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Effect of edible coating on quality of fresh cut sliced papaya

Deepika Kohli*, Aanchal Srivastava, Sanjay Kumar, Shuchi Upadhyay, Gurpreet Kaur
Department of Food Technology, Uttaranchal University, Dehradun, Uttarakhand, India

Abstract
The present study was carried out to evaluate the effect of coating on the quality of papaya fruit. The freshly harvested papaya fruits were sliced in equal size and coated with 2%, 3% and 4% CMC. The coated and uncoated fruits were stored at 4°C for 14 days. The quality of fruits was checked on the basis of change in TSS, physiological weight loss, size loss and vitamin C. It was found that the 4% CMC coated material shows minimum change in quality during storage as compare to other coated and uncoated material. The maximum change in TSS was 40% in uncoated samples. The physiological weight of samples decreases gradually during storage and maximum weight loss of 49 % was obtained in case of controlled samples. The size loss was observed to be minimum of 13% for 4% CMC coated fruits. The vitamin C loss was also observed during storage and maximum of 25% for uncoated samples was obtained.

Keywords: papaya, *Carica papaya* L., vitamin C

Introduction
Papaya (*Carica papaya* L.) is a juicy and tasty fruit which belongs to the family Caricaceae. Practically every part of the papaya plant is of economic value. Its uses range from nutritional to medicinal [1]. Papaya (*Carica papaya* L.) is an important fruit as it is good source of vitamins, dietary fibre and minerals and provides flavour, aroma and texture to the pleasure of eating. Fully ripened papaya fruits are usually eaten fresh as the enzymes in the fruit produce calm, soothing feelings in the stomach. Papaya is known for its fine and natural laxative virtue which aids digestion. The anti-inflammatory properties and high antioxidant content of papaya is known to prevent cholesterol oxidation and can be used in preventative treatments against strokes, heart attacks, diabetic, heart disease and blood pressure [2]. Papaya is a powerhouse of nutrients and is available throughout the year. It is rich source of threes powerful antioxidant vitamin C, vitamin A and vitamin E; the minerals, magnesium and potassium; the B vitamin pantothenic acid and folate and fiber. All the nutrients of papaya as a whole improve cardiovascular system, protect against heart diseases, heart attacks, strokes and prevent colon cancer. The fruit is an excellent source of beta carotene that prevents damage caused by free radicals that may cause some forms of cancer. It is reported that it helps in the prevention of diabetic heart disease. Papaya lowers high cholesterol levels as it is a good source of fibre [3].
Edible films and coatings are considered as a new approach for fruits and vegetables preservation especially through past decades. There are wide ranges of materials which are used to supply edible films and coatings such as lipids, polysaccharides, carbohydrates, proteins, and etc. each having many constituents. On top of that, each material includes different characteristics which cause unlike effects on food features [4]. Edible films and coatings mostly act as modified atmosphere and regulate O_2 and CO_2 transmission between coated fruits and environment, which in turn prevents ripening process that leads to senescence and decay [5].
The polysaccharides as coating materials for fruits have been applied extensively in the past few years. They have benefits of availability, low cost, and biodegradability [6]. Several cellulose derivatives such as methyl cellulose (MC), carboxymethyl cellulose (CMC), and hydroxylpropylmethyl cellulose (HPMC) are widely produced commercially [4]. The coatings and films based on these cellulose ethers are commonly transparent, flexible, odorless, tasteless, water-soluble, and resistant to O_2 and CO_2 [7]. Edible coatings based on cellulose derivatives have also been used to delay ripening in some climacteric fruits like mango, papaya and avocado [8, 9]. Effect of edible coating on the quality of fruit and vegetables was studied by many investigators, pineapple [10], mango [11], papaya [12] and avocado [13].
The present study addresses the increase of shelf life of fresh cut papaya and to investigate the effect of application of carboxymethyl cellulose coating on fresh cut papaya.

Materials and Methods
Materials: Papaya fruits were procured from local market in Dehradun, Uttarakhand. Care should be taken to procure papaya fruit without any defect on visual inspection, homogenous size, physiological maturity and intense yellow colour. Selected fruits were cleaned and washed by removing damaged fruits.

Coating formulation and application: The different concentration of CMC coating formulation (2%, 3% and 4%) the CMC was mixed in distilled water for 30 min by stirring at 60°C. Glycerol 2% w/v was added as plasticizer and the solutions were again mixed for 20 min by stirring at the same temperature. Then they were stored at room temperature to get

cold [14]. The fresh equal size cult fruits were dipped in different concentrations for 60 sec. All fruits were then air dried for approximately 60 sec and stored at 4°C and tested for quality with three replications for each treatment [14].

Qualitative attributes evaluation: Quality attribute were monitored on every alternate days by checking weight loss by using analytical balance [15]. Water loss was calculated in terms by following equation: (A-B)/A × 100, where A is initial weight of fruits and B is fruit weight after storage. The size reduction was measured by using vernier calliper [16]. TSS by using hand refractrometer of both coated and uncoated fruits. Vitamin C by the titramitric method [17]. The vitamin C (mg/100ml) = (y/x) × 10mg. x is amount of die used for standard solution. Y is amount of die used for sample solution.

Result and Discussion

The coatings films significantly conserved water content. The post-harvest weight changes in fruits and vegetables are mainly due to the loss of water which leads to wilting and shriveling. The physical weight loss was maximum for uncoated fresh cut papaya fruit. The effect of different concentration of edible coating on physiological weight loss was observed and show in Fig. 1. The weight of all cut papaya fruit was gradually decreased from first day to final day. The percent of physiological weight loss of uncoated fruits was higher as compare to coated material. The minimum loss was observed in case of 4% CMC. The weight loss was observed to be 49%, 47%, 23%, and 13% for control, 2% CMC, 3% CMC and 4% CMC coated fruits respectively.

The change in fruits size during storage period is shown in Fig. 2. The size of all cut papaya fruit was gradually decreased. The percent of size reduction of uncoated fruits was higher as compare to coated material. The minimum loss was observed in case of 4% CMC. The size loss was observed to be 45%, 42%, 30%, and 13% for control, 2% CMC, 3% CMC and 4% CMC coated fruits respectively.

At the refrigerated temperature, the ascorbic acid contents of coated papaya were significantly different from the control papaya. The reduction of ascorbic acid loss in coated papaya was due to the low oxygen permeability of CMC coating which lowered the activity of the enzymes and prevented oxidation of ascorbic acid. The change in vitamin C content in fruits during storage period is shown in Fig. 3. The ascorbic acid content of all cut papaya fruit was gradually decreased. The percent of vitamin C reduction of uncoated fruits was higher as compare to coated material. The minimum loss was observed in case of 4% CMC. The vitamin C loss was observed to be 25%, 23%, 20%, and 10% for control, 2% CMC, 3% CMC and 4% CMC coated fruits respectively.

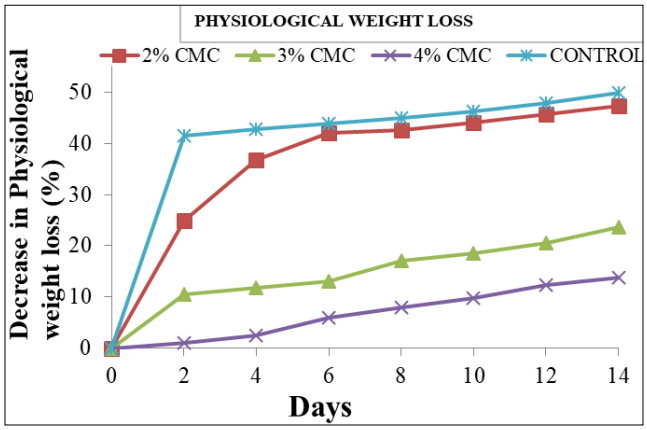

Fig 1: Effect coating on physiological weight loss of papaya fruit

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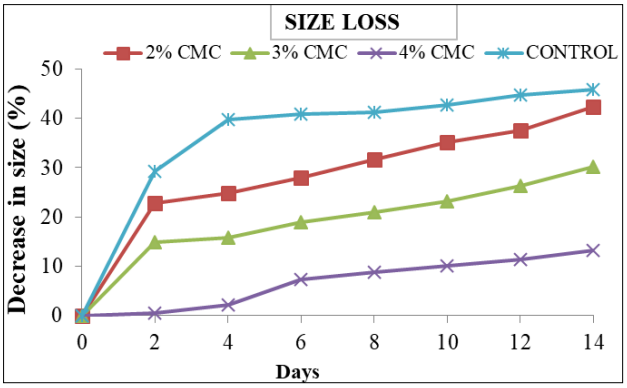

Fig 2: Effect coating on size of papaya fruit.

The change in TSS in fruits during storage period is shown in Fig. 4. The TSS of all cut papaya fruit was gradually decreased. The percent of change in TSS reduction of uncoated fruits was higher as compare to coated material. The minimum loss was observed in case of 4% CMC. The TSS loss was observed to be 40%, 36%, 34%, and 22% for control, 2% CMC, 3% CMC and 4% CMC coated fruits respectively.

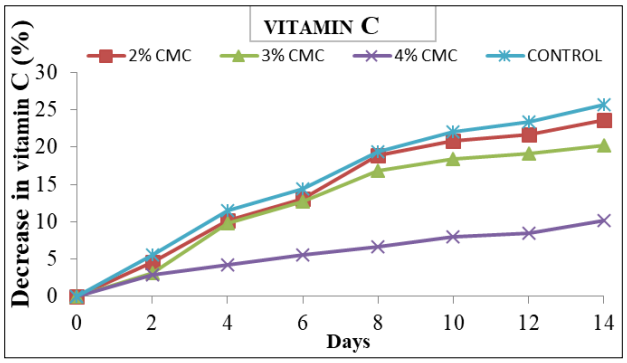

Fig 3: Effect coating on vitamin C of papaya fruit

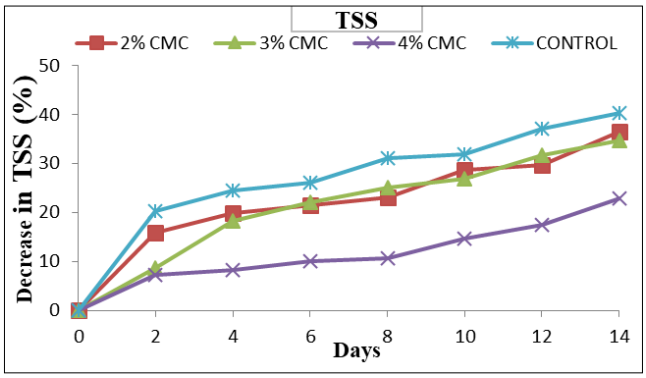

Fig. 4: Effect coating on TSS of papaya fruit

Conclusion

The 4% CMC coated material was found best to shows minimum change in quality during storage as compare to other coated and uncoated material. The maximum change was observed in case of uncoated materials. The minimum change in TSS was 22.9% in 4% CMC coated samples. The physiological weight of samples decreases gradually during storage and minimum weight loss of 13.7 % was obtained in case of 4% CMC coated. The size loss was minimum 13% for 4% CMC coated fruits. The ascorbic acid loss was also observed during storage and it was minimum 10 % for 4% CMC coated samples.

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