The Andhra Agric. J 62(2): 426-431, 2015

Prepackaging of Fresh-cut Cauliflower Curds

Pran K Thakur and Jahangir Kabir
Department of Post Harvest Technology of Hort. Crops. Faculty of Horticulture,
Bidhan Chandra Krishi Viswavidyalaya, Mohanpur- 741252, Nadia, West Bengal, India

ABSTRACT

Cauliflower curd pieces were subjected to pre-treatments viz., non-blanching treatment (T_1), hot water blanching (T_2) and vapour blanching (T_3) and packed in polyethylene 200 gauge (P) and polypropylene 100 gauge (PP) with 0% and 1% perforation and stored in ambient condition. In general it was observed that non-blanching treatment was superior to vapour blanching and vapour blanching was superior to hot water blanching in retaining the post-harvest quality of the curd. Polypropylene package exhibited better result compared to polyethylene in controlling the physiological loss of weight (PLW), blackening, textural degradation rate and sensory quality. PLW, textural degradation was least with non-perforated packages. The treatment combination T_1V_0PP (non- blanching X 0% perforation ´ polypropylene 100 gauge) was best because of lowest PLW, texture degradation and better sensory quality throughout the period of storage of the curd i.e., upto 5th day of storage. Other interaction treatments like T_1V_1PP (non-blanching X 1% perforation ´ polypropylene 100 gauge), T_3V_0PP (vapour blanching X 0% perforation X polypropylene 100 gauge) were also effective in retaining the quality of curd during storage.

Key words : Cauliflower, Fresh-cut, Prepackaging, Blanching.

India is the second largest producer of cauliflower in the world with an estimated production of about 6.74 million tons (Anon., 2011). In spite of high production, in a tropical country like India, it is difficult to maintain the quality and storability of the produce and a post harvest losses to an extent of nearly 25-40% occurs due to poor packaging and post harvest handling. Recently there has been an increase in demand for minimally processed fresh-cut vegetables due to their freshness, convenience and human health benefits. Among the limitation of fresh-cut products are spoilage, desication, discolouration, textural changes and development of off-flavour. When assessing the product quality, the consumer takes product appearance into consideration as a primary criterion, and colour is probably the main factor considered (Kays,1999). Plastic prepackaging provides protection against moisture loss and abrasion (Kharkongor *et al.,*2010), creates modified atmosphere and consequently reduces decay, softening and loss of solids (Sandha,2002) and enhance shelf-life. Considering the importance and limited information on the aspect, the present investigation was undertaken to standardize fresh-cut cauliflower in convenient size consumer package for efficient retail chain management and reduce the post harvest losses.

MATERIAL AND METHODS

Freshly harvested, white compact cauliflower curd with relatively smooth surface, tender texture, free from blemishes were cut and trimmed into 2.5 cm size pieces. The curd pieces were subjected to various pre-treatment viz., No blanching (T_1) , Hot water blanching (T_2), Vapour blanching(T_3) and then packed in polyethylene (P) (200 gauge 20.6 ´ 24.9 cm^2) and Polypropylene (PP) (100 gauge 22.5 ´ 20.5 cm^2) with perforation(vent) of 0% (V_0) and 1% (V_1) and replicated thrice .Thus different treatment combination were as follows: T_1V_0P (No blanching, 0% perforation of polyethylene 200 gauge), T_1V_1P (No blanching, 1% perforation of polyethylene 200 gauge), T_1V_0PP (No blanching, 0% perforation of polypropylene 100 gauge), T_1V_1PP (No blanching, 1 % perforation of polypropylene 100 gauge), T_2V_0P (Hot water blanching, 0% perforation of polyethylene 200 gauge), T_2V_1P (Hot water blanching, 1 % perforation of polyethylene 200 gauge), T_2V_0PP (Hot water blanching, (0%) perforation of polypropylene 100 gauge), T_2V_1PP (Hot water

blanching, 1 % perforation of polypropylene 100 gauge), T_3V_0P (Vapour blanching, 0 % perforation of polyethylene 200 gauge), T_3V_1P (Vapour blanching, 1 % perforation of polyethylene 200 gauge), T_3V_0PP (Vapour blanching, 0 % perforation of polypropylene 100 gauge), T_3V_1PP (Vapour blanching, 1 % perforation of polypropylene 100 gauge). The curd pieces in the polythene packages were stored in cool, dry place on racks at room temperature. The minimum and maximum temperature varied from 16.6°C to 17.0°C and 28.6°C to 30.6°C respectively and relative humidity 50-78.8%. Observation were recorded everyday during the period of investigation on physiological loss in weight (PLW%) , textural degradation and sensory quality. For determining the physiological loss in weight, cauliflower curd pieces packed in different polythene packages were weighed on the day of observation and expressed in percentage of the original weight. Changes in texture quality from firm curd pieces to soft curd pieces, very soft curd pieces and rotten curd pieces were observed individually by visual mean and expressed in percentage. Sensory quality was evaluated on the basis of general appearance and acceptability depending upon the condition of the curd as follows :1=Outstanding fresh like, 2=Bright, excellent white colour and free from blemishes, 3 = Good, mild yellowish no blackening, 4 = Fair, yellowish slight blackening, 5 = Poor, unacceptable, colour deteriorated, blackened and shriveled. The experiment was laid out in 3 factor factorial completely randomized design.

RESULTS AND DISCUSSION

Table 1 showed that individual effect of pretreatment, polyethylene packages and perforation for PLW were significant (5%) at different days of storage. Throughout the storage period PLW of T_1 (No blanching) remained significantly lower than T_3 (vapour blanching) while PLW of T_2 (Hot water blanching) was high and not available for observation after 2nd day of observation because curd pieces were not acceptable and subsequently rejected due to rotting. Further the effect of PP (polypropylene) and V_0 (non perforation) to P (polyethylene) and V (1 % perforation). The interaction effect of pretreatment, polythene packages and perforation on PLW is presented in (Table 2). It indicated that PLW of blanching × prepackaging × perforation were significant during storage period (from 1st day up to 5th day). On the 1st day PLW was least in T_1V_0PP 0.19 % followed by T_1V_1PP 0.22 % and T_3V_0PP 0.27 % in that increasing order. The PLW of cauliflower curd pieces increased gradually with increase in storage period. However the trend remain same and on the 5th day PLW was lest in T_1V_0PP followed by T_1V_1PP and T_3V_0PP in that increasing order.

Pre-treatment effect of textural degradation (Table 3) showed that treatment without blanching was superior to vapour blanching followed by hot water blanching during the storage period. Further polypropylene and non perforation had a better individual effect. The interaction effect of pretreatment, polythene packages and perforation on textural degradation of T_1V_0PP remained lower than T_1V_1PP and T_3V_0PP throughout the storage period (Table 4). Hot water blanched curd pieces were not available for observation after 2nd day of storage due to rotting.

The sensory score of T_1V_0PP remained good (2) up to 4th day and slightly deteriorated to 3 (fair) on the 5th day. The score of T_1V_1PP remained 3 both on 4th and 5th day (Table5). The hot water treated (T_2V_0P, T_2V_0PP, T_2V_1P, T_2V_1PP) curd were unacceptable (score 5) from 3rd day itself. The sensory score of vapour blanching treated (T_3V_0P, T_3V_0PP, T_3V_1P, T_3V_1PP) curds were poor (4) from 4th day onwards. However T_3V_0PP treatment (Vapour blanching+0% perforation + polypropylene) was fairly good and acceptable up to 4 days.

The results of different post-harvest physical characters revealed that in general non-blanching treatment was superior to vapour blanching and vapour blanching was superior to hot water blanching. Polypropylene package exhibited better result compared to polyethylene in controlling the PLW, shrinkage, blackening, textural degradation and sensory quality. Lower the perforation rate of package (irrespective of type of package) better was the retention of quality of cauliflower curd. PLW and shrinkage was least with non-perforated packages. The treatment combination T_1V_0PP (without blanching ´ 0% perforated ´ polypropylene 100 gauge) was best because of lowest PLW,

Table 1. Effect of pretreatment, Prepackages and perforation on PLW (%) of cauliflower curd.

Treatment	Storage period (days)				
	1	2	3	4	5
T_1	0.68	2.83	6.10	7.78	8.52
T_2	0.92	8.73	-	-	-
T_3	0.75	3.56	6.34	8.49	11.90
SE.m. (±)	0.003	0.005	0.004	0.003	0.005
CD (5%)	0.008	0.010	0.009	0.006	0.010
V_0	0.50	3.55	4.22	4.86	6.30
V_1	1.07	4.74	5.86	5.99	7.31
SE.m. (±)	0.003	0.004	0.004	0.002	0.004
CD (5%)	0.006	0.009	0.008	0.005	0.008
P	0.87	6.62	5.44	6.44	7.60
PP	0.70	3.46	2.85	4.41	6.02
SE.m. (±)	0.003	0.004	0.003	0.002	0.004
CD (5%)	0.006	0.009	0.008	0.005	0.008

Table 2. Interaction effect of pretreatment, prepackages and perforation on PLW (%) of cauliflower curd during storage.

Treatment	Storage period (days)				
	1	2	3	4	5
T_1V_0P	1.10	3.77	9.56	9.68	10.13
T_1V_0PP	0.19	0.45	1.45	3.18	4.30
T_1V_1P	2.17	6.56	10.25	11.20	11.57
T_1V_1PP	0.22	3.29	4.11	7.08	8.11
T_2V_0P	0.82	11.08	-	-	-
T_2V_0PP	0.33	1.44	-	-	-
T_2V_1P	0.51	11.08	-	-	-
T_2V_1PP	1.09	8.27	-	-	-
T_3V_0P	0.31	2.01	4.38	7.14	11.07
T_3V_0PP	0.27	0.65	3.17	7.05	10.58
T_3V_1P	1.14	3.71	7.16	9.17	12.83
T_3V_1PP	1.29	5.15	9.71	10.62	13.13
SE.m. (±)	0.007	0.010	0.009	0.006	0.010
CD (5%)	0.016	0.020	0.019	0.013	0.021

T_1 (No blanching), T_2 (Hot water blanching), T_3 (Vapour blanching) P_1 (Polyethylene 200 gauge), PP (Polypropylene 100 gauge), V_0 (0% Perforation), V_1 (1% Perforation), – (Rejected curd)

Table 3. Effect of pretreatment, prepackages and perforation on textual degradation (%) of cauliflower curd during storage.

Treatment	Storage period (days)				
	1	2	3	4	5
T_1	0.20	0.49	1.10	1.46	1.95
T_2	0.74	0.78	-	-	-
T_3	0.21	0.71	1.80	2.24	2.84
SE.m. (±)	0.020	0.029	0.048	0.014	0.037
CD (5%)	0.042	0.061	0.100	0.029	0.078
V_0	0.30	0.50	0.86	1.05	1.40
V_1	0.46	0.82	1.07	1.41	1.79
SE.m. (±)	0.016	0.024	0.039	0.011	0.030
CD (5%)	0.034	0.050	0.082	0.024	0.063
P	0.43	0.68	1.06	1.30	1.69
PP	0.34	0.63	0.87	1.17	1.51
SE.m. (±)	0.016	0.024	0.039	0.011	0.030
CD (5%)	0.034	0.050	0.082	0.024	0.063

Table 4. Interaction effect of pretreatment, prepackages and perforation on textual degradation (%) of cauliflower curd.

Treatment	Storage period (days)				
	1	2	3	4	5
T_1V_0P	0.26	0.60	1.26	1.72	1.99
T_1V_0PP	0.01	0.20	0.60	0.90	1.36
T_1V_1P	0.38	0.78	1.53	2.10	2.86
T_1V_1PP	0.13	0.40	1.00	1.15	1.62
T_2V_0P	0.53	0.75	-	-	-
T_2V_0PP	0.73	0.78	-	-	-
T_2V_1P	0.90	1.66	-	-	-
T_2V_1PP	0.80	0.80	-	-	-
T_3V_0P	0.19	0.40	1.60	1.98	2.30
T_3V_0PP	0.15	0.29	1.33	1.72	2.10
T_3V_1P	0.34	0.50	1.99	2.00	2.99
T_3V_1PP	0.20	0.79	2.29	3.27	4.00
SE.m. (±)	0.041	0.059	0.097	0.028	0.075
CD (5%)	0.084	0.122	0.201	0.059	0.156

T_1 (No blanching), T_2 (Hot water blanching), T_3 (Vapour blanching) P_1 (Polyethylene 200 gauge), PP (Polypropylene 100 gauge), V_0 (0% Perforation), V_1 (1% Perforation), – (Rejected curd)

Table 5. Effect of prepackaging on sensory evaluation of cauliflower curd during storage under ambient condition.

Treatment	Storage period (days)				
	1	2	3	4	5
T_1V_0P	1	2	3	3	4
T_1V_0PP	1	1	2	2	3
T_1V_1P	1	2	3	3	4
T_1V_1PP	1	2	2	3	3
T_2V_0P	3	4	5	-	-
T_2V_0PP	3	4	5	-	-
T_2V_1P	3	4	5	-	-
T_2V_1PP	3	4	5	-	-
T_3V_0P	1	2	3	4	4
T_3V_0PP	1	2	3	3	4
T_3V_1P	1	2	3	4	4
T_3V_1PP	1	2	3	4	5

T_1 (No blanching), T_2 (Hot water blanching), T_3 (Vapour blanching)
P (Polyethylene 200 gauge), PP (Polypropylene 100 gauge),
V_0 (0% Perforation), V_1 (1% Perforation)
1 = Excellent, 2 = Good, 3 = Fairly good, 4 = Poor, 5 = Unacceptable, – = rejected

shrinkage, texture degradation and good sensory quality throughout the period of storage of the curd i.e., up to 5th day. Other interaction treatments like T_1V_1PP (without blanching ´ 1% perforation ´ polypropylene 100 gauge) T_3V_0PP (vapour blanching ´ 0% perforation ´ polypropylene 100 gauge) were also effective in retaining the quality of curd during storage.

Blanching pretreatment followed by packaging has not been reported previously in cauliflower. Blanching pretreatment mainly employed for processing purpose to control the enzyme activity resulted in discolouration of curd. The cooking of the curd pieces during hot water blanching and excess moisture on the epidermal layer might be the possible reason for its susceptibility to fungal infection during storage (Frazier and Westhoff, 1997). The micro-environment created on the fruit surface became congenial for growth of dormant spores and as a result curds blanched with hot water were highly infected after 2nd days of storage and unavailable for further observation. Initially up to 2nd day of storage however there was no blackening due to inactivation of polyphenol enzyme activity (Lin, 1997).

According to Ceausescu *et al.* (1998) shelf life could be doubled in polyethylene (PE) bags than those stored without PE bags. Low density polyethylene has been reported to maintain a fresh flavour longer than thicker polyethylene which developed an off flavour (Madhavi and Ghosh 1998). In the present investigation however polyethylene with 200 gauge thickness was found to be inferior to polypropylene in controlling the PLW, shrinkage, and sensory quality. The superiority of polypropylene (with or without perforated) in prepackaging has been reported by Menjura and Villamizar (2004) which is in conformity with the present findings. Plastic bags helped in maintaining highest appearance and acceptability in cauliflower (Talukder *et al.*, 2003) and might also have acted as physical barrier for the decay organism up to a certain period (Jeong *et al.*, 1990). The shelf-life of 5 days at ambient condition in the present investigation has also been supported by Talukder *et al.* (2003).

LITERATURE CITED

Anonymous 2011 Indian Horticulture Database, National Horticulture Board, Ministry of Agriculture, Govt. of India.

Ceausescu M E, Amarintei A, Alexe C and Dobreanu M 1988 Performance in storage of some cauliflower varieties. *Productia Vegetala Horticulture,* 37(6) : 36 – 39.

Frazier W C and Westhoff DC 1997 Food Microbiology. Tata McGraw Hill Publishing Company, New Delhi.

Jeong J C, Park K W, Jang Y J 1990 Influence of packaging with high density polyethylene film on the quality of leaf lettuce (*Lactuca sativa* L. cv. Cheongchima) during low temperature storage. *Journal of Korean Soc. Hort. Sci.,* 31 (3) : 219 – 225.

Kays S J 1999 Preharvest factors affecting quality. Postharvest Biol. Technol., 15:223-247.

Kharkongor I, Pillo N G, Assumi S R and Kabir J 2010 Prepackaging of coriander (*Coriandrum sativum*). *Environment & Ecology,* 28 (2):940-943

Lin S B 1997 Drying and freezing. Drying of Vegetables. In: Processing Vegetables. Smith D. S, Cash J.N, Nip W. K and Hui J.H (eds). Technomic Publishing Co. Inc. Larcaster, Pennyslvania, USA. pp. 73

Madhavi D I and Ghosh S P 1998 Cauliflower. In Handbook of vegetable and technology. Solunkhe, D.K. and Kadam, S.S. (eds.). Published by Marcel Dekker Inc., 270 Madison Avenue , New York, pp. 330.

Sandha M S 2002 Pre and post harvest treatment for prolonged post harvest life of vegetables. In : Post harvest handling and fruits and vegetables, Sandhu, A.S. and Bol, J.S. (eds.) Published by Super Natural Design, 1808, Maharah Nagar, Ludhiana – 141004, pp. 81 – 84.

Talukder S, Uddin S, Khalequzzaman K M, Alam M, Islam Z and Khuda SMKE 2003 Prepackaging, storage losses and physiological changes of fresh cauliflower as influenced by post harvest treatments. *Asian J. Plant Sci.,* 2(5): 438-441

(Received on 13.11.2013 and revised on 14.10.2014)