COLOR ANALYSIS OF REHYDRATED AND DRIED PRETREATED SWEET POTATOES

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Introduction

Sweet potato (*Ipomoea batatas* L.) is a large, starchy, sweet-tasting, tube root belonging to the family *Convolvulaceae* and distantly related to the potato(*Solanumtuberosum*).It is an excellent source of carbohydrates, vitamin A, carotene, calcium, phosphorus and a fair source of thiamine and iron. It is an inexpensive but rich source of energy, high in carbohydrates and is called poor man food. It is the seventh most important crop grown in 111 countries around the world. China is the largest producer with 68.6% share of sweet potato production in the world and India holds the eighth position.

Colour is an important quality attribute in the food and bioprocess industry, and it influences consumer's choice and preferences.The colour change can be due to chemical, biochemical, microbial or physical changes. It is one of the most important sensory factors which can result in immediate acceptance or rejection of the produce as it helps to assess the quality attributes such as flavour, pigments, freshness and quality. Browning is the limiting factor in the fresh cut fruits and vegetables (Brecht, 1995).It is the main hurdle in marketing and different treatments have been reported to control browning. Various factors are responsible mainly, water loss (Chuma *et al*., 1984), enzymatic activity e.g. polyphenol oxidase (Bower & Van Lelyveld, 1985, Nicoli *et al*., 1994) and phenylalanine-ammonia-lyase (PAL) (Ke & Saltveit, 1989),increased production of carbon dioxide and elthylene (Moretti *et al*., 1998), flavor and aroma alteration (Moretti & Sargent, 2000)., Sapers & Miller(1992; 1993;

1995) proposed the utilization of sulfites, ascorbic acid, surface digestion, heated ascorbic and citric acid solution to overcome browning in fresh-cut products, Kishnana(2010)recommended soaking in acetic acid or citric acid and sodium metabisulfite at low concentrations,

The present study was undertaken with an objective to study the color variation of the pre-treated dried and rehydrated sweet potatoes.

Material and Methods

The sweet potato variety was procured from a local vegetable market in Ludhiana within 24 hrs of harvest .The sweet potatoes were pre washed under the tap water and were patted dried with the muslin cloth to remove the excess water adhering to the surface.The skin was removed with the help of a peeler and the conical edges were removed to make it of uniform length 70-80 mm with 35-45mm diameter. This size was chosen as per the industry requirements. The sweet potatoes were sliced into a thickness of 7.5mm and 12.5mm.

Pre-treatment

The details of the sweet potato subjected to various pre- treatments are detailed in Table

Table 1: Details of the pre-treatments, slice and bed thickness of sweet potatoes.

S.no	Slice thickness (mm)	Bed Thickness(cm)	Pre-treatment
1.	7.50	4	No Treatment (control)
2.	7.50	8	
3.	12.50	4	
4.	12.50	8	
5.	7.50	4	Acetic Acid (1%)soaking for 1 hr
6.	7.50	8	

7.	12.50	4	
8.	12.50	8	
9.	7.50	4	Blanching in tap water @ 100˚C
10	7.50	8	
11	12.50	4	
12	12.50	8	

Thesliced sweet potatoes were subjected to three treatments (i) pre-treatment with acetic acid (1%) for 1 hr (Krishnan et al 2010) (ii) blanched in water at 100˚C for 2.5 to 4min in a thermostatically controlled water bath and (iii) no treatment (control).After pre treatment these were subjected to drying in 2 different layers 4 and 8 cms in in a Satake test dryer (TDR – class 3c) to a moisture content of 8%(db). The dried produce was stored in LDPE(Low Density Polythene Bags) at room temperature.

Color measurement

The Colour was recorded using a Hunter Laboratory Instrument Model CIE 1996 (Hunter Associates Laboratory, Inc., Reston, Virginia, U.S.A.)in terms of L,a,b(L measures the blackness /whiteness (0-100),a measures redness(+)/greenness(-),b measures yellowness(+)/blueness(-)(hunterlab 2008)).The colour of fresh sweet potato was expressed in terms of the '$L_{standard}$' '$a_{standard}$' and '$b_{standard}$',dried and rehydrated samples as L_{sample} ,a_{sample}, b_{sample}. ΔE, which signifies the total colour difference (Matthey and Hanna, 1997).

$$\Delta E = (\Delta L^2+\Delta a^2+\Delta b^2)^{1/2} \quad \ldots\ldots (1)$$

Where $\Delta L = L_{sample} - L_{standard}$; $\Delta a = a_{sample} - a_{standard}$; $\Delta b = b_{sample} - b_{standard}$.

Results and Discussion

The values of L which records the lightness and varies from 0-100(black/white) was minimum(41.8-49.3) for the blanched samples while the samples pre-treated with acetic acid recorded the values of L ranged from 56.1-62.93 and the control values ranged from 59.70-63.63. The variation in the ΔE was significant when compared to the different pre-treatments at constant temperature. The blanched samples showed higher values of ΔE in comparison to acetic acid treated and control samples. Minimum value of ΔE was recorded for sample 4 (6.88) followed by sample 8(7.18) and maximum value was recorded for sample 11 (28.26) for dried sweet potatoes.The high values of ΔE in the blanched samples could be due to browning resulting from enzymatic and non enzymatic reactions. The non enzymatic browning during processing is caused mainly by reducing sugars and amino acids which undergo maillard reaction at high temperatures (Marquez and Anon,1986)At constant slice thickness(7.5 or 12.5mm) bed thickness played an important role. The value of ΔE decreased with increase in the bed thickness. Similar trend was recorded in all three treatments for dried sweet potatoes.

The rehydrated samples recorded higher values of ΔE in comparison to the dried samples under similar conditions. Sample 4 with the slice thickness 12.5mm and bed thickness 8 cm recorded the minimum value of 21.33 when the maximum value was recorded for sample 5 with 29.51.The rehydration of blanched samples was not carried out due to visual rejection of the dried samples (Table 2).

Table 2:Variation of L, a, b and ΔE values of pre- treated dried and rehydrated potatoes

Sample	Dried sweet potatoes				Rehydrated sweet potatoes			
	L_{sample}	a_{sample}	b_{sample}	ΔE	L_{sample}	a_{sample}	b_{sample}	ΔE
1.	59.70	1.5	10.4	10.30	41.8	-0.8	9.2	28.41
2.	56.63	1.63	10.53	13.4	45.6	1.9	8.2	24.36
3.	61.0	0.63	11.03	8.25	45.1	1.9	7.52	25.00
4.	63.63	0.1	11.83	6.88	49.2	3.2	13.7	21.33
5.	56.1	-0.5	8.1	13.86	41.2	-1.7	2.2	29.51
6.	57	1.67	9.67	12.98	41.6	-0.7	3.5	28.98
7.	59.64	1.0	10.27	10.36	45.9	3.4	9.7	25.07
8.	62.93	1.2	10.53	7.18	43.6	7.6	12.0	26.48
9.	45.57	1.367	7.1	24.36	-	-	-	-
10.	44.8	2.63	7.1	25.27	-	-	-	-
11.	41.8	3.07	7.13	28.26	-	-	-	-
12.	49.3	1.33	5.7	20.85	-	-	-	-

Conclusion

Colour is one of the most widely measured product quality attributes in postharvest handling and in the food processing research and industry. It can be evaluated both by instrumental (objective) and visual (subjective) measurements. Total thickness of the sliced sweet potato and the drying layer played an important role in preserving the color of the pretreated and rehydrated sweet potato close to the original. It was observed that the blanched sweet potatoes sample had the highest ΔE values. ΔE of rehydrated sweet potatoes was higher in comparison to the dried sweet potatoes. Minimum ΔE was recorded for control samples followed by the samples treated with 1% acetic acid with slice thickness 12.5cm and bed thickness 8 cm. Colour measurements are often reported based on different colour indices even for the same

product, making it difficult to compare results in the literature. There is a need for standardisation to improve the traceability and transferability of measurements. The correlation between colour and other sensory quality attributes is well established, but future prospects exist in the application of objective non-destructive colour measurement in predictive modelling of the nutritional quality of fresh and processed food products.

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