

During the conduction of the kinetic process the following parameters were determined in each three hours: total soluble solids (°Brix) using a brix saccharimeter, pH using a pHmeter, total acidity for titration - following Silva (2009) methodology - and alcohol content (°GL) using an ebulliometer.

3. RESULTS AND DISCUSSION

The Figure 1 shows the variation of the substrate consumption relative to the ethanol production over the fermentation period of sapodilla juice.

It was verified that in the reactor III (RIII) the alcohol content of 5.9 was acquired in an inferior time (9 h) what could have been possible due an influence of the lowest initial substrate concentration (15 °Brix). On the other hand, in the reactors RI and RII, the alcohol content was 7.5 and 7.35 ° GL, respectively. It was observed that the best result was 7.5 °GL on RI, which had the biggest concentration of initial concentration (19 °Brix). This result was closer to the Patra's et al. (2016), which obtained fermented sapodilla with 7.33 °GL and it was lower than the one obtained by

Ranjitha et al. (2015), since they found alcohol contents in a percentage between 10.1 and 11.2% (v/v) on the fermentation process. It can be observed that the results are in accordance with Decree 6,871 of June 4, 2009 that establishes that the alcoholic degree of fermented fruit should be from 4 to 14% v/v (Brazil, 2009)

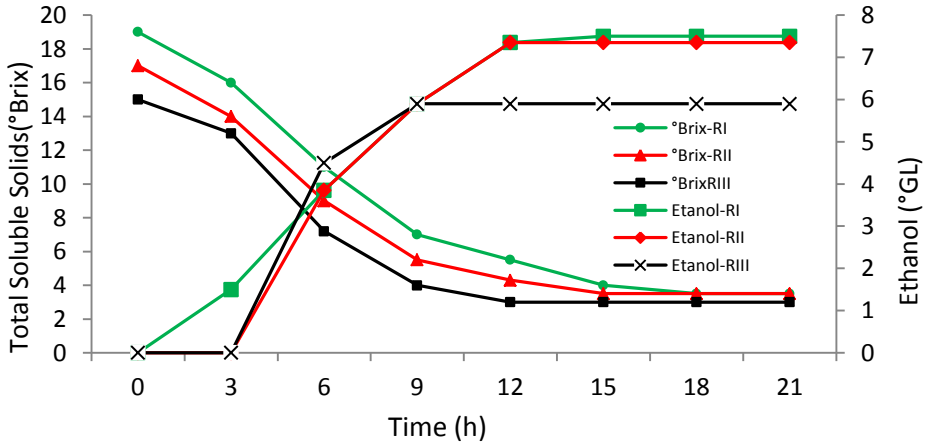

Figure 1: Effect of the substrate concentration variation on ethanol production of fermented sapodilla.

The Figure 2 shows the variation of pH and total acidity that happened during the sapodilla juice fermentation. It was observed that during the process of fermentation the pH has remained in the ideal value for fermentation, between 4 and 5.

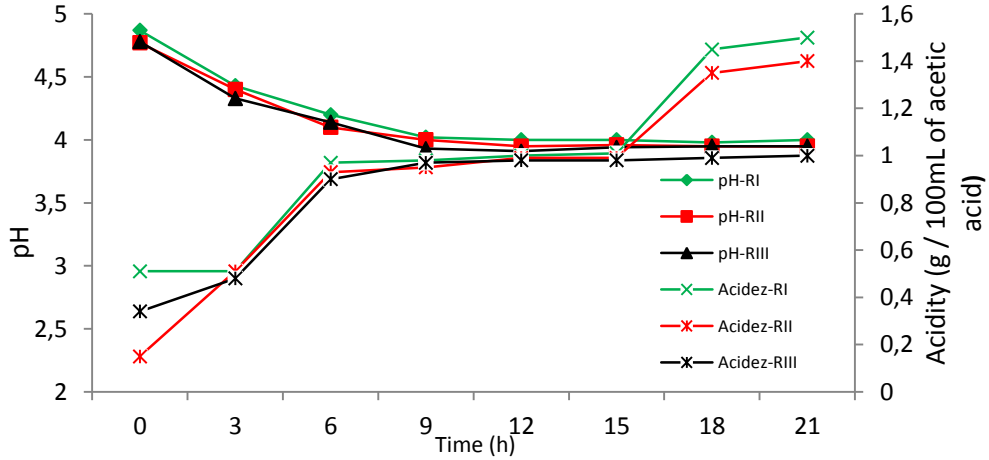

Figure 2: pH and total acidity variation during the fermentation process of sapodilla juice.

It can be noticed that the pH of the juice decreased during the fermentation process, which according to Torres Neto et al. (2006), indicates that the H^+ formation is associated with the microbial increase. The total sapodilla's fermentation acidity was stabilized between 6 and 15 hours with a small elevation in the end of the fermentation.

4. CONCLUSION

The analysis of the results of this study allows us to conclude that the sapodilla juice fermentation favored the acquirement of a fermented juice with good level of alcohol, and within the legislation's specifications for fermented fruits, considering that the alcoholic content of the fermented juice was proportional to the initial content of soluble solids of sapodilla juice.

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