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Carotenoids as influenced by the chemicals, steam blanching and organic acids in carnation

S Sindhuja and T Padmalatha

Abstract
An investigation was carried out on "carotenoids as influenced by the chemicals, steam blanching and oranganic acids in carnation" at College of Horticulture, Rajendranagar, Hyderabad during the year 2014. Effect of pre-drying treatments (steam blanching and organic acids) on total carotenoids (µg/g) in carnation was studied using cultivar: Harvey with 9 treatments *viz*., T_1 - Steam blanching for 1 min, T_2 - Steam blanching for 2 min, T_3 - Soaking in citric acid (0.5%) for 15 min ,T_4 - Soaking in citric acid (1%) for 15 min ,T_5 - Soaking in ascorbic acid (0.5%) for 15 min ,T_6 - Soaking in ascorbic acid (1%) for 15 min ,T_7 - Soaking in tartaric acid (0.5%) for 15 min , T_8 - Soaking in tartaric acid (1%) for 15 min and T_9 - Control (Soaking in distilled water for 15 min). Similarly effect of pre-drying treatments (chemicals) on total carotenoids (µg/g) in carnation was studied using cultivar: Harvey with 9 treatments *viz*., T_1 - Soaking in sodium bisulphite (1%) solution for 30 min, T_2 - Soaking in sodium bisulphite (2%) solution for 30 min, T_3 - Soaking in magnesium chloride (5%) solution for 5 h ,T_4 - Soaking in magnesium chloride (10%) solution for 5 h ,T_5 - Soaking in magnesium sulphate (5%) solution for 4 h, T_6 - Soaking in magnesium sulphate (10%) solution for 4 h and T_7 - Control (Soaking in distilled water for 30 min). Minimum retention of total carotenoids (21.51 µg/g) was observed when flowers of cv. Harvey treated with distilled water for 15 min (T_9). Among the chemical treatments, minimum retention of total carotenoid content (17.86 µg/g) was observed when flowers of cv. Harvey treated with sodium bisulphite (2%) for 30 min (T_2). Hence, the pre-drying treatments should be utilized for producing better quality dehydrated flowers.

Keywords: carotenoids, chemicals, steam blanching, organic acids, carnation

Introduction
Carnation (*Dianthus caryophyllus* L.) the 'divine flower' or 'flower of the Gods' is one of the most important cut flower of the world, due to its excellent keeping quality, wide range of forms, ability to withstand long distances even after continuous shipping (Nagri and Singh, 2011) [3]. Carnation belongs to family Caryophyllaceae and is indigenous to the Mediterranean region. Particularly, France is considered as its origin and it is national flower of Spain, Monaco and Slovenia. The word for genus *Dianthus* was coined by Greek botanist Theophrastus and is derived for divine ("*dios*") and flower ("*anthos*"). Whereas, Linnaeus chose the species name, caryophyllus (*caryon*-nuts; *phyllon*-leaf) after the genus of clove, as the fragrance from carnation is reminiscent of clove. The common name, carnation is said to be derived from a Latin word *'carnatio'* (*caro; carnis* -flesh) and also from a Greek word *'coronation'* (*"corone"*- flower garland) as the Greeks wove *Dianthus* flowers to decorate crowns of their athletes.

Carnation in modern times has become one of the most important cut flower crops. Some of its varieties are used for bedding, pots, rock gardens, window boxes and edging too. Besides aesthetic value, carnation flowers are considered to be cardio tonic, diaphoretic and alexiteric. Carnation flower stalks are light in weight with more dry matter with variant colours, which are mostly photoretensive. In carnation, carotenoids enhance the value of dry flowers. Sharma *et al.* (2000) [5] reported that carotenoid degradation was least in steam blanched samples of carrot after dehydration when compared to water blanching. Wang Kun (2012) [6] found that the best method of colour keeping in red and pink carnation flower petals was pre soaking in 5% and 1% citric acid solutions respectively for 45 min followed by drying in hot air oven with silica gel embedding.

In India, very little organized research work was done in carnation flowers for production of dry flowers. The growing demand for dry flowers is increasing day by day due to change in purchasing power and living habit of the human being in the world. Keeping in view the above points, the present study on effect of predrying treatments on carotenoid content in carnation was conducted.

Material and Methods

An experiment was carried out entitled "carotenoids as influenced by the chemicals, steam blanching and oranganic acids in carnation" at College of Horticulture, Rajendranagar, Hyderabad during the year 2014. For conducting the experiment one, the organic acids viz., citric acid, ascorbic acid and tartaric acid which have the potential to protect the colour of some flowers like rose, rhododendron, peony etc. during the process of drying were used. Inexpensive and easily available chemicals *viz*., sodium bisulphite, magnesium chloride, magnesium sulphate which help in retention of colour during drying of flowers like rose, peony etc. were also used in conducting the experiment. Effect of pre-drying treatments (steam blanching and organic acids) on total carotenoids (µg/g) in carnation was studied using cultivar: Harvey in CRD with four replications and 9 treatments *viz*., T_1 - Steam blanching for 1 min, T_2 - Steam blanching for 2 min, T_3 - Soaking in citric acid (0.5%) for 15 min ,T_4 - Soaking in citric acid (1%) for 15 min ,T_5 - Soaking in ascorbic acid (0.5%) for 15 min, T_6 - Soaking in ascorbic acid (1%) for 15 min ,T_7 - Soaking in tartaric acid (0.5%) for 15 min , T_8 - Soaking in tartaric acid (1%) for 15 min and T_9 - Control (Soaking in distilled water for 15 min). Similarly Effect of pre-drying treatments (chemicals) on total carotenoids (µg/g) in carnation was studied using cultivar: Harvey with 9 treatments *viz*., T_1 - Soaking in sodium bisulphite (1%) solution for 30 min, T_2 - Soaking in sodium bisulphite (2%) solution for 30 min, T_3 - Soaking in magnesium chloride (5%) solution for 5 h ,T_4 - Soaking in magnesium chloride (10%) solution for 5 h ,T_5 - Soaking in magnesium sulphate (5%) solution for 4 h, T_6 - Soaking in magnesium sulphate (10%) solution for 4 h and T_7 - Control (Soaking in distilled water for 30 min). In both the experiments, Hot air oven drying at 55± 1 ^oC with borax + silica gel mixture as the embedding medium.

Total carotenoid estimation: It was done using saponification. Homogenized sample of 1±0.5 g was taken in a 100 ml conical flask and dissolved in 10 ml of working alcoholic KOH solution freshly prepared before analysis. The flask was incubated at 37 ^oC for 30 min, shaking intermittently. The contents were transferred into a separating funnel for extraction.

Extraction of total carotenoids: Extract the saponified mixture with petroleum ether. Use 50 ml of the solvent for each extraction in a separating funnel. Pool the upper solvent layer. Pool after each extraction in a separate 250 ml conical flask. Transfer the lower alcohol layer back to the separating funnel for next extraction. Repeat the process for 3-4 times or until a clear white layer is obtained indicating complete extraction. Pour the pooled petroleum ether layer into the separating funnel after discarding the lower layer, and wash three times with distilled water. Dispense the washed solvent into a conical flask and add 20-30 g of anhydrous sodium sulphate to remove excess water. Transfer the solvent to a 100 ml measuring cylinder, volume "y" is measured and noted, and OD of the solution (x) measured at a wavelength of 450nm in a spectrophotometer (UV- VIS, CE 7400).

Observations

O.D of the sample, x= ----------
Voiume of the pooled extract, y= ---------- ml
Sample wt., z= ---------- g

Calculations

1 OD = 4 µg/ml (10000/2500)
"x" OD= 4 x X µg
"y" ml contains 4X x Xy µg of total carotenes
4xy µg is derived from 'z'mg sample

$$\text{Therefore, } \frac{4xy \times 100}{z\ g} = \text{---- µg \%}$$

Total carotenoids are expressed in µg per 100 grams of the given sample following (Zakaria *et al*., 1979) [7]. The data were subjected statistical analysis to Completely Randomized Block Design for the above two experiments as per the procedure outlined by Panse and Sukhatme (1985) [4].

Results and Discussion

Influence of pre-drying treatments (steam blanching and organic acids): The total carotenoid content of carnation flowers as influenced by the pre- drying treatment with steam blanching and organic acids is presented in table 1 and depicted in fig 1. The data revealed that the total carotenoids was significantly affected by the pre-drying treatments. Maximum retention of carotenoid content was recorded when flowers of cv. Harvey treated with citric acid (0.5%) for 15 min (66.30) followed by cv. Harvey treated with tartaric acid (1%) for 15 min (59.75). Minimum retention of total carotenoids was observed with flowers of cv. Harvey treated with control soaking in distilled water for 15 min (21.51) and was on par with ascorbic acid (1%) for 15 min (21.75).

The observations confirm that maximum retention of total carotenoid content was recorded when flowers of cv. Harvey treated with citric acid (0.5%) for 15 minutes (66.55 µg/g). Citric acid pretreatment will constraint oxidation, inactivate enzymes, micro-organisms on surface and carotene is thoroughly protected. Bechoff *et al*. (2011) [1] noticed a slight improvement in carotenoid content of orange fleshed sweet potato chips with citric acid pre-treatment, under acidic pH. Le khac Lam Dien *et al*. (2013) [2] showed that steam blanching with 0.04% citric acid the gac fruit (*Momordica cochinchinensis*) powder retained more carotene than control owing to anti-oxidant activity of citric acid.

Effect of pre-drying (chemicals) treatments on total carotenoids (µg/g): The data on total carotenoid content of carnation dry flower as influenced by the pre-drying (chemicals) treatments is presented in table 2 and depicted in fig 2.

Total carotenoid content was significantly influenced among the pre-drying treatments. Maximum retention of total carotenoids was noticed when flowers of cv. Harvey treated with magnesium chloride (10%) for 5 h (80.72) followed by flowers of cv. Harvey treated with magnesium sulphate (5%) for 4 h (62.16). Total carotenoids retention was least when flowers of cv. Harvey were pre-treated with sodium bisulphite 2% for 30 min (17.86).

During the process of drying, the colour of the flowers is degraded due to isomerisation and enzymatic oxidation of the carotenoid pigment resulting in browning of the dried flowers. Pre-drying treatment of carnation flowers with magnesium chloride (10 %) for 5 h would have countered the isomerisation and enzymatic oxidation of carotenoids leading to the production of quality dry flowers with better sensory score for colour and overall acceptability and high carotenoid content.

From the study, it is concluded that minimum retention of total carotenoids (21.51 µg/g) was observed when flowers of cv. Harvey treated with distilled water for 15 min (T_9). Cv. Harvey treated with steam blanching for two min (2.05) recorded least score for shape among steam blanching and organic acids. Whereas minimum retention of total carotenoid content (17.86 µg/g) was observed when flowers of cv. Harvey treated with sodium bisulphite (2%) for 30 min (T_2), least score for brittleness (1.57) was recorded with control (soaking in distilled water for 30 min) among chemicals as pre-drying treatments. These results should be utilized for producing enhanced quality dry flowers in carnation.

Table 1: Effect of pre-drying treatments (steam blanching and organic acids) on total carotenoids (µg/g) in carnation cultivar Harvey

Treatments (T)	Total carotenoids (µg/g)
T_1 - Steam blanching for 1 min	37.86
T_2 - Steam blanching for 2 min	27.29
T_3 - Soaking in citric acid (0.5%) for 15 min	66.30
T_4 - Soaking in citric acid (1%) for 15 min	53.25
T_5 - Soaking in ascorbic acid (0.5%) for 15min	59.40
T_6 - Soaking in ascorbic acid (1%) for 15 min	21.75
T_7 - Soaking in tartaric acid (0.5%) for 15 min	25.50
T_8 - Soaking in tartaric acid (1%) for 15 min	59.75
T_9 - Control (Soaking in distilled water for 15min)	21.51
S.Em±	0.69
CD at 5%	2.02

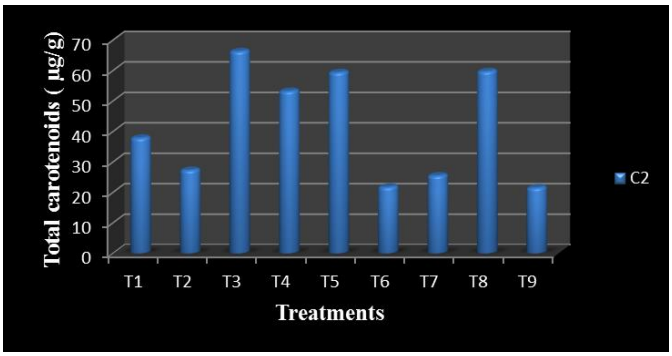

Fig 1: Effect of pre-drying treatments (steam blanching and organic acids) on total carotenoids (µg/g) in carnation cultivar Harvey

Table 2: Effect of pre-drying (chemicals) treatments on total carotenoids (µg/g) in carnation cultivar Harvey

Treatments (T)	Total Carotenoids (µg/g)
T_1 - Soaking in sodium bisulphite (1%) solution for 30 min	19.28
T_2 - Soaking in sodium bisulphite (2%) solution for 30 min	17.86
T_3 - Soaking in magnesium chloride (5%) solution for 5 h	61.26
T_4 - Soaking in magnesium chloride (10%) solution for 5 h	80.72
T_5 - Soaking in magnesium sulphate (5%) solution for 4 h	62.16
T_6 - Soaking in magnesium sulphate (10%) solution for 4 h	19.62
T_7 - Control (Soaking in distilled water for 30 min)	23.43
S.Em±	0.82
CD at 5%	2.44

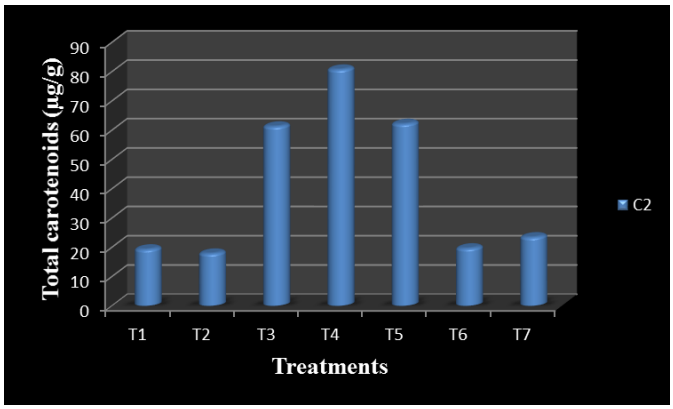

Fig 2: Effect of pre-drying (chemicals) treatments on total carotenoids (µg/g) in carnation cultivar Harvey

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