COMPARISON OF CAROTENOIDS OBTAINED FROM THE BAGASSE OF PEDUNCLE CASHEW BY ENZYMATIC RETTING, AQUEOUS AND ALCOHOL EXTRACTION

ABSTRACT - The stalk of the cashew pomace is rich in carotenoid compounds, which have high added value due to their coloring and their antioxidant power. The aim of this study was to evaluate the extraction efficiency of compound yellow carotenoids, through instrumental color, extract of cashew stem obtained by macerating enzyme by aqueous extraction and alcohol. The extracts were obtained by three cycles of pressing / dilution in aqueous solution, with or without addition of enzymes, and alcohol. We studied the physico-chemical properties of pH, soluble solids and instrumental color. It was observed that the highest levels of instrumental color parameter b were obtained in the extracts in ethanol, followed by extracts with addition of pectinolytic enzyme preparation, indicating that there was a gain of carotenoids in relation to water extracts in three pressings in both experiments.

Keywords: enzymes; Agro-industrial residues; cashew; pectinolític.

INTRODUCTION

The bagasse, a byproduct of the process of obtaining the cashew juice, represents about 25% to 30% by weight of the stem, usually discarded or used to produce flour for animal feed (LEITE, 1994). Such a fate for the bagasse can be considered a waste, since this byproduct of the cashew industry is a source of polyphenols and carotenoids, compounds with high added value in terms of their functional properties in food, beyond the power of the dye carotenoids (ABREU , 2001).

The appearance of a food contributes greatly to its acceptability for this reason the color is one of the main attributes of foods, both natural and processed them, making them visually pleasing and attractive. The color of food results in the presence of colored compounds existing in the natural product (natural pigments), or the addition of synthetic dyes (E BOBBIO BOBBIO, 2003). However, synthetic dyes have been questioned by certain segments of the population, and this trend, coupled with the continuous and adverse publicity has increased the interest in natural dyes (Araujo, 2004).

The extraction of pigments from plant tissues, usually occurs with the use of organic solvents. However, the fact that many solvents emit greenhouse gases and / or carcinogenic motivated to conduct research for the replacement of solvents during the acquisition of plant pigments for cleaner processes that do not promote environmentally and health damage (ROSENTHAL, PYLE & NIRAJAN, 1996). The use of enzymes with mixed activities (cellulases, hemicellulases and pectinases, mainly), hydrolyze the structural polysaccharides

of cell walls of tissues, favoring the release of its contents including the carotenoid pigments (DOMINGUEZ, NÚÑEZ & Lema, 1994); (DELGADO -VARGAS, WALLS & JIMÉNEZ LÓPEZ, 2000).

The aim of this study was to evaluate the extraction efficiency of compound yellow carotenoids, through instrumental color, extract of cashew stem obtained by macerating enzyme by aqueous extraction and alcohol.

MATERIALS AND METHODS

Raw material: the cashew bagasse was kindly provided by industry-Jandaia Juices of Brazil, located in Wormleysburg, state of Ceará. The bagasse was stored in polyethylene bags in a freezer in the pilot plant Embrapa Tropical at a temperature of -18°C until processing.

Obtaining the extract of cashew bagasse: Three experiments were conducted to obtain the extract from the stalk of the cashew pomace. In the first experiment, mingled with four kilograms of bagasse with four pounds of water and homogenized manually. In the second experiment was mixed four pounds of mulch to four pounds of ethanol solution 70% - HCl (1.5 N) and the third experiment, mingled with four kilograms of bagasse to four kilograms of water and added to 500 ppm (part of million) of pectinolytic enzyme complex, thus all experiments were conducted in a 1:1 ratio (weight of mulch: net weight of the mixture). The mixtures were homogenized manually and kept in water bath for an hour for a better action of pectinolytic enzyme complex in the case of enzyme extract added. Getting the cashew pomace extract was performed according to methodology described by Abreu (2001). The method basically comprises the following steps: (a) wetting the mulch with water or ethanol solution acidified with a 1:1 (weight / weight), (b) pressing the wet pulp in press EXPELLER the type manufactured by CEIL with a strength of 804.61 N (Newtons), (c) repetition of steps (a) and (b) with the pressing of the bagasse humidification before. Three passes were performed and the prey was obtained in this way, three extracts (Figure 01).

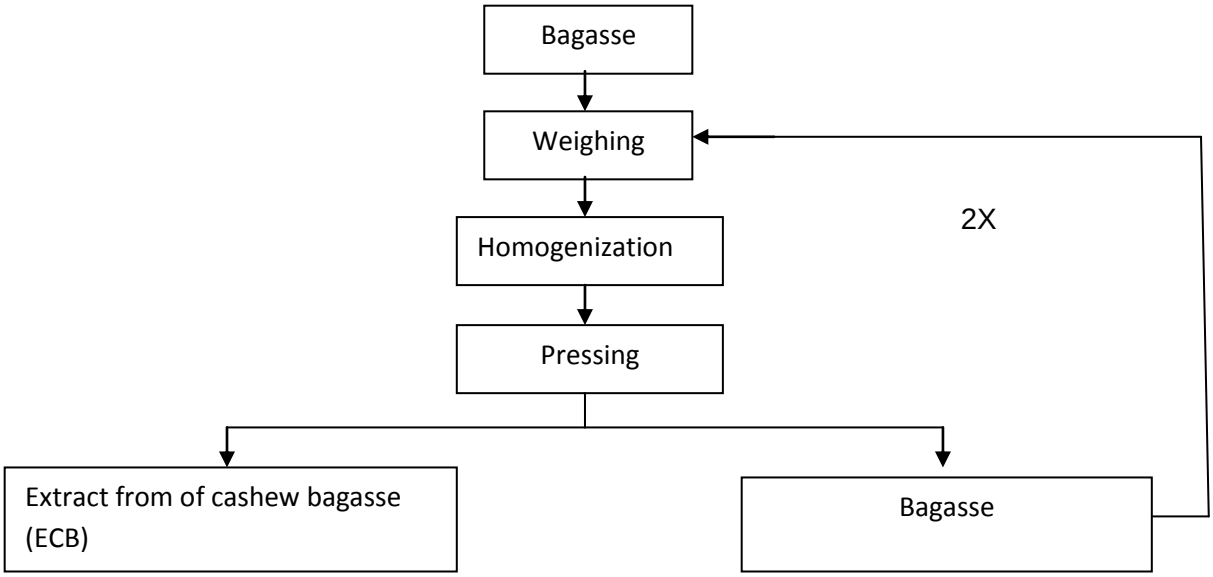


Figure 01- Fluxogram of obtention of extraction of cashew bagasse.

Determination of compression applied by the spring: The compression of the spring was measured by compressing the spring is in intervals of 10 mm and measuring their strength (N) in a Universal Testing Equipment and Instron model 8802. The initial length of the spring at rest was 242.45 mm.

Enzymatic treatment of pomace extract the stem of the cashew: to obtain the pigment extracted enzyme, we repeated the procedure for obtaining the cashew pomace extract with a concentration of 500 ppm of the enzyme complex pectinolytic added before the first pressing and maintenance on a water bath.

Analysis: Analyses were performed in duplicate. The pH and soluble solids were determined by the Standards Institute INSTITUTO ADOLFO LUTZ (1985). The instrumental color analysis were performed with a colorimeter MINOLTA CR-300. The system CIELAB (Commission International d'Eclairage), enables the measurement of instrumental color through the color parameters: L *= lightness (0 = black and 100 = white), a * (-80 = green to zero, zero to + 100 = red) and b * (blue = -100 to zero and zero to +70 = yellow) (Modesto et al, 2005).

RESULTS AND DISCUSSION

The force applied in the spring showed a linear behavior as a function of distance from the compression of 80 mm, which can be seen in equation 1, since then the performance became non linear. In this work we used 21.7 mm of spring deflection, resulting in 804 N of

applied force (table 01).

Table 1: Correlation between the distance of compression spring used with the force exerted on the system of press expeller.

CHARACTERISTIC	**VALUES**									
Compression (mm)	10	20	30	40	50	60	70	80	90	100
Force (N)	361	739	1123	1512	1902	2298	2695	3159	3824	4608

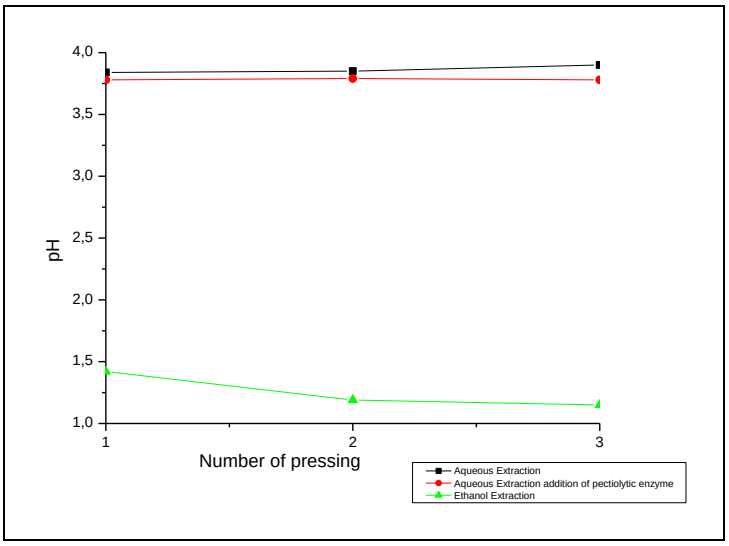
Force = (44.811 * Distance) - 242.45 Eq. 1

Equation 1 - Equation relating the strength of N applied in spring and compression in mm.

The maintenance of constant force spring for all experiments contributes to the tearing of the cell wall fiber cashew, facilitating the expulsion of the carotenoid components that were inside the chromoplasts fiber.

Figure 02 shows the results of pH values of extracts in aqueous solution with and without enzymes, and alcoholic extract:

Figure 02 - Graph of pH of the extract of the stalk of the cashew bagasse obtained by soaking in aqueous solution with addition of pectinolytic enzyme complex and solution ethanol - HCl (1.5 N).



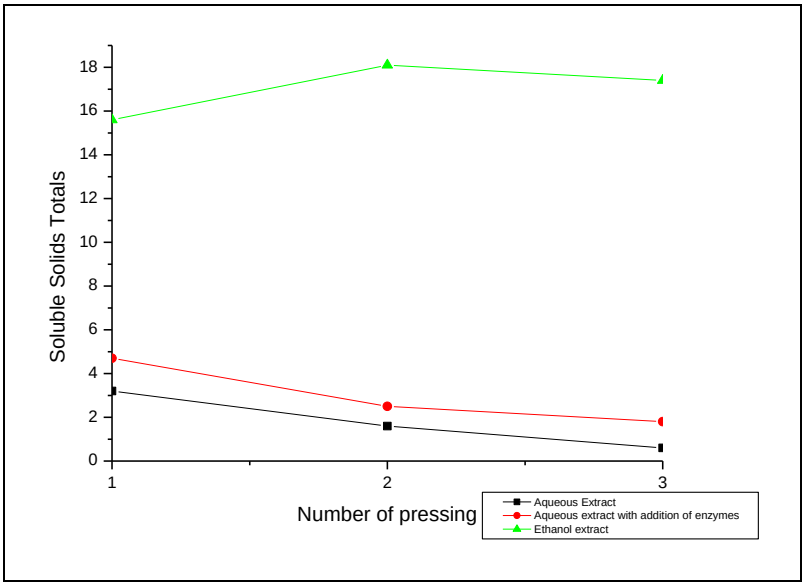
The pH of the extracts added enzymes and 500 ppm of the aqueous extract, obtained without enzyme, showed values between 3.5 and 4.0. The extracts obtained with the addition of pectinolytic enzyme complex, the pH values were slightly lower than the values obtained in extracts of enzymes. This was due to pectinolytic enzymes on pectin present in the cell wall of fiber cashew combined with mechanical action of pressing, hydrolyzing acid poligalaturônico units to smaller units of acid and contributing to a decrease in pH (Figure

02).

In the extract from the stalk of the cashew bagasse obtained from ethanol solution - HCl (1.5 N), pH was the lowest among the extracts tested, that was to be expected because of the actual solution used for the extraction of carotenoid compounds Tues mild acid formation. It was also noted that over the extractions, the pH was decreased gradually indicating greater laceration fiber cashew by mechanical force of the press, releasing acid content (Figure 02).

Figure 03 represents the values of soluble solids for the three extracts:

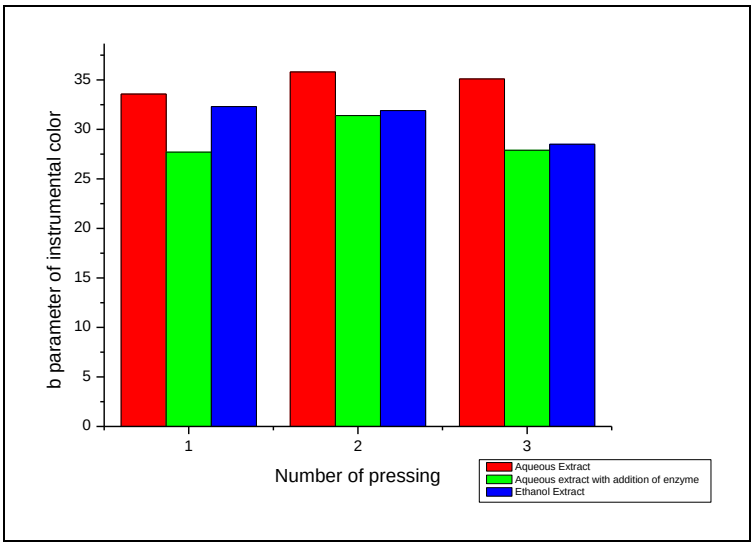
Figure 03 - Graph of total soluble solids of the extract of the stalk of the cashew bagasse obtained by soaking in aqueous solution with addition of pectinolytic enzyme complex in solution and ethanol - HCl (1.5 N).



The content of soluble solids in the extract obtained in ethanol solution was higher than the levels found in aqueous extracts and added 500 ppm of pectinolytic enzyme complex. This was due to the fact that alcohol solution to extract more compounds present in the fiber cashew, due to higher solubility of these compounds in alcohol than in water. The soluble solids content was gradually increasing over the pressings, which was not observed with aqueous extracts, obtained by addition of pectinolytic enzyme complex, where the values of soluble solids were decreasing along each pressing, due to the fact that fiber go becoming gradually poorer in soluble solids in each pressing, especially in sugar, which is the most soluble solids (Figure 03).

Figure 04 shows the values of parameters b color instrumental to the extracts obtained in aqueous solution (with and without addition of pectinolytic enzyme complex) and in ethanol solution:

Figure 04 - Graph of parameter b of instrumental color of the stalk of the cashew bagasse obtained by soaking in aqueous solution with addition of pectinolytic enzyme complex in solution and ethanol - HCl (1.5 N).

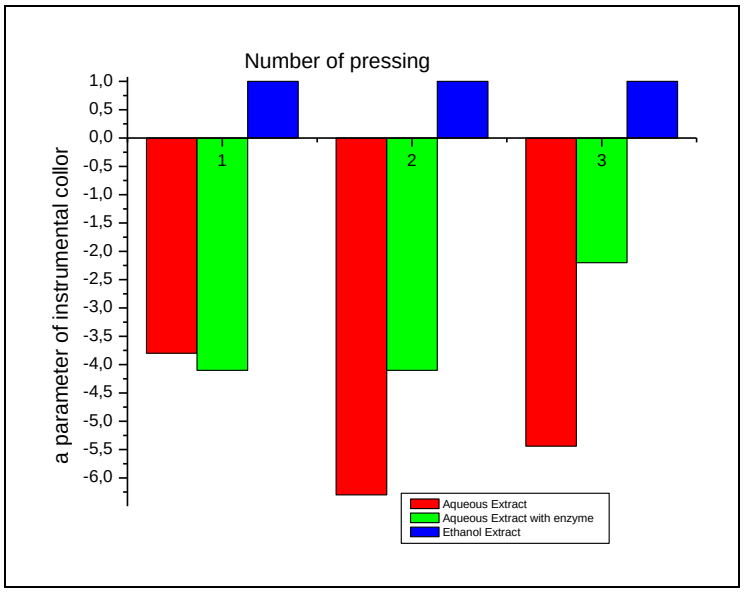


Extraction with ethanol solution - HCl (1.5 N) showed higher values of instrumental color parameter b of the first pressing of the macerated aqueous extracts obtained with and without added enzymes. In the second and third pressings, the values were similar in alcoholic extracts and added enzymes, and lower in the aqueous extract without enzyme (figure 04).

It was observed that both the values of extracts in ethanol extracts as in the added enzyme values were higher. Ethanol extracts in the higher extraction of carotenoid compounds resulting in higher b parameter of instrumental color was due to the hydrophobic character of the carotenoid compounds, which facilitated the extraction of these compounds. Have we added extracts of enzymes, these values were higher due to the action of pectinolytic enzyme complex acting on the cell wall of fiber cashew, hydrolyzing polygalacturonic acid units and releasing the carotenoid compounds (figure 04).

Figure 05 shows the parameter values of the instrumental color of the extracts, with and without enzymes, and the ethanol extract:

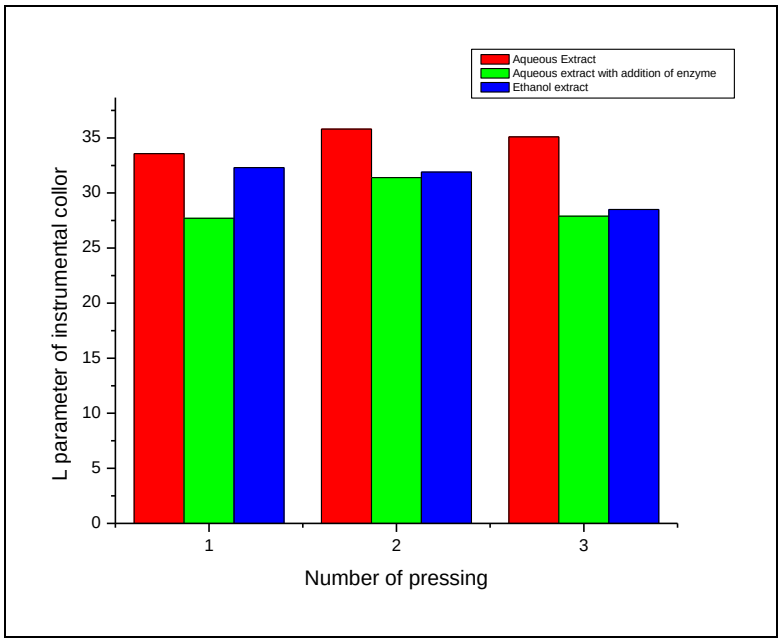
Figure 05 - Graph of the parameter of instrumental color of the stalk of the cashew bagasse obtained by soaking in aqueous solution with addition of pectinolytic enzyme complex in solution and ethanol - HCl (1.5 N).



The alcoholic extract showed the positive values of the parameter a of instrumental color, indicating greater intensity of red color, which may be due to the presence of carotenoids, which have color ranging from yellow to red. The negative values in the aqueous extract were higher than the values obtained for the extracts added enzymes indicated a greater green color in these extracts, but the values of b were significantly higher in the three statements, prevailed the yellow color due to carotenoids present (Figure 05).

Figure 06 shows the values of the parameter L of instrumental color to the extracts, with and without addition of enzymes, and the alcoholic extracts:

Figure 06 - Graph of instrumental color parameter L of the stalk of the cashew bagasse obtained by soaking in aqueous solution with addition of pectinolytic enzyme complex in solution and ethanol - HCl (1.5 N).



The highest values of instrumental color parameter L were obtained, respectively, in aqueous extracts without enzyme, followed by alcoholic extracts and the extracts obtained with addition of enzymes. As the extracts obtained with ethanol solution and with addition of enzymes had lower values of L, had lower luminosity, indicating that these extracts were darker (figure 06).

CONCLUSIONS

The higher levels of instrumental color parameter b were obtained in the extracts in ethanol, followed by extracts with addition of pectinolytic enzyme preparation, indicating that there was a gain of carotenoids in relation to water extracts in three pressings.

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