69 - STUDY OF THE PHYSICO-CHEMICAL PROPERTIES OF SACCHARINE SORGHUM MOLASSES (SORGHUM BICOLOR L. MOENCH)

MARIA DO SOCORRO ROCHA MELO PEIXOTO[1]
DANIELE IDALINO JANEBRO[2]
SAMARA ALCÂNTARA COSTA[2]
ALUÍSIO DE MOURA FERREIRA[2]
VERA LÚCIA ANTUNES DE LIMA[3]
1. Universidade Estadual da Paraíba,
2. Faculdade Maurício de Nassau
3. Universidade Federal de Campina
1. e.mail:Socorrorocha.1@hotmail.com

INTRODUCTION

Sorghum (Sorghum bicolor L. Moench) was probably "domesticated" in Ethiopia, about 5,000 years ago and then was grown in West Africa, from Sudan to the Niger River. It is a relatively new culture in America, having been introduced in the U.S. in 1857 (RIBAS, 2006, DUARTE,2008).

In Brazil, its introduction is attributed to the slaves, where the culture became known as the corn of Angola. Although an ancient culture, it was only in the late nineteenth century that showed significance among the cereals, becoming the world's fifth in acreage after wheat, maize, rice and barley (LIMA, 1981; RIBAS, 2006).

In the Northeast the sorghum was introduced by the Agronomic Research Institute of Pernambuco in the twentieth century. Their culture is highly adaptable to regions of low rainfall, adverse soil and climate of large varieties, for example the semi-arid of Northeast in Brazil. This variety of sorghum has high levels of carbohydrates and minerals in the juice of the stem (FONTES et al., 2011).

Given these assumptions the study aimed to investigate the physico-chemical by-product of sweet sorghum in the form of molasses as an alternative nutritional supplement.

METHODOLOGY

The sorghum was botanical product of vegetal origin tested (Sorghum bicolor L. Moench) variety of IPA 467-4-2, registered at the Ministry of Agriculture, Livestock and Food Supply under No. 01325 on 30/09/1998.

The seeds planting was done in 01 hectare area located in the Catolé Community of Jose Ferreira - Campina Grande PB. After 110 days of planting, we measured an area of 5 x 20 m, and removed 15 sheaves of sorghum plant, where they were separated 200 samples for any weighing of their panicles and separation of the stem for analysis º Brix, which reached around 17 %, confirming the full maturity of sorghum. Then we proceeded to withdrawal the entire production of sorghum, separating the straw from the stem. The stem were sent to the cane sugar mill "Vaca Brava" in Areia-PB for the production of molasses, which was the subject of this study.

The same was submitted to the following analysis: humidity content, ash, pH, free acidity, Hydroxymethylfurfural, diastase activity, total soluble solids and insoluble solids established using the methodology described by the Adolfo Lutz Institute (BRAZIL, 2005).

RESULTS AND DISCUSSION

The analyses of physical-chemical and honeys and honeydew aimed to compare the results obtained with standards dictated by official international agencies, or with established by the original country, making it clear not only a concern for product quality but also in determining of their nutritional properties (MARCHINI, 2001). Although the legislation is not directly valid for molasses, it fits perfectly in this situation.

The results obtained in the physical-chemical analysis in the sample of sorghum molasses are shown in Table 1.

TABLE 1: Physical and chemical characterization saccharine sorghum molasses (IPA 467-4-2).

Determinação	Teor
Umidade e Voláteis (g/100g)	15,4 (0,0) a
Cinzas (g/100g)	11,1 (0,2) a
pH	5,3 (0,0) a
Acidez livre (meq/Kg)	165 (4,4) a
Hidroximetilfurfural (mg/100g)	0,6 (0,0) a
Atividade diastásica	13,9 Tabela GOTHE
Sólidos solúveis totais (g/100g) (ºBrix)	81 (0,0) a
Sólidos insolúveis em H_2O	0,45 (0,0) a

a - Média e estimativa de desvio padrão.
Obs.: Médias seguidas pela mesma letra não diferem estatisticamente pelo teste de Tukey, a 5% de probabilidade

Analyzing the data in Table 1, in relation to the humidity content found in the molasses in the study was 15.4%, where we can infer that the values are in agreement with current legislation, since it sets the value for this variable of 20% or 20g/100g product (BRAZIL, 2000, BERA, 2010), for value above the acceptable level can lead to fermentation caused by the action of microorganisms that grow easily with high humidity (LANARA, 1981, SCHWEITZER, 2001). In a recent study conducted by Fontes et al. (2011) with molasses produced with the same variety of sorghum (IPA467-4-2) was obtained with a humidity content of 24.32%.

Higher values were detected by Arruda (2003) that analyzing honeys from the Chapada do Araripe in Ceará, found in an average humidity content of 15.74%, alternating from 14.97 to 17.23%. Almeida (2002) researching honeys produced in Cerrado areas (tropical savanas) in the city of Pirassununga - São Paulo, recorded a variation from 16.6 to 20.8% with an average of 18.01%. Rodrigues et al. (2002) and Silva et al. (2002) obtained 18.76% humidity in honeys in the region of the Brejo (marsh) in Paraiba State, Costa et al (2000) found values of 20.8 in sugar cane molasses.

According Finizola (2007) and Bera (2010), the humidity in honey is variable, as well as other constituents, being influenced by humidity and environmental conditions. The ash contents also called solid mineral residue, shown in Table 1, estimates the gross amount and / or mineral wealth of the sample analyzed. The sample of sorghum molasses had a relatively high, with 11.1% compared to value allowed by Brazilian law which is 1.2% (BRAZIL, 2000), however, this value is similar to other works such as performed by Fontes et al. (2011) found that 7.35% of ash in molasses of the same variety, according with them, molasses has a higher mineral content in relation to honey. Costa et al. (2000) determined an ash content of 8.5% in sugar cane molasses.

The dark color of molasses due to the presence of minerals that directly influence the flavor, aroma and color of honey, are present in higher concentrations in dark honeys, compared with the light honey. Have been identified in honey numerous chemical elements: K, Na, Ca, Mg, Mn, Ti, Co, Mo, Fe, Cu, Li, Ni, Pb, Sn, Zn, O, Ba, Ga, Bi, Ag, Au ,, Zn (BERA 2010), among these, potassium is the element that is in greater quantities in honey, nearly 1 / 3 of the ash, and sodium reaches 1 / 10 maximum (SODRÉ, 2000).

The searches about mineral in honey have shown quite variable level depending on botanical origin and soil (SODRÉ, 2000). Feller et al. (1989), analyzing honey from Canada, found that light honey-colored has fewer minerals. The darker colored honeys, ranging from amber to dark amber, tend to have higher amounts of minerals, second Finola (2007) and Costa et al. (2000).

Several researchers in determining ash content in honey, obtained values varied as Marchini (2001) who studied the ash content in honey from different cities of São Paulo found values of 0.24 and 0.16% for flower honeys eucalyptus and wild, respectively. Sodré (2000) studied honeys on the north coast of Bahia obtained ash contents ranging from 0.09 to 0.67%.

The acidity and pH in honeys are two parameters that contribute to the strength of honey to the damage caused by microorganisms. A higher acidity enhances the flavor and influence in the formation of color, but on the other hand, can encourage the growth of yeast to be more resistant to acidity. The product analyzed in this study had an acidity of 165 mEq / kg of molasses and pH 5.3 (Table 1). As for the evaluated parameters we can infer that the molasses had to be above the desired range, because the legislation establishes a maximum value of 50 meq / kg and a pH greater than 4.5 for honey molasses (BRAZIL, 2000).

The acidity and pH values above the desired range may be justified due to the high content of minerals (11.15%) found in the product studied, because according to Finola et al. (2007) found a directly proportional relationship between the free acidity and ash content of honey. These authors explained this relationship whereas a higher mineral content corresponds to a greater fraction of acidic saline in the product. These results were consistent with some studies described in the literature as the Font et al. (2011) where they found abnormal values of minerals and pH on sorghum molasses the same variety used in this study, with values ranging from 7.39% to 5.4%. Similar changes were found by Finola (2007) in São Paulo, which produced mean values of free acidity in honey ranging from 12.5 meq / kg to 75.5.

Also shown in Table 1 the average values of hydroxymethylfurfural (HMF) of sorghum molasses. The average HMF obtained in the experiment was 0.6 mg / kg. According to current legislation (BRAZIL, 2000) establishes a maximum of 60 mg HMF / kg honey. From the data of the legislation, we can infer that the product is within the standard of quality required. Veríssimo (1988) says that the HMF is an indicator of quality in the honey, since, when elevated, indicates a significant decrease in its nutritive value, the destruction by heating of some vitamins and enzymes that are thermolabiles.

The HMF values found in this study corroborate with the findings of Souza et al. (2004) who studied the physicochemical characteristics of honey samples of Melipona asilvai, from semi-arid region of Bahia State, found mean values of HMF of 2.44 mg / kg with a range of 0.52 to 7.93 mg / kg.

In Table 1, compared to the average diastase activity, was found a value of 13.9 DN (05 in Gothe scale). According to current legislation established by the MAPA (BRAZIL, 2000) the minimum value of diastase activity in honey is 8 DN. The honeys with low enzyme content must be at least 03 diastase activity corresponding to the scale of Gothe, always that hydroxymethylfurfural content does not exceed 15mg/kg. With these results we can conclude that the sorghum molasses is in accordance with the standards of purity. In similar studies conducted by Bianchi (1989), who studied wild honeys, found an average diastase activity of 17.65 DN. and Melo (2002), analyzing the blossom honeys of Baraúna found values similar to those found in this study of DN 13.27.

Table 1 shows that the total soluble solids Brix) analyzed in sorghum molasses (81mg/100g) are in accordance with the legislation for molasses, establishing a content of 65 to 75% ºBrix. Similar values were found by Silva (2001) who studied honeys piauienses observed an average of 78.70%. Melo (2002) found average values of 81.63% for blossom honeys Baraúna. The Brix indicates the amount in grams of solids that are dissolved in water, exists in a food, however, the value will vary with the cooking temperature, type of material and time of maturation (BERA, 2010). According to current legislation in Brazil and abroad, no longer requires this determination in quality control of honey table like flowers honey or honeydew (BERA, 2010).

It's shown in Table 1, the content of insoluble solids in water, where the average was 0.45% detectable. According to current legislation established by the Ministry of Agriculture, Livestock and Supply (BRAZIL, 2000), the maximum allowable insoluble solids in water on honey is up 0.5%. We can infer that the molasses has good quality with regard to purity and it can be used safely by consumers. These results corroborate the findings of Silva (2001) found that the mean percentage of insoluble solids in honey from Piaui State, a variation from 0.06 to 0.09%. In a similar study carried out by Melo (2002) analyzed honeys from wild blossom and blossom of Baraúna found average initial insoluble solids in water to the honey stored in Paraiba 0.08% and 0.06% respectively.

CONCLUSION

According to Brazilian law and Mercosur for honey and molasses, physico-chemical parameters of Sorghum bicolor molasses obtained in this study were within the established standards, except for ash content, pH and acidity that have values that do not fit with current legislation, since the compounds of molasses and syrup are different products of honey legislation requiring appropriate to their characteristics.

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Endereço: Manoel Elias de Araújo, 453
Bairro: Jardim Tavares
Campina Grande-PB CEP: 58402022
socorrorocha.1@hotmail.com

STUDY OF THE PHYSICO-CHEMICAL PROPERTIES OF SACCHARINE SORGHUM MOLASSES (SORGHUM BICOLOR L. MOENCH)

ABSTRACT

Due to the population growth not to be accompanied by the increase of the arable areas, seeks be cultivated that adapt better to certain areas and this way as the sorghum is a cereal of short maturation period whose culture is from high adaptability to the areas of low precipitations of rains, adverse soils and of great climatic varieties, such as the semi-arid Northeast, this study aimed to characterize the physico-chemical byproduct of sorghum (sorghum bicolor L. Moench) variety 467-4-2 IPA in the form of molasses. The molasses was obtained from the juice of sorghum stem and showed humidity content 15.4%, ashes 11.1%, with pH of 5.3, free acidity of 165 mEq / kg, hydroxymethylfurfural 0.6 mg/100g, diastasic activity equivalent to 13.9 in Table GOTHE, soluble solids 81g/100g and insoluble solids 0.45. The molasses was within the norms proposed by the legislation, except the ashes content, pH and acidity.

KEYWORDS: sorghum, molasses, physicochemical characterization.

ETUDE DES PROPRIÉTÉS PHYSICO-CHIMIQUES DU SORGHO COLLANTE SACCHARINE (SORGHUM BICOLOR L. MOENCH)

SOMMAIRE

En raison de la croissance démographique n'est pas accompagnée par un accrue des terres cultivées la demand est des cultivars qui sont mieux adaptées à certaines régions et de cette manière le sorgho est une céréales de courte période de maturation dont la culture est très adaptable à des régions de faible pluviosité, de sol défavorables et de grandes variétés météorologiques, telles que le nord-Est semi-aride, cette étude visait à caractériser les propriétés physico-chimiques du sous-produit du sorgho (Sorghum bicolor L. Moench) variété IPA 467-4-2 sous la forme de mélasse. La mélasse a été obtenue à partir du jus du culm du sorgho et présenté un teneur en humidité de 15,4%, 11,1% de cendres, avec un pH de 5,3, l'acidité de 165 mEq / kg, 0,6 mg/100g hydroxyméthylfurfural, activité diastasique équivalente à 13,9 dans le tableau GOTHE, solides solubles 81g/100g et solides insolubles 0,45. La mélasse a été dans les règles proposées par la législation, à l'exception de la teneur en cendres, le pH et l'acidité.

MOTS-CLÉS: le sorgho, la mélasse, la caractérisation physico-chimique.

ESTUDO DAS PHYSICO-CHEMICAL CHARACTERISTICS DO SACCHARINE SORGHUM MOLASSES DO (SORGHUM BICOLOR L. MOENCH)

RESUMEN

Debido al crecimiento de la población no va acompañado de una mayor demanda de tierras de cultivo son los cultivares que se adaptan mejor a determinadas regiones y de esta manera el grano de sorgo es un período de maduración corto, cuya cultura es muy adaptable a regiones de baja precipitación, el suelo condiciones climáticas adversas y las grandes variedades, como el semiárido nordestino este estudio tuvo como objetivo caracterizar el subproducto físico-químicas de sorgo (Sorghum bicolor L. Moench) variedad 467-4-2 IPA en forma de melaza. La melaza se obtiene del jugo de contenido de humedad del tallo y el sorgo mostró un 15,4%, 11,1% de cenizas, con un pH de 5,3, la acidez de 165 mEq / kg, 0,6 mg por cada 100g de hidroximetilfurfural, actividad equivalente a 13,9 diastásico en la tabla GOTHE, sólidos solubles y sólidos insolubles 81g/100g 0,45. La melaza estaba dentro de las normas propuestas por la legislación, salvo el contenido en cenizas, pH y acidez.

PALABRAS CLAVE: sorgo, melaza, caracterización físico-química.

ESTUDO DAS CARACTERÍSTICAS FÍSICO-QUÍMICAS DO MELADO DO SORGO GRANÍFERO SACARINO (SORGHUM BICOLOR L. MOENCH)

RESUMO

Devido ao crescimento populacional não ser acompanhado pelo aumento das áreas cultiváveis procura-se cultivares que se adaptem melhor a determinadas regiões e desta forma como o sorgo é um cereal de curto período de maturação cuja cultura é de alta adaptabilidade às regiões de baixas precipitações, solos adversos e de grandes variedades climáticas, como por exemplo, o Semi-árido Nordestino este trabalho objetivou a caracterização físico-química do subproduto do sorgo (Sorghum bicolor L. Moench) variedade IPA 467-4-2 em forma de melado. O melado foi obtido a partir do caldo do colmo do sorgo e apresentou teor umidade 15,4%, 11,1% de cinzas, com pH de 5,3, acidez livre de 165 meq/Kg, hidroximetilfurfural 0,6mg/100g, atividade diastásica equivalente a 13,9 na Tabela GOTHE, sólidos solúveis totais 81g/100g e sólidos insolúveis 0,45. O melado apresentou-se dentro das normas propostas pela legislação, exceto o teor de cinzas, pH e acidez.

PALAVRAS-CHAVE: sorgo, melado, caracterização físico-química.