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Quality assessment of microwave blanched sweet corn kernels

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■ **ABSTRACT :** Sweet corn (*Zea mays* L.) is an annual grass of the Poaceae (Grass) family. Sweet corn also called sugar corn and pole corn which is a variety of maize with high sugar content. It is a good source of carbohydrate, fibre, carotenoids, minerals and vitamins (A and E) and widely used as fresh, processed food and to make masala corn, curry and corn bread. Shelf-life of ready to use fresh sweet corn kernels is important due to its high moisture content. Blanching is one of the steps for shelf-life extension during storage. Therefore, an investigation was carried out to study the effects of microwave blanching treatments on the quality of sweet corn kernels in order to determine suitable blanching time. Sweet corn kernels were blanched in microwave for various times (1, 3, 5 and 7 min) at 540 watt. Blanched samples were also analyzed for sensory analysis and physico-chemical qualities *i.e.* moisture content, TSS, pH, total sugar, total carotenoids, colour (L*value, hue angle, chroma) and firmness using standard methods. These blanching treatments were evaluated with respect to the highest sensory score and the process was optimized on the basis of the maximum retention of colour, texture and total carotenoids and minimum loss of total soluble solids and total sugar. The degree of colour, texture, flavour, taste and overall acceptability was found higher for sample MB_3 (Sample blanched for 3 min). From result it was observed that there was decrease in moisture, TSS, total sugar while increase in pH for 1 to 7 min blanching time. There was a strong significant influence of the blanching time, on colour, firmness and total carotenoids. It can be concluded that sweet corn kernels blanched for 3 min resulted in better quality parameters.

■ **KEY WORDS :** Sweet corn kernels, Blanching time, Quality, Total carotenoids

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Sweet corn [*Zea mays* (L.) var. *saccharata*] is a cultivated plant grown for human consumption and is a raw or processed material of the food industry throughout the world. It is popular with the consumer for its unique taste, pleasant flavor and sweetness. Sweet corn plays an important role in the human diet because of its health- promoting nutritional characteristics. The nutritional value of sweet corn kernels is related to the content of water (72.7%) and to the total content of solid parts (27.3%). Solid parts include hydrocarbons (81%), proteins (13%), lipids (3.5%) and others (2.5%). Starch is the dominant hydrocarbon component (Szymanek, 2012). Sugar corn kernels are moderately high in calories in comparison to other vegetables. Corn features high-quality phyto-nutrition profile comprising of dietary fibre, vitamins and antioxidants in addition to moderate proportion of minerals. Sweet corn contains significant amount of lutein, zeaxanthin and other carotenoids (Junpatiw *et al*., 2013). Sweet corn has been widely consumed as a healthy food since it is rich in carotenoids.

Carotenoids, such as the xanthophyllus, lutein and zeaxanthin, have garnered interest due to their association with eye health.

Fresh sweet corn kernels continue to respire, using available and stored sugars and organic acids. They begin to senescence rapidly so it requires careful marketing. These changes if not controlled can lead to rapid senescence and deterioration of the product. Methods for control the changes are numerous and can include the use of blanching treatment. It stabilizes the product and thereby extends its shelf-life. Blanching is done for the purpose of inactivating enzymes; modifying texture; preserving colour, flavour and nutritional value and removing trapped air. In view of the above facts and increasing economic importance of sweet corn in fresh cut produce industry, the study was undertaken with the objective of determining the effect of microwave blanching and on quality parameters of sweet corn kernels.

METHODOLOGY

Sample preparation:

Fresh sweet corn was procured from the local market and was then washed thoroughly with water. Fresh corns were dehusked and kernels were removed from the cob. The sweet corn kernels were microwave blanched for 1, 3, 5 and 7 min at 540W. After blanching all samples were cooled in ice water.

Organoleptic evaluation:

The organoleptic scoring was done by a panel of 10 members. A nine point hedonic scale was used to evaluate the results and expressed as mean scores by taking average of all the replicates.

Moisture content:

The percentage retention of moisture was analyzed by the process of oven drying method. The difference between initial and final was considered as moisture and percentage calculated.

$$\text{Moisture content (\%)} = \frac{\text{Initial weight} - \text{Final weight after drying}}{\text{Initial weight}} \times 100$$

pH:

The pH of sweet corn kernel was determined by using pH meter (Trongpanich *et al*., 2002).

Total soluble solids (^{0}Brix):

TSS was measured with a hand refractometer (0-32^{0}Brix).

Sugar content:

Sugar content (%) was analyzed using the phenol-sulfuric method (Riad and Brecht, 2003).

Carotenoids:

The total carotenoids in sweet corn kernels were quantified by the spectrometric method (Song *et al*., 2013).

Colour:

Colour changes were determined by the measuring the reflectance of the sweet corn kernels using colour flex EZ colourimeter. Colour was measured using CIE L*, a*, b* Scale. The a* and b* values was calculated to hue angle ($\tan^{-1} b^*/ a^*$) and chroma ($(a^{*2}+ b^{*2})^{1/}2$).

Texture:

Typical texture profile analysis (TPA) curves were obtained using texture analyzer (TA-XT plus).

RESULTS AND DISCUSSION

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Organoleptic properties of blanched sweet corn kernels:

Organoleptic evaluation:

The organoleptic characteristic is of great importance from the point of food material acceptability by the consumer. Means of scores for all quality attributes and overall acceptability of all samples was significantly different which is evident from Table 1. The degree of flavour, taste, colour and texture liking was found to be significantly higher in treatment MB_3 (samples blanched for 3 min) followed by MB_5 (samples blanched for 5min).

Physico-chemical properties of blanched sweet corn kernels:

Colour:

The experimental values of colour (L* value, Hue angle and Chroma) revealed that there was non-significant difference among sample MB_1 and MB_3 (Table 2). The lightness of sweet corn kernels varied

from 65.18 to 61.81 for 1 to 7 min blanching time. The maximum hue angle was observed in sample MB_7 *i.e.* 92.07 and smallest for sample UB *i.e.* 86.81. The chroma varied between 48.09 to 49.07 for 1 to 7 min blanching time. However, there is increase in chroma with increase in blanching time. The performance observed here is consistent with the citation by Barrett *et al*. (2000).

Firmness:

Firmness of sweet corn kernels increased significantly with blanching time upto 3 min and then declined (Table 2). Increasing firmness upto 3 min and then declined was observed for sweet corn by Barrett *et al*. (2000). This increase may be due to application of heat to promote the gelatinization of starch in corn and this resulted in increase in firmness of sweet corn kernels. (Barrett *et al*., 2000).

Moisture:

Moisture content decreased with increase in blanching time from 1 to 7 min (Table 3). The decrease in moisture content was more in sample MB_7 (72.04 %) than sample UB (75.60%). Similar observation for increasing moisture content was observed by Macdaniel *et al*. (1988).

Table 1: Effect of microwave blanching on organoleptic properties of sweet corn kernels

Treatment/ analysis	Colour	Texture	Flavour	Taste	Overall acceptability
UB	7.2	7.2	7.3	7	7.2
MB_1	7.5	7.6	7.6	7.4	7.5
MB_3	9	9	9	9	9
MB_5	8.3	8	8.5	8	8.2
MB_7	7.4	7.5	8	7.6	7.5
F-value	9.121*	7.106*	6.801*	4.306*	7.325*
S.E.±	0.216	0.262	0.262	0.366	0.262
C.D. (P=0.05)	0.679	0.824	0.824	1.154	0.424

*indicate significance of value at P=0.01

where, UB: Control (unblanched sweet corn kernels) ; MB_1: 1 min blanching time ; MB_3: 3 min blanching time ; MB_5: 5 min blanching time MB_7: 7 min blanching time

Table 2: Effect of microwave blanching on colour and texture of sweet corn kernels

Treatment/ analysis	Colour			Texture
	L-value	Chroma	Hue angle	Firmness
UB	67.29	36.18	86.81	128
MB_1	65.18	48.09	89.02	156
MB_3	64.45	48.15	89.04	188
MB_5	63.28	48.60	91.46	180
MB_7	61.81	49.07	92.07	159
F-value	20.451*	44.376*	72.287*	1614.9*
S.E.±	0.377	0.256	0.259	0.577
C.D. (P=0.05)	1.187	0.808	0.816	1.81

* indicate significance of value at P=0.01

Table 3: Effect of microwave blanching on physico- chemical properties of sweet corn kernels

Treatment/ analysis	Moisture (%)	TSS (°Brix)	pH	Total sugar (%)	Total carotenoids (ug/g)
UB	75.60	6.81	6.54	13.24	449
MB_1	75.20	6.75	6.61	11.38	536
MB_3	74.60	6.62	6.70	8.86	685
MB_5	73.89	6.11	6.81	6.19	627
MB_7	72.04	5.92	6.92	3.29	532
F-value	58933*	76.748*	696.90*	23.133*	25220*
S.E.±	0.005	0.045	0.005	0.226	0.577
C.D. (P=0.05)	0.018	0.144	0.018	0.824	1.81

* indicate significance of value at P=0.01

Total soluble solids (TSS):

Statistically there was significant difference in TSS for all the samples. From the data presented in Table 3, it can be seen that lowest TSS was obtained in MB_7 *i.e.* 5.92 and highest for unblanched samples *i.e.* 6.81. Observed TSS was in close agreement with the value obtained for sweet corn kernels by Trongpanich *et al*. (2002). The TSS decreased as the level of blanching time increased. The decreased in TSS may be due to passing sample through more heat treatment during blanching so that leaching of total soluble solid occurred. (Trongpanich *et al*.,2002).

pH:

pH of sweet corn kernels blanched for different blanching time increased with increase in blanching time (Table 3). It increased from 6.54 to 6.92 for 1 to 7 min blanching time. This result is in agreement to Trongpanich *et al*. (2002) who observe significance increase in pH due to loss of some food constituents, especially volatile acids, during blanching which raises the pH of the food toward neutral.

Total sugar:

Total sugar content of sweet corn kernels during blanching experiments varied from 13.24 per cent to 3.29 per cent (Table 3). These results are in line with finding obtained by Alan *et al*. (2014). According to Shu (1990) decrease in sugar may be due to leaching of sugar during blanching.

Total carotenoids (TC):

Compared to fresh sample, total carotenoids content increased on blanching, it increased from 449 to 685 µg/g (Table 3). Maximum retention was observed in MB_3 sample and minimum in UB sample. The increase in TC occurs may be due to the release of bound carotenoids from the food matrix as a result of blanching (Junpatiw *et al*., 2013). It was also observed that thermal treatment enhanced the availability of total carotenoids (TC).

Conclusion:

Blanching is extremely important for further processing of sweet corn and to extend the shelf-life. In this study, various microwave blanching time were considered based on the highest sensory score and maximum retention of carotenoid, colour and texture, the process was optimized. The best blanching treatment for sweet corn based on these process parameters was 3 min at 540 watt in microwave.

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