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Ajeet Rundla
Research Scholar, Vaugh Institute of Agricultural Engineering & Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Atul Anand Mishra
Vaugh Institute of Agricultural Engineering & Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Corresponding Author:
Ajeet Rundla
Research Scholar, Vaugh Institute of Agricultural Engineering & Technology, Sam Higginbottom University of Agriculture, Technology & Sciences, Prayagraj, Uttar Pradesh, India

Studies on organoleptic properties of osmotically dehydrated carrot (*Daucus carota* L.) slices in sugar and salt solution

Ajeet Rundla and Atul Anand Mishra

Abstract
The study was conducted at Allahabad's Vaugh Institute of Agricultural Engineering and Technology's Department of Food Process Engineering. The effect of different concentrations of osmotic agents, such as salt solutions (5 percent, 8 percent, 11 percent concentration) and sugar solutions (55 ºBrix, 60 ºBrix, 65 ºBrix concentration), on drying and various organoleptic parameters of carrot slices was investigated in this report. A comparison of the effects of osmotic agents was also investigated. Overall, the organoleptic parameters of dehydrated carrot slices revealed that the sugar solution outperformed the salt solution. When fresh carrot slices were examined, the color was reddish and the moisture content was found to be very high. For each concentration of all solutions, the osmotic drying time was 4 hours. The reddish color of carrot slices after drying was preserved in sugar solutions of all concentrations. For osmotic dehydration of carrot slices, a sugar solution with a concentration of 60oBrix works well.

Keywords: Organoleptic, properties, osmotically, dehydrated, *Daucus carota* L.

Introduction

Due to a lack of proper retailing and adequate storage capacity, over 20–40% of India's fruit and vegetable production goes to waste. India's vegetable production is second only to China's. The production of vegetables and fruits accounts for more than 30% of the agricultural GDP (Gross Domestic Product). Crop diversification has resulted in an increase in horticulture output, which reached 185.2 billion tons in 2010. However, the real challenge begins when the manufacturing is over.

The food industry is primarily concerned with preserving food to increase its shelf life while also maintaining its safety and quality. As a result, a continual trickle of new 'minimal' preservation strategies has emerged. Simultaneously, the advancement of the hurdle concept has rekindled interest in ancient preservation methods and how they may be coupled with current technologies.

Food preservation is the treatment and processing of food in order to prevent or considerably slow deterioration (loss of quality, edibility, or nutritional value) caused or accelerated by microorganisms. In most cases, preservation entails inhibiting the growth of bacteria, fungus, and other microorganisms, as well as delaying the oxidation of fat that causes rancidity. It also covers techniques that prevent natural aging and discoloration from occurring during food preparation, such as the enzymatic browning reaction that occurs after apples have been chopped.

Osmotic dehydration occurs when water is removed from a lower concentration of a solute to a greater concentration through a semipermeable membrane, resulting in an equilibrium situation on both sides (Tiwari 2005) [9]. Because it lowers the water activity of fruits and vegetables, osmotic dehydration has been widely used in the preservation of food materials. Because of the color, aroma, nutritional contents, and taste compound retention value, osmotic dehydration is favoured over other methods.

Research Methodology

The osmotic dehydration of carrot slices using microwave drying was investigated in the Department of Food Process Engineering, Vaugh Institute of Agricultural Engineering and Technology, Allahabad. In this investigation, the following materials and methods were used:

Materials

Carrot: The carrot (*Daucus carota* L.) is an orange-colored root vegetable. The carrot root vegetable was purchased from a local carrot market and was of good quality and maturity. For osmotic dehydration, fully grown, reddish-colored, flawless carrots were employed.

Sugar: Common sugar (Sucrose) was acquired at a local store.

Equipment and instruments used: We used weighing balances, a hot air oven, and a muffle furnace from Vaugh Institute of Agricultural Engineering and Technology Allahabad's Food Process Engineering department. Weighing scales were used to weigh different proportions of carrot slices and salt. The moisture content of osmotically dried carrots of various sugar solution concentrations was determined using a hot air oven. The ash content of osmotically dehydrated carrot slices of various sugar solution concentrations was measured using the muffle furnace. After osmotic treatment in sugar solution, the carrot slices were dried in the microwave. The investigation was conducted using a microwave made by Ken Star (Model=OM-20 EGO, Output Power=800W, Frequency =2450 MHz).

Experimental procedure

Carrot slices preparation: Carrots of uniform color, size, and shape were chosen, weighed, and washed. After removing the top and bottom portion of the carrots, they were carefully washed with tap water, weighed, and sliced into 3-4 mm thick slices. The yield recovery of fresh slices to be used for osmotic dehydration was recorded by weighing the prepared slices again. After that, slices were blanched for 5 minutes at 60 °C using a low-temperature-long-time (LTLT) method. For osmotic dehydration, blanched carrots were air chilled.

Preparation of salt solution: A salt solution with three distinct concentrations, namely 5%, 8%, and 11%, was prepared. 400 ml solution is necessary for 200 grams of sliced carrot slices. 20 gm salt and 380 ml water were used to make 400 ml of 5% salt solution. 32 gram salt and 368 ml water were used to make an 8% salt solution. 44 gram salt and 356 ml water were used to make the 11 percent salt solution.

Sugar syrup preparation: Sugar syrup was made in three distinct concentrations: 55°Brix, 60°Brix, and 65°Brix. 400 g of syrup is required for 200 g of prepared carrot slices. For 400 gm of 55°Brix concentration sugar syrup, 220 mg of sugar and 180 gm of water were used, 240 gr of sugar and 160 gm of water for 60°Brix sugar syrup, and 260 gam of sugar and 140 gm of water for 65°Brix sugar syrup. In this study, the slice-to-sugar-syrup ratio was kept at 1:2 (W/V).

Osmosis: 200 g prepared carrot slices were dipped in 55, 60, and 65°Brix sugar syrup in a 1:2 (W/V) solution ratio and allowed to continue osmosis for 4 hours at 44 ºC. Water flows out of the carrot slices to the sugar during the osmosis process, and a fraction of the solute travels into the carrot slices. The carrot slices were removed out of the osmotic solution at the end of the treatment for a specific osmotic duration, and the osmosed carrot slices were weighed to determine the extent of water loss from the slices via osmosis.

Microwave drying: A 200 g carrot sample was placed in a microwave-safe tray. An aspiration mechanism was added to the oven to empty the inside air. During the drying stage, the microwave was set to maximum power for 60 seconds and then turned off for 15 seconds (Baysal *et al.*, 2003) [1].

Method

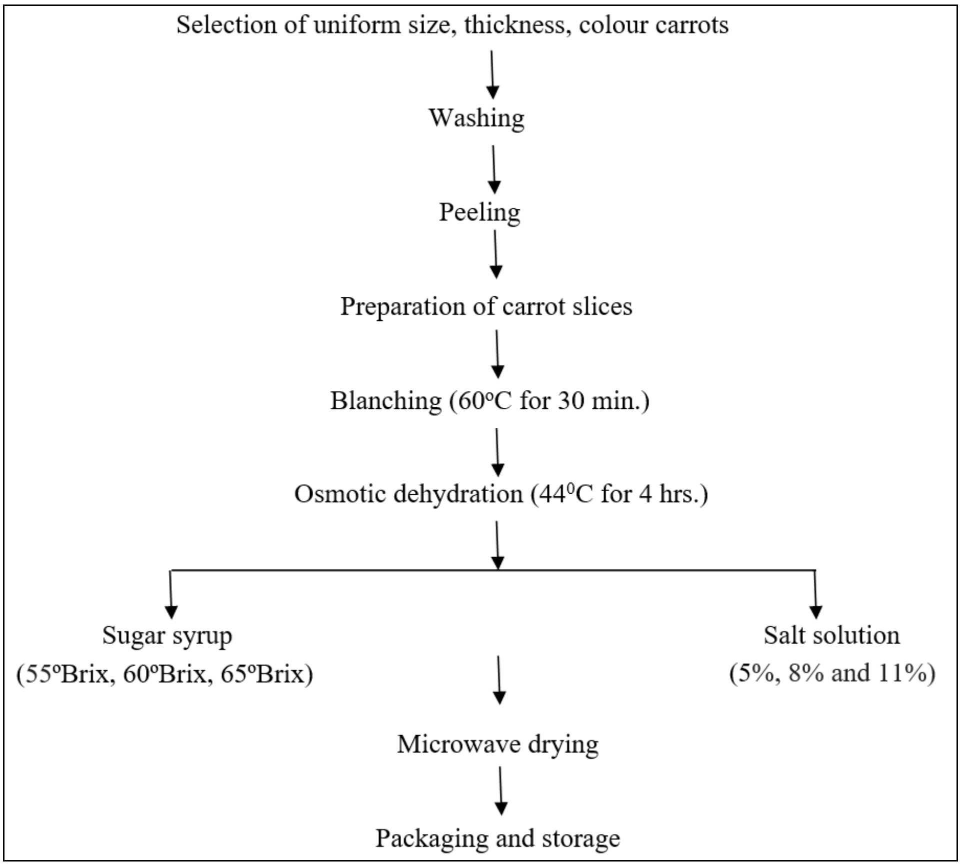

Fig 1: Osmotic dehydration of carrot slices

Results and Discussions

Effect on Colour

Tables 1 and 2 show that sensory score for color was significantly superior in osmotically dehydrated carrot slices when compared to fresh carrot slices. No significant differences were observed among osmotically dehydrated carrot slices except in the case of T2 (60°Brix syrup), which had a significantly higher 25.88 score for color, followed by T1 (24.46) and T3 (22.29), while T6 had the lowest score (15.43). (11 percent salt solution).

Table 1: Sensory score for colour treated with sugar solution

Sample code	Sugar Concentration (^{0}Brix)	Colour (30)
T_1	55 ^{0}Brix	24.46
T_2	60 ^{0}Brix	25.88
T_3	65 ^{0}Brix	22.29

Table 2: Sensory score for colour treated with salt solution

Sample code	Salt Concentration (%)	Colour (30)
T_4	5%	19.81
T_5	8%	17.33
T_6	11%	15.43

Effect on texture

The texture of dehydrated carrot slices was dramatically influenced by the various treatments (Table 3 and 4). The osmotically dehydrated carrot slices had a considerably higher overall texture score than the untreated control sample. Treatment T2 (60°Brix syrup) had the highest texture score (22.86). In the case of control slices, the lowest score (12.39) was found (T9).

Table 3: Sensory score for texture treated with sugar solution:

Sample code	Sugar Concentration (^{0}Brix)	Texture (30)
T_1	55 ^{0}Brix	20.24
T_2	60 ^{0}Brix	22.86
T_3	65 ^{0}Brix	19.16

Table 4: Sensory score for texture treated with salt solution:

Sample code	Salt Concentration (%)	Texture (30)
T_4	5%	20.33
T_5	8%	21.51
T_6	11%	12.39

Effect on flavor

Table 5 and 6 show that the sensory score for flavor in osmotically dehydrated carrot slices was significantly higher than in untreated control samples. Most of the treatments found that samples acquired from osmotic pre-treatments had statistically non-significant differences in flavor score (Table 4.5, 4.6). Carrot slices produced with 60°Brix (T2) scored substantially higher (30.46), followed by treatment T4 (28.41). (5 percent salt solution). In control, a minimum score of 18.61 was recorded (T6 11 percent salt solution).

Table 5: Sensory score for flavor treated with sugar solution:

Sample code	Sugar Concentration (^{0}Brix)	Flavor (40)
T_1	55 ^{0}Brix	28.11
T_2	60 ^{0}Brix	30.46
T_3	65 ^{0}Brix	25.13

Table 6: Sensory score for flavor treated with salt solution:

Sample code	Salt Concentration (%)	Flavor (40)
T_4	5%	28.41
T	8%	24.36
T_6	11%	18.61

Conclusion

The sugar solution of 60 ºBrix was found to be the optimum for dehydrating carrot slices. In the concentration of 60 ºBrix sugar solution, the overall organoleptic parameter was found to be satisfactory.

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