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Food & Nutrition Sciences: Minimal Processing of Fresh Cut Capsicum

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Abstract—*Minimal processing can provide fresh and quality products through a hurdle approach. Taking into consideration the present study is aimed on the objectives like Development of the surface sanitization protocol for fresh capsicum, Development of packaging system for the sanitized capsicum & Storage studies of the minimally processed capsicum. Surface sanitization was done by 10% Sodium hypochlorite solution. Then capsicums were cut into ready to cook form and treated with 2% Calcium chloride & Citric acid. For packaging the fresh cut capsicum, 8 types of packaging systems were developed for the minimally processed samples as well as the controlled sample. Storage studies of the samples were conducted for the parameters like weight loss, acidity and TSS. The effect of temperature was studied by keeping these samples in normal and refrigerated condition. The study revealed that HDPE and Zip PE without holes were ideal for storing. Self-life of the minimally processed sample was increased by 1 day in room temperature condition (38◦C) and 2 days in refrigerated condition (10◦C). The pith of capsicum is not edible at all. Thus by this minimal processing the cost involved in refrigeration and transportation can be minimized.*

1. INTRODUCTION

Fresh-cut vegetables are minimally processed, ready-to-use, trimmed and/or peeled, and/or cut parts of vegetables. These vegetables are usually pre-packaged for convenience and to retain freshness. Lettuce and prepared salads are the most common fresh-cut vegetables. However, carrot, tomato, broccoli, cauliflower, and cabbage are also available in fresh-cut form. The shelf life of fresh-cut vegetables is about a week. Fresh-cut vegetables fulfill rising consumer demand for healthy, palatable, safe, and easy to use/serve plant foods. In Indian context, the present day nuclear families need ready to cook and ready to eat foods because of paucity of time. Consumer is more health and quality conscious and more averse to chemical preservatives. Newer methods of processing are being tried to suit the changing needs of the consumers. Minimally processing can provide fresh and quality products through a hurdle approach. Reason is expenses, labour and hygiene to individual as well as catering industry.

2. OBJECTIVE

- Developing surface sanitization protocol for fresh capsicum.
- Designing the packaging systems for the sanitized capsicum.
- Storage studies of the minimally processed capsicum.

3. MATERIAL AND METHODS

3.1 Surface sanitization protocol for fresh capsicum and minimal processing of capsicum

Capsicums from the nearby market were bought .Then it was washed with normal water and dried under fan in ambient temperature. After that the capsicums were sanitized using 10% sodium hypochlorite solution. Then it was dipped in the solution for 4-5 minutes and dried in ambient condition for the water removal. Then the knives and the utensils were sanitized using hydrogen peroxide solution, worker's hands and the platform were also sanitized using the same.

The capsicums were cut by means of sterilized knife into ready to cook form. The cut capsicums were dipped in 2% of calcium chloride solution for 5 minutes then dried it under ambient condition. We again dipped it in citric acid solution for 10 minutes then dried it under ambient condition.

3.2 Development of packaging system for the sanitized capsicum

The cut and dried capsicum were packaged in 8 types of different packaging systems as listed below.

- High density polyethylene (HDPE) with holes
- High density polyethylene without holes
- Low density polyethylene (LDPE) with holes
- Low density polyethylene without holes
- Zip polyethylene (PE) with holes
- Zip Polyethylene without holes
- Theemoform container
- Paper bag

- Cling film

The samples were packaged in their respective packaging systems and coded symbolically for convenience in further studies. The symbols and their significance are listed below.

The symbolic name for the control samples (these samples were not treated/minimally processed) are like,

TKC+H-1: HDPE with holes, normal condition

TKC+H-2: HDPE with holes, refrigerated condition

TKC-H-1: HDPE without holes normal condition

TKC-H-2: HDPE with holes refrigerated condition

TNC+H-1: LDPE with holes normal condition

TNC+H-2: LDPE with holes refrigerated condition

TNC-H-1: LDPE without holes normal condition

ZC+H-1: Zip PE with holes normal condition

ZC+H-2: Zip PE with holes refrigerated condition

ZC-H-1: Zip PE without holes normal condition

ZC-H-2: Zip PE without holes refrigerated condition

TCC-1: Theemoform container normal condition

TCC-2: Theemoform container refrigerated condition

PCC-1: Paper container normal condition

PCC-2: Paper container refrigerated condition

1: Sample without packaging & treatment in normal condition

2: Sample without packaging & treatment in refrigerated condition

The symbolic names for the treated/minimally processed samples are like,

TKT+H-1: HDPE with holes, normal condition

TKT+H-2: HDPE with holes, refrigerated condition

TKT-H-1: HDPE without holes normal condition

TKT-H-2: HDPE with holes refrigerated condition

TNT+H-1: LDPE with holes normal condition

TNT+H-2: LDPE with holes refrigerated condition

TNT-H-1: LDPE without holes normal condition

ZT+H-1: Zip PE with holes normal condition

ZT+H-2: Zip PE with holes refrigerated condition

ZT-H-1: Zip PE without holes normal condition

ZT-H-2: Zip PE without holes refrigerated condition

TCT-1: Theemoform container normal condition

TCT-2: Theemoform container refrigerated condition

PCT-1: Paper container normal condition

PCT-2: Paper container refrigerated condition

The symbolic name of treated/minimally processed samples which were selected for acidity and TSS (Total Soluble Solid) measurement are as follows,

TKTA+H-1: HDPE with holes, normal condition

TKTA+H-2: HDPE with holes, refrigerated condition

TKTA-H-1: HDPE without holes normal condition

TKTA-H-2: HDPE with holes refrigerated condition

TNTA+H-1: LDPE with holes normal condition

TNTA+H-2: LDPE with holes refrigerated condition

TNTA-H-1: LDPE without holes normal condition

TNTA-H-2: LDPE without holes refrigerated condition

ZTA+H-1: Zip PE with holes normal condition

ZTA+H-2: Zip PE with holes refrigerated condition

ZTA-H-1: Zip PE without holes normal condition

ZTA-H-2: Zip PE without holes refrigerated condition

TCTA-1: Theemoform container normal condition

TCTA-2: Theemoform container refrigerated condition

PCTA-1: Paper container normal condition

PCTA-2: Paper container refrigerated condition

3.3 Storage study of the minimally processed capsicum

Both the treated & untreated fresh cut capsicums were packaged then kept for storage. The storage condition for the study included both in refrigerated and normal atmospheric i.e. room temperature. Experiments were conducted for measuring parameters like weight loss, acidity and Total Soluble Solid (TSS).

For observing the trend in weight loss we had measured the wt. of the samples as well as the packaging material. Form the code name of every package, we can identify what kind of packaging material is used and in what temperature condition it was kept. Each package contained 50 gm. of sample. The weight of packaging material like HDPE with holes, HDPE without hole, LDPE with holes, LDPE without hole, ZIP PE, Theemoform container, Paper container are 7.80gm., 10gm.,1.28gm., 3gm., 6.33gm., 8gm., 6gm. and 12gm. respectively. The weight loss was calculated by the formula, Weight loss = Initial Weight of the sample – Final weight of the sample. But in practical condition it was not desirable that we would directly measure the weight of the sample kept inside a package. This can cause both physical and chemical change in the sample. So each time we measured the wt. of the whole package and by deducting the wt. of the packaging material we can get the actual wt. of the sample.

For acidity measurement, 10 gm. of sample were taken and a paste was made by mortar and pestle. The paste was then heated in a heater and boiled for 10 minutes. Then 100 ml of sample was prepared and kept in centrifuge. The filtrate was taken and titrated against 1N sodium hydroxide solution. Acidity was calculated according to the formula, Acidity = (FBR-IBR)*Normality*100/Volume of the sample. Here FBR is Final Burette Reading and IBR is Initial Burette Reading.

For calculating TSS (◦Brix), we took few drops from the paste which was prepared from mortar and pestle. Juice was extracted from the paste and taken upon a glass slab. After that with the help of a hand refractometer, the TSS of the sample was recorded by visualizing clear cross mark inside graduated scale of refractometer.

4. RESULT AND DISCUSSION

The results were analyzed to study the shelf life period of minimally processed capsicum. The effects of different storage conditions as well as different packaging material on quality parameters of the minimally processed capsicum were also studied.

4.1 Effect of different packaging materials on weight loss

The minimally processed products must have a fresh appearance, visually acceptable, be of consistent quality throughout storage period inside the package, and be reasonably free of defects. More often the weight of the desired product must remain constant during the storage time period. When different samples were observed for the variation in their weight, we found that there is a negligible change in case of refrigerated (i.e. kept at 10◦C) samples. But a remarkable change in weight was found in case of samples kept in room temperature i.e. 38◦C.

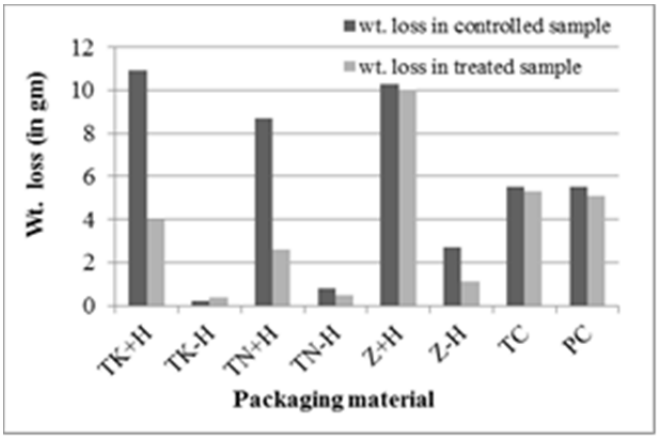

Fig. 1: Comparison of wt. loss of treated and controlled samples in normal condition

TKC-H-1 had least physiological loss in weight and the highest weight loss was observed for capsicum pieces kept in TKC+H-1. This clearly indicates that due to holes present in the packaging material caused the escape of moisture from the sample and hence the weight reduced. Unpacked fruit pieces had highest physiological loss in weight and completely damaged in one day and observation could not be taken. Similarly, the weight loss was minimum i.e.0.4 gm. for the sample TKT-H-1 and the weight loss was maximum i.e. 5.3 gm. for TCT-1.

4.2 Effect of different packaging materials on TSS

The TSS content of a fruit is usually obtained from assessing the ◦Brix of the fruit. The TSS content includes carbohydrates, organic acids, proteins, fats and minerals present in the matter. So it is important that the TSS should be balanced during the storage time period.

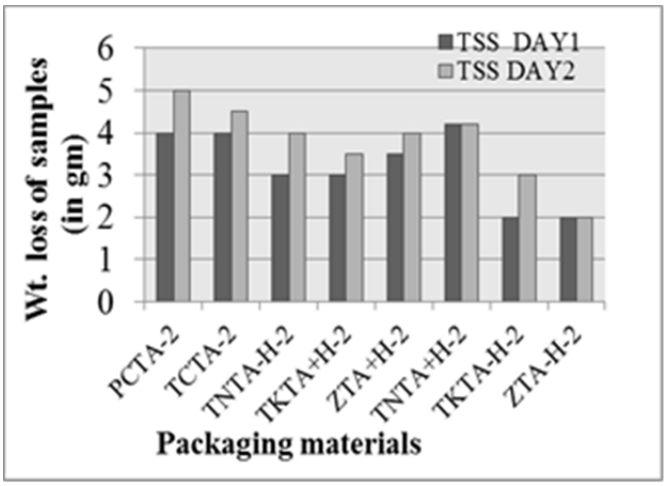

Fig. 2: Comparison of TSS in refrigerated samples.

It is clear from Fig. 2. that fresh cut capsicum pieces kept in TNTA+H-2 had highest value of TSS in day1 i.e. 4.2 which maintained the same fashion in day 2 also. But in the second day the highest value of TSS was found in the sample TCTA-2 i.e. 4.5. This clearly indicates that holes present in the packaging material caused the moisture to escape from the sample and hence the TSS value is higher. Unpacked fruit pieces had highest physiological loss in weight and completely damaged in one day and observation could not be taken. It can be marked that on the second day all the samples were having an increment in the TSS values. In case of paper container is showing the highest variation, this may be due to absorption of moisture by the container itself.

4.3 Effect of different packaging materials on acidity

The acidic strength of the processed material should maintain a constant rate. The fluctuation in this value is not desired.

Here it is clear from Fig. 3. that the acidic strength of sample-2 is 5. The sample like TCTA-2 and TNTA-H-2 are showing the minimum variation i.e. 5.55 and 5 respectively. The highest variation was observed in case of TKTA+H-2 i.e. 25. So this packaging system should be avoided. Other samples

like TKTA-H-2, TNTA+H-2, ZTA+H-2, ZTA-H-2, PCTA-2 are showing values like 8.33, 10, 12, 8.33 and 10 respectively. So by observing the acidic strength trait Theemoform container is best suited for the storage purpose.

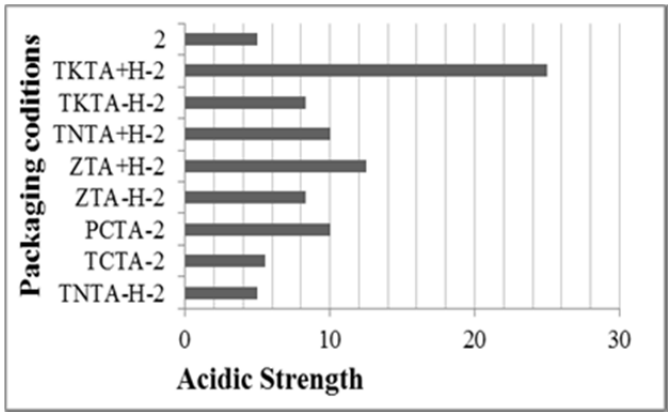

Fig. 3: Comparison of acidic strength of the samples

5. CONCLUSION

From the experiments it was analyzed that minimally processed capsicum remain fresh for longer time in Zip polyethylene which is without holes .In this case minimum change of acidity TSS and weight loss are desirable. For this purpose the ZIP PE and HDPE without holes suits the best. As we know the pith of capsicum is not edible at all. So in minimal processing we just cut it out and the capsicum took more space both in transportation and refrigeration. So by means of minimal processing we can minimize the cost involved in transport. We can also have a kind of organic food which is mostly preferred by educated consumers these days.

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