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Short Communication

Effect of Pretreatments on Quality Attributes of Dried Green Chilli Powder

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Abstract

Chilli (Capsicum annuum L) known for their sharp acidic flavor and color was processed in to powder and evaluated for its chemical attributes. The chillies of two different verities (Tejas and NP-46) were blanched in hot water at 90^0C for 3 minute and given horizontal cuts of 1cm in order to improve the drying rate after blanching. These cuts of chillies were pretreated with the solution containing 1% ascorbic acid, 0.3% sodium metabisulphite, 0.3% sodium metabisulphite and 1% calcium chloride after blanching by giving 10 minute soaking in above solutions. The ratio of the green chilli: pretreatment solution is 250 g: 1 Liter followed by surface drying at 60^0C and 70^0C; then ground to make a fine powder. Green chilli powder yielded from Tejas variety has shown more green color as compared to NP-46. Using NaMS at drying air temperature of 60^0C provided more bright green color.

Keywords: Chilli, powder, pretreatments, blanching, ascorbic acid, reducing sugar, quality attributes.

Introduction

Chilli is a vegetable fruit of the plants 'Capsicum annuum' and 'Capsicum frutescence' that come from the genus Capsicum, belonging to the family of Solanaceae. These fruits are small in size and are known for their sharp acidic flavor and color. Chilies contain health benefiting an alkaloid compound in them, capsaicin which gives strong spicy pungent character. Early laboratory studies on experimental mammals suggest that capsaicin has anti-bacterial, anti-carcinogenic, analgesic and anti-diabetic properties. It also found to reduce LDL cholesterol levels in obese individuals. The vitamin and mineral content (per 100 gm) is calcium (29 mg), phosphorus (78 mg), iron (1.2 mg), potassium (374 mg), thiamine (0.22 mg), riboflavin (0.36 mg), and niacin (4.4 mg)[1]. Capsicum is rich in protein also i.e. (12-15%). Chilies are also good in B-complex group of vitamins such as niacin, pyridoxine (vitamin B-6), riboflavin and thiamin (vitamin B-1). These vitamins are essential in the sense that body requires them from external sources to replenish.

The color of chilli spice powder is due to the presence of red-pigmented carotenoids. The main pigments are capsanthin, capsorubin, zeaxanthin and cryptoxanthin. Carotenoids are very stable in intact plant tissue. However, when chillies are processed by drying and then grinding into spice powder, the carotenoids auto-oxidize easily, due to the effects of heat, light and oxygen. This leads to a more orange and less intense coloration that devalues the spice powder. In addition, carotenoids have provitamin-A activity.

The control of browning is one of the most important issues in the food industry, as color is a significant attribute of food which influences consumer decision and brown foods (especially fruits) are seen as spoiled. Several methods can be applied to avoid enzymatic browning, based on inactivating the enzyme (heat) or by removing essential components (most often oxygen) from the product such as blanching, dehydration, addition of inhibitors. The green chilly is highly perishable but at the same time available throughout the year. The increasing demand of processed ready to eat and ready to cook products has resulted in growing industry of Indian spices. Dehydrated and chemically pretreated green chilli powder has extended shelf life and can be easily incorporated in various homemade recepies like red chilli powder. There are no much reports on preparation of green chilli powder with reduced browning so the study was undertaken with objectives such as; i. To study the physico-chemical characteristics of green chillies, ii. To standardize the process for preparation of green chilli powder, iii. To study the effect of various pretreatments to prevent browning and quality attributes in green chilli powder.

Material and Methods

The good quality chillies were obtained when harvested between the periods of immature stage to mature stage from local market. The selected chillies were fresh, uniform and sound in nature. Two types of varieties of the green chillies were taken for experiment i.e. Tejas (dark green) and NP-46 (pale green).

Sample Preparation: Grading is done manually to remove the undersized, black and spoiled chillies to get the good quality green chilli powder from the fresh green chillies. Before pretreatment the waste material i.e. stalk portion is removed manually. The chillies were blanched in hot water at 90^0C for 3 minute[2]. The chillies were given horizontal cuts of 1cm in order to improve the drying rate after blanching. The green chillies were pretreated with the solution containing: 1% ascorbic acid, 0.3% sodium metabisulphite, 0.3% sodium metabisulphite and 1% calcium chloride after blanching by giving 10 minute soaking in above solutions. The ratio of the green chilli: pretreatment solution is 250 g: 1 Liter.

Drying of Green Chilli: Pretreated chillies are then surface dried and transferred to the drying in the hot air oven at two temperatures i.e. at 60^0C and 70^0C for every treatment and for both selected varieties[3].

Powdering of Dehydrated Chilli: After complete drying the dehydrated chilli samples obtained at different drying temperatures were taken for grinding in food processor mixer grinder to make powder of dried green chillies.

Chemical Analysis of Chilli and Chilli powder: Ascorbic acid, reducing sugar, chlorophyll, Total soluble solids (TSS) of chilli was determined[4]. The ascorbic acid content of the green chilli is determined by method given by Ranganna[7]. Reducing sugar was analyzed using the Nelson-Somogyi method[7], which is suitable for food with low reducing sugar. The concentration of reducing sugar was obtained using a spectrophotometer at 520 nm and a standard curve of glucose was used.

Results and Discussion

The length, girth, average weight, waste index, colour of fresh green chilli of both varieties was determined and values are represented in table 1.

Table-1
Physical analysis of fresh green chilli

Parameters	Green Chilli Variety	
	Tejas	NP-46
Length (cm)	10.44	12.15
Girth (cm)	2.99	3.53
Average Weight (gram)	2.52	3.72
Waste index	0.94	0.93
Color	Dark green	Pale green

The chemical properties of fresh green chillies with respect to their moisture content, chlorophyll content, ascorbic acid content, reducing sugar, and total soluble solids content are shown in table 2.

Table-2
Chemical analysis of fresh green chillies

Parameters	Green Chilli Variety	
	Tejas	NP-46
Moisture content (%)	89	92
chlorophyll mg/100 g	42.22	29.73
Ascorbic acid mg/100g	29.33	23.25
Reducing sugar (g) /100g	2.8	3.6
Ash (%)	0.65	0.55
Total Soluble solids	10	11

Dried chilli powder prepared from fresh-blanched chilli without chemical pretreatment, using different drying air temperatures, were processed and compared to chemically dried chilli. A lower value of color of dried chilli using drying air temperatures of 70^0C was observed compared with the drying at 60^0C method[5]. However; drying at 60^0C method significantly improved the lightness of dried chilli compared to the 70^0C drying method[6].

Nutritional compounds of dried chilli obtained from different drying air temperatures were also monitored and compared with the each drying method. Table 5 shows that the reducing sugar levels of the chilli were between 50 to160 mg/g dried chillis[8]. Even though different drying air temperatures did not significantly affect reducing sugar, the decrease in reducing sugar resulted in the forming of browning compounds due to the non-enzymatic browning reaction between reducing sugar and amino acid. This result is compatible with the decrease in color.

The same results were found for ascorbic acid in dried chilli[7]. As drying air temperatures using a lab-scaled dryer increased, decreases in ascorbic acid were noted in table 3 and 4. Ascorbic acid was degraded by higher temperatures and the degradation product (L dehydroascorbic acid, DHAA) could participate in Strecker degradation with amino acid, producing a browning pigment. Not only does the high temperature of drying air affect the loss of ascorbic acid, but a long period of drying time can also introduce a significant loss of ascorbic acid.

As shown in tables 3 and 4, using a pretreatment method before drying could not prevent the degradation of ascorbic acid both at 60^0C and 70^0C temperature regime, with the exception of soaking in ascorbic acid solution which was significantly higher than other chemical pretreatments and control[8]. Generally, ascorbic acid is used for food products as antioxidizing agent. This contradicted with these results, as the soaking of chilli in this solution was found to lead to a darker color, even though the amount of ascorbic acid was increased after the drying process.

This can be explained as ascorbic acid was oxidized by the high temperature of drying air leading to DHAA and a wide variety of carbonyl and other unsaturated compounds being formed. The breakdown products then participated in Strecker degradation with amino acids and further polymerized to form melanoidins or non nitrogenous caramel-like pigments. Therefore, using ascorbic acid does not improve the color stability of dried chilli. The mechanism of browning pigment developed during chilli drying involves different reactions.

Table-3
Ascorbic acid content (mg/100gm) Variety Tejas

Pretreatment	Variety Tejas at 60^0C	Variety Tejas at 70^0C
Blanching	30.40	32.91
NaMS	33.29	39.27
NaMS + $CaCl_2$	46.97	49.78
Ascorbic acid	49.20	51.56

Table-4
Ascorbic acid content (mg/100gm) Variety NP-46

Pretreatment	Variety NP-46 at 60^0C	Variety NP-46 at 70^0C
Blanching (control)	27.80	24.21
NaMS	36.7	35.7
NaMS + $CaCl_2$	43.88	42.50
Ascorbic acid	48.79	74.25

Reducing sugar content of dried chilli obtained from different chemical pretreatments was quite different table 5 and 6, using a drying air temperature of 60^0C and 70^0C, but reducing sugar content were significantly decreased compared with the blanched sample. Meanwhile, using chemical substances with the two drying temperature method proved to improve the amount of reducing sugar of dried chilli compared to the blanched (control) sample. However, the reducing sugar of dried chilli decreased compared to fresh chilli in all cases. It is suggested that the degradation of the reducing sugar causes the browning pigment to develop due to a maillard reaction, and therefore a decrease in lightness and color was observed.

Table-5
Reducing sugar content (mg/gm) Variety Tejas

Pretreatment	Variety Tejas at 60^0C	Variety Tejas at 70^0C
Blanching (control)	41	60
Ascorbic acid	45	90
NaMS	47	60
NaMS + $CaCl_2$	50	160

Table-6
Reducing sugar content (mg/gm) Variety NP-46

Pretreatment	Variety NP-46 at 60^0C	Variety NP-46 at 70^0C
Blanching (control)	102	130
Ascorbic acid	118	126
NaMS	195	210
NaMS + $CaCl_2$	264	298

NaMS inhibits browning reaction by binding with the carbonyl group of reducing and other compounds to retard the browning process[9]. However from the readings in table 7 and 8, sodium metabisulphite combined with $CaCl_2$ preserved the green color. Adding $CaCl_2$ found to improve the green color, but the reason behind this cannot be assisted without studying the required drying time as the purpose behind the $CaCl_2$ addition was to reduce the drying time. $CaCl_2$ may react with water molecules resulting in increased water mobility and reduced drying time. Thus, thermal degradation and oxidation of carotenoids can be minimized along with using of NaMS as an inhibitor of browning reaction. These results suggested that calcium may be acting in some manner to block the amino groups before entering into the enzymatic browning reaction.

Table-7
Absorbance at 540 nm Variety Tejas

Pretreatment	Variety Tejas at 60^0C	Variety Tejas at 70^0C
Blanching (control)	0.110	0.135
NaMS	0.134	0.168
Ascorbic acid	0.172	0.155
NaMS + $CaCl_2$	0.232	0.196

Table-8
Absorbance at 540 nm for Variety NP-46

Pretreatment	Variety NP-46 at 60^0C	Variety NP-46 at 70^0C
Blanching (control)	0.083	0.090
NaMS	0.100	0.123
Ascorbic acid	0.104	0.107
NaMS + $CaCl_2$	0.127	0.184

Conclusion

The green chilli was examined chemically as well as morphologically for its suitability for powder processing. It was found that the green chilli powder yielded from Tejas variety has shown more green color.

A lab scale hot air oven using a temperature range of 70^0C provided darker brown color and less green color as shown in spectrphotometric absorbance at 540 nm. Not only has the drying temperature affected the nutrient content but also the drying time. Using NaMS at drying air temperature of 60^0C provided more bright green color as sulfite inhibits the non-enzymatic browning reaction. In addition, soaking in NaMS combined with $CaCl_2$ produced highest color value. Reducing sugar could not be preserved by soaking in chemical solutions. An increase in ascorbic acid content was found when treated with ascorbic acid solutions for both the temperatures of drying.

In order to obtain aesthetic or acceptable color value and minimum nutrient losses in green chilli powder the pretreatment of NaMS combined with the $CaCl_2$ can be used with drying temperature of 60^0C excluding one or two contradictory results.

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