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INFLUENCE OF OSMOTIC PRETREATMENT ON THE TOTAL CAROTENOIDS CONTENT OF DRIED MANGO

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ABSTRACT: The effect of the osmotic dehydration in sucrose solution (44% w/w) for 80 minutes on the total carotenoids content of dried 'Tommy Atkins' mango was investigated. The osmotic process was carried out in an incubator at 34°C and agitation of 100 rpm. Drying tests were conducted in vertical tray dryer at two different temperatures (60 and 70°C) and air velocity of 3.0 m/s, until the sample final moisture reached 25% (wet basis). The osmotic dehydration could be considered to be an efficient method, as the pretreated dried samples had lower carotenoids losses, an important important quality attribute of the mango.
KEYWORDS: drying, osmotic dehydration, quality.

INTRODUCTION: Mango, one of the most important seasonal fruits of tropical and subtropical countries, has been reported to contain high amounts of carotenoids (Chen et al., 2004; Pott et al., 2005).
Carotenoids are important components, because they give specific coloration to fruit and besides show protective activity against a variety of degenerative diseases. For instance, ß-carotene is the dominant carotenoid in mango and it has been shown to possess high vitamin A activity and antioxidative capacity (Godoy and Rodriguez-Amaya, 1989; Miller et al., 1996; Mercadante and Rodriguez-Amaya, 1998).
The composition of carotenoids in mango can be affected by many factors, such as some processing conditions. The range of processed mango products includes juice, nectar, concentrates, jam, fruit bars, flakes, chutney and dried fruit (Schieber et al., 2000; Berardini et al., 2005).
Dried mango is the commonly preserved form of the fruit in Asia and it has also become increasingly popular in Europe (Tedjo et al., 2002; Berardini et al., 2005). However, water removal using high temperatures and long drying times may cause serious decreases in the nutritive and sensorial values (Lin et al., 1998).
One way of producing dried fruits of good quality is to use a pre-drying treatment, such as osmotic dehydration, able to reduce energy consumption and improve food quality (Lenart, 1996; Lin et al., 1998).
The purpose of this work was to evaluate the influence of osmotic dehydration in combination with drying in the total carotenoid content of 'Tommy Atkins' mango fruit.

METHODOLOGY: Tommy Atkins' mangoes were obtained from a local market in Petrolina, Brazil. The average initial fruit pulp moisture content was 80.2% (w/w) and soluble solids content was 11.2°Brix.

The osmotic dehydration was based in a previous work (Azoubel & Silva, 2008), in which a 44% (w/w) sucrose solution was used, maintained at 34°C and agitation at 80 rpm. After 80 minutes of experiment, samples were taken out from the osmotic medium, lightly rinsed to remove any excess sugar solution, drained and then placed on a pre-weighed drying tray in order to proceed to the drying process.
Drying experiments were carried out in a continuous flow fixed bed dryer at constant air velocity of 3.0 m/s and at two air temperatures (60 and 70°C), until the moisture of the samples reached 25% (w/w). The dryer system consisted of vertical air flow through trays and was arranged as a closed circuit. To maintain constant air condition only one tray was used with a single layer of sample on it (approximately 90g). For the air heating, three electric resistances were used (two of 1600W and one of 800W), which could work independently, controlled by a digital thermostat. A thermal-hygrometer (TESTO, model 635) was used to measure the dry bulb temperature and the drying air humidity. The air velocity was monitored by using an anemometer (AIRFLOW, model LCS 6000).
The carotenoid content was quantified based in the methodology of Rodriguez-Amaya (1999). In brief, there was an acetone extraction, followed by a separation and a dilution in hexane, finally measuring absorbance at 470 nm. Some precautions against pigment degradation or alteration were taken, such as protection from light and high temperatures, and the use of a short analysis time. Total carotenoids were calculated as μg per g of fruit and results are shown as carotenoid loss. All analysis was carried out in triplicate.
The moisture content was determined gravimetrically by drying in vacuum oven at 70°C for 24h.

RESULTS AND DISCUSSION: Total carotenoids slightly decreased after osmotic dehydration, where around 3% loss was observed, and can be partially associated with pigment diffusion from the fruit to the solution. In addition, the temperature used (34°C) was relatively low and the samples were not in contact with oxygen during the process.
Table 1 shows the carotenoid loss (CL) for fresh (FS) and osmotically dehydrated (ODS) samples, for each test performed. The osmotically treated and dried mangoes showed lower carotenoid loss than the untreated ones. Sanjinez-Argadoña (2005) reported that dried guavas samples without osmotic pretreatment showed a more pronounced carotenoid degradation, probably due to cellular tissue damage and increased exposure to oxygen, which resulted in pigment degradation, while the osmotically pretreated sample had a formation of a sugar barrier layer at the product surface, limiting the contact between the fruit and the oxygen, reducing carotenoid oxidation, as previously observed by Shi and Le Maguer (2000).

Table 1. Dried mango carotenoid loss (CL) for fresh (FS) and osmotically dehydrated samples (ODS)

T (°C)	Sample	CL (%)
60	FS	57.41
	ODS	26.62
70	FS	50.57
	ODS	24.61

In relation to the temperature, hot air drying at 60°C caused the highest carotenoid losses. As observed by Karabulut et al. (2007) in the drying of apricot at 50-80°C, elevated temperatures provided lower decrease in β-carotene content of the fruit samples, what was probably because solubility of β-carotene increased at high temperatures. Also, as mentioned before, the degrading effect on decreasing of carotenoids content can be ascribed to oxidation with air. Consenquently, drying time has gained importance. The time required to obtain the desired final moisture of 25% (wet basis) decreased with temperature elevation, from 60 min to 55 min, and from 118 min to 80 min, for untreated and osmotically pretreated samples, respectively, causing the reduction of the product exposure to the air and, thus, the lower carotenoid losses.

CONCLUSION: The osmotic dehydration process can be considered to be an efficient method with respect to product quality, since it contributes to the water removal from the fruit to the tissue and cause lower losses of the mango carotenoid content, which is one of the most important quality attributes of the fruit.

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