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Use Of Different Drying Methods For The Preparation And Conservation Of Cassava Flour (Manihot Esculenta Crantz).

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ABSTRACT

Cassava (Manihot esculentacrantz), is a shrub cultivated for its edible root, has a high carbohydrate content, is characterized by being resistant to drought, pests and diseases, it can be harvested at various times of the year. The experimental material used in this work was cassava flour and a completely randomized design was applied in a 2x3x3 factorial arrangement with 3 replications. The functional analysis was based on a 5% Tukey test to compare averages of the treatments. At the sensory evaluation of the characteristics of cassava flour, the attributes were evaluated; As they were odor, color, flavor and texture, when comparing the treatments, the tasters selected as the best to T2 (A_1B_2), which corresponds to 6 hours of drying by 65°C. Physical chemical tests were performed on the finished product: pH, humidity, ash, starch, and the results of these analyzes were within the allowed parameters. In addition, microbiological tests were carried out on molds and yeasts, the results of which were within the allowed limits, and a shelf life of 90 days was determined.

Keywords: Drying methods, preparation, conservation, cassava flour

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INTRODUCTION

The cassava (Manihot esculentacrantz), is a shrub of the Euphorbiaceae family, cultivated for its edible root, it is also known as cassava, casaba or casabe, it has a high content of carbohydrates, it is characterized by being resistant to drought, pests and diseases, it is harvested at various times of the year and is used in the food industry (Sánchez et al., 2009).The Manihot esculenta, for its great production and multiple uses has become the basis of food for the rural population and an alternative marketing in urban centers as the roots are rich in starch and its leaves rich in protein. This tuber has many advantages for farmers, given that it grows on poor soils where growing other products is impossible (Aguilera, 2010). If despite the 10 thousand years that have elapsed since this tuber was domesticated have not yet proven all their benefits (Martínez et al., 2005).

Cassava is grown mainly in the tropical plains, in the outer foothills of the mountain range, the crops are located throughout the country. The largest percentage of cassava producers are small farmers with limited economic resources, becoming a subsistence crop in areas of 0.25 to 5.0 hectares (Zambrano-Acosta, 2016).Currently, the cultivation of the tuber has spread to about 90 tropical and subtropical countries, it is estimated that its roots feed around 5 million people, of the 203 million tons of fresh roots that are produced in the world, approximately 18% (37 million tons) are produced by Latin American countries(Ávalos, 2011).

Flour is one of the main products of the cassava, and its use is widespread throughout the country, forming part of the daily reflection of many consumers(INFOAGRO, 2008).

In the nutritional aspect, cassava flour is a food very rich in carbohydrates (85%), poor in fats and proteins, it contributes moderately, vitamins of group B (B2, B6), vitamin C, magnesium, potassium, Calcium and iron, in addition, is that since it does not contain gluten it is a suitable food for celiac. For the production of quality flour, the producer needs to observe the technical procedures for food processing, proper location of the processing unit, use of rigorous hygiene measures and technological quality equipment for processing and packaging(FAO, 2010).

Cassava has been transformed into flour to be used as a substitute for wheat flour, corn, rice, among others. In food formulations such as: bread, pasta, mix, etc. As you can also use cassava flour as a thickener and extender of dried soup, condiments, baby food. So that considering the previous thing, in the present investigation it was proposed as objective, to determine suitable drying times and temperatures for the conservation of cassava flour.

MATERIALS AND METHODS

The present research work was carried out in the artisanal production plant 5 of November, Las canton of the Naves, province of Bolivar (Ecuador).

Experiment management

For the transformation of cassava into flour, the following procedure was followed:

Reception and weighing of the raw material.

Selection. It consisted in the removal of roots in poor condition that could give a bad presentation or bad flavor to the finished product (cassava flour).

Washed. Remnants of dirt and sand were removed.

Bare. The bark was removed from the roots.

Chopped. With the use of a disk cutter, the slicing was carried out in homogeneous sizes.

Drying. The drying was carried out in a tray oven in order to reduce the humidity of the final product.

Grinding. The milling was done in an industrial disk mill (Arhur Fried, 300 mm Ecuador), which was fitted with a cloth filter to put the fine powder that results from the process.

Sieved. By using a 212 microns screen.

Finally, the flour was weighed, packed and stored in a place free of moisture.

The process in general was carried out by using two methodologies such as: take-off times (Factor A_1: 6 hours and Factor A_2: 8 hours) and drying temperatures (Factor B_1: 45°C and Factor B_2: 65°C), the combination of factors shown in table 1.

Tabla 1: Combination of study factors

Treatments	Combination	Description	
		Drying times	Drying temperatures
1	A_1B_1	6 hours	45°C
2	A_1B_2	6 hours	65°C
3	A_2B_1	8 hours	45°C
4	A_2B_2	8 hours	65°C

For the present investigation, a completely randomized design with a 2x2x3 factorial arrangement with three repetitions was applied.

Sensory analysis

With the help of 10 semi-trained tasters, the analysis was carried out, for which the following characteristics were considered for the product: odor, color, flavor and texture; giving it a quantitative qualification according to the established by Torresand Pacheco (2007).

Bromatological Analysis

Moisture and pH analysis were carried out according to the INEN-NTE 0518 standard; ash and density according to the INEN-NTE 520 standard and minimum starch according to the INEN-NTE 524 standard.

Microbiological analysis

The microbiological analyzes were according to the INEN-NTE 1529-5 standard (molds and yeasts).

Statistical analysis

The Tukey test at 5% was applied to compare the averages between treatments, for which statistical software Infostat was used.

RESULTS AND DISCUSSIONS

Sensory analysis

Odor. It is generated by a complex mixture of gases, vapors and dust, where the composition of the mixture influences the type of odor perceived by the receiver.

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Table 2: Comparison of means for the odor variable

Treatments	Factors	Media	Rank
T2	A_1B_2	3.47	A
T1	A_1B_1	3.27	A
T4	A_2B_2	3.27	A
T3	A_2B_1	3.20	A

Regarding the odor of cassava flour (Table 2), there was no significant difference between the treatments, in the process factors did not influence in studies. However, numerically, better acceptance I present the treatment T2 (A_1B_2) that corresponds (6 hours for 65°C drying) with a pleasant odor in relation to the other treatments.

Color. It is one of the sensory elements with more information and has an intense relationship with emotions and is a visual experience that human beings have in common. Color has a universal meaning associated with the experience of the observer.

Table 3: Comparison of means for the color variable

Treatments	Factors	Media	Rank
T2	A_1B_2	3.53	A
T4	A_2B_2	3.30	A
T1	A_1B_1	3.27	A
T3	A_2B_1	3.20	A

In relation to color (table 3), using the data obtained with the Tukey test at 5%, we can consider that there is no significant difference between the treatments. Although numerically the treatment T2 (A_1B_2) that corresponds to (6 hours 65°C drying) presented the best color.

Flavor. This characteristic is mainly due to chemical sensations detected by flavor (tongue) as well as by odor.

Table 4: Comparison of means for the flavor variable

Treatments	Factors	Media	Rank
T2	A_1B_2	3.47	A
T4	A_2B_2	3.43	A
T1	A_1B_1	3.17	A
T3	A_2B_1	3.13	A

In relation to flavor (table 4), by means of the data obtained with the Tukey test at 5%, it was observed that there was no significant difference in their levels because the treatments are the same. It is numerically appreciated that the best treatment is T2 (A_1B_2) (6 hours for 65°C drying), in addition, the tasters detected a salty flavor in the flour.

Texture. It is a property that is captured through the sense of touch the softness roughness and roughness.

Tabla 5: Comparison of means for the texture variable

Treatments	Factors	Media	Rank
T2	A_1B_2	3.60	A
T4	A_2B_2	3.43	A
T3	A_2B_1	3.23	B
T1	A_1B_1	3.20	B

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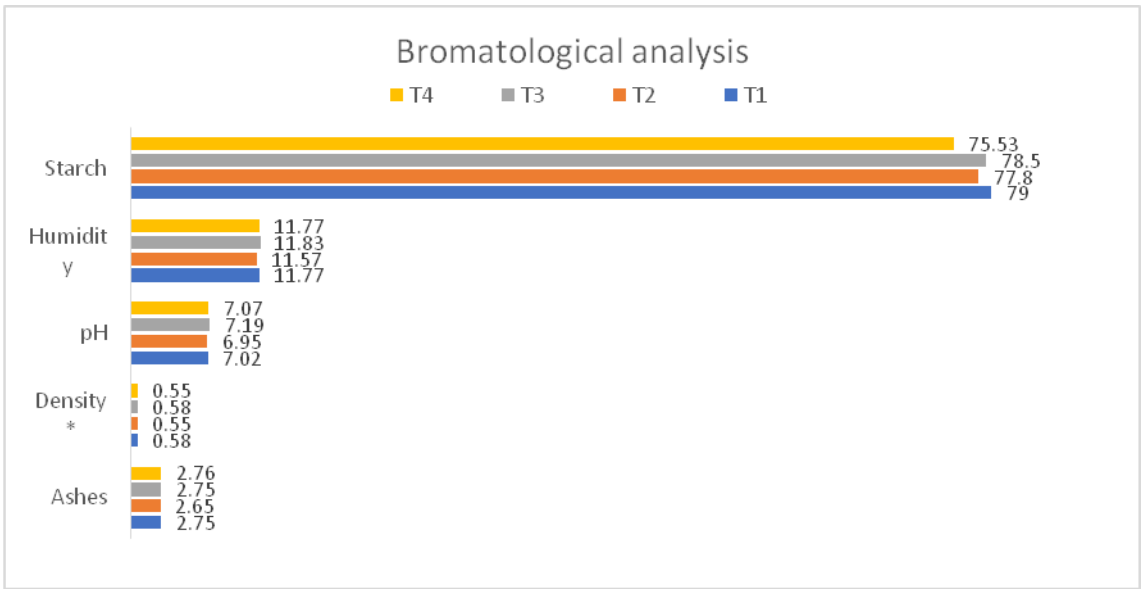
In relation to the texture of the elaboration and conservation of cassava flour, according to the results of the Tukey test at 5%, it was observed that there is a significant difference and two statistically different groups can be seen. The best treatment turned out to be T2 (A_1B_2) (6 hours at 65°C drying), the tasters, framed in a semi-fine state.

Bromatological Analysis



*, significant statistical difference

Figure 1: Bromatological analysis of the finished product

Using the data obtained with the Tukey test at 5% to compare the significance of factor A (drying time) and factor B (drying temperature), in the ash analysis was observed that there is no significant difference. When comparing these results with the INEN 520 standard, which determines that the maximum percentage of ash is 3.5, this means that the results obtained were within the permitted range. In relation to the density of the finished product it was observed that there is no significant difference in the drying time, but in the temperature levels if a highly significant difference was found. In pH it was possible to appreciate that the treatment T2 (A_1B_2) that corresponds to 6 hours of drying at 65°C, this had a lower value of pH, which is why it is the most advisable and is within the permitted range. In the moisture results, it can be seen that the treatment T2 (A_1B_2) is the best, comparing with INEN 518 standards (maximum humidity of the flour is 14.5), therefore, the graph indicates that it has percentages that are within the allowed range. With regard to starch content and comparing with the INEN 524 standard that suggests that the more percentage serves as the main constituent of food, therefore, the T1 (A_1B_1) corresponds to (6 hours at 45°C) was cataloged as the best.

Microbiological analysis

In the microbiological analyzes, the results obtained are within the parameters allowed by the standard (INEN 529) which indicates that it must have $5X10^2$ minimum and maximum $5X10^3$ CFU, in the product it obtained values of molds of 200 CFU and of yeasts of 1800UFC,determining a conservation time of up to 90 days.

GRATITUDE

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