International Food Research Journal 22(2): 753-760 (2015)
Journal homepage: http://www.ifrj.upm.edu.my

Quality changes of fresh cut cantaloupe (*Cucumis melo* L. var Reticulatus cv. Glamour) in different types of polypropylene packaging

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Article history

Received: 9 January 2014
Received in revised form: 2 September 2014
Accepted: 5 September 2014

Keywords

Cantaloupe
Fresh-cut
Physico-chemical
Quality
Packaging
Microbial activity

Abstract

Consumers today prefer to purchase ready-to-eat, fresh-cut fruit that is readily available at the markets and retailers. They generally select the fresh-cut fruit base on the quality, freshness, nutrition and safety. The effects of packaging condition on fresh-cut Cantaloupe were studied during 18 days of storage at 2°C and 87% RH. Fresh-cut Cantaloupe pieces were packed in a Polypropylene (PP) container. As a control, the container was cover with lid without film, while Sample 1 (S1) was sealed only by a 40 µm PP film and Sample 2 (S2) was sealed with a 40 µm PP film and then adding the lid cover. Changes in colour, firmness Total Soluble Solids (TSS), pH, Titratable Acidity (TA) and Total Plate Count (TPC) were evaluated over time. During storage, it was found that the firmness significantly decreased from day 0 until day in all packaging conditions. Color parameters Luminosity (L*) and Chromaticity (C) were significantly change at the significance level of 95% ($p<0.05$) while hue angle (h_{ab}) were not significant ($p<0.05$) change for all types of packaging. Meanwhile, pH, Titratable Acidity (TA) and Total Plate Count (TPC) were significantly changed over time at the significance level of 95% ($p<0.05$). The fresh cut cantaloupe packed with the control method showed better appearance and quality as compared to the other treatments after 18 days of storage. These results suggest that the PP container with a lid cover only (control) is suitable to be used for fresh cut cantaloupe during the first 18 days of storage at 2°C.

Introduction

Cantaloupe (*Cucumis Melo* L.) fruits in Malaysia appear to be the biggest potential in fresh-cut product industry and offer the highest profit returns to our country. Cantaloupe is also known as Rockmelon in Malaysia. Rockmelon which is known as 'Timun batu' in Malay language are getting popular in our country. Nowadays, consumers are interested in knowing about the quality of food in storage. They are more concerned with health problems associated with food consumption and are likely to understand the physiological and biochemical changes that take place during storage (Watada and Qi, 1999; Lamikanra *et al.*, 2000). Changes in the texture, flavour and appearance are the limiting factors of fresh-cut product quality that have been reported in cantaloupes because fresh-cut fruits are more perishable than unprocessed fruits (Huxsoll and Bolin, 1989; Portela and Cantwell, 2001; Aguayo *et al.*, 2004). As the physiology of fresh-cut cantaloupe changes quickly, it is difficult to predict the perishability of cantaloupe.

Packaging of fresh- cut fruits provide an additional benefit to the consumer and are very convenient because it is ready to eat (James and Ngarmsak, 2010). Most of the published studies in this area have investigated the effects of Modified Atmosphere Packaging (MAP) on the quality of fresh cut Cantaloupe. These studies were reported by (Bai *et al.*, 2001; Boynton, 2004; Corbo *et al.*, 2010). Packaging is the main factor to preserve the fruits in order to extend the shelf life. It is important to keep the fruits fresh, safe and nutritious for the consumers. In addition, food packaging can also retard product deterioration, retain the beneficial effects of processing, and maintain or increase the quality and safety of food. In doing so, packaging provides protection from 3 major classes of external influences: chemical, biological, and physical. A wide selection of packaging materials is available in the market. One of the major polymers to be used in the food industry is Polypropylene (PP) material. These materials are safe, inexpensive, versatile and

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flexible (Tice, 2003).

No studies have been undertaken to evaluate the quality of fresh cut cantaloupe with different type of Polypropylene (PP) packaging materials. Most of the plastic films do not have the enough permeability to reach an in-bag, high gas concentration, so the process of non-aerobic respiration will be initiated (Ahvenainen, 1996). This objective of this study was carried out to evaluate the effects of Polypropylene (PP) packaging materials on the quality of fresh cut cantaloupe during storage for 18 days at 2°C and 87% RH.

Materials and Methods

Fruit preparation

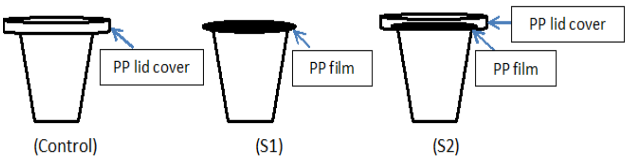
Cantaloupe melons (*Cucumis melo* L.var. Reticulatus) cultivar Glamour was purchased from a commercial grower farm, Selangor at a maturity of ¾ of full slip and transported to the Laboratory and stored at an optimum temperature of 10°C and 90% RH for 48 hours. The fruits were stored for not more than three days before the samples were prepared (Luna-Guzma´n *et al*., 1999). A quantity of fruits numbering 55 melons was withdrawn from the cold room at 10°C and 90% RH due to postharvest ripening (Zainal Abidin *et al*., 2013). The fruits were then stored for 18 days. According to Zainal Abidin *et al*. (2013), fresh cut cantaloupe can be processed for about three weeks and can be stored for 19 days in the marketplace.

Fresh-cut preparation

All the utensils were sanitized before starting the experiment to prevent contamination during the sample preparation and treatment as described by (Portela and Cantwell, 2001; Supapvanich and Tucker, 2011; Zainal Abidin *et al*., 2013). Ceramic knives, cutting boards, spoon, baskets, basins, and others were sanitized by immersion in 1000 ppm sodium hypochlorite solution inside the basins (Zainal Abidin *et al*., 2013). The fruits were taken from the cold room at 10°C and 90% RH and immediately washed with tap water and rubbed with the gloves for 1 min to remove the dirt on the surface of the skin. The melons were immersed in 150 ppm of hydrogen peroxide as a sanitizer before they were rinsed with tap water again and allowed to be air-dried. After that, the skin of the fruits was peeled with a sharp knife and immersed with deionized water to avoid contamination. Sharp knives were used to reduce the flesh wounding (Portela and Cantwell, 2001; Zainal Abidin *et al*., 2013). The procedures described by (Zainal Abidin *et al*., 2013) were followed whereby the melon fruits were cut into half and the seeds removed. The halved melons were then cut into eight wedge size parts, each of similar size of 3 cube-shaped melons, approximately 2.0 x 2.0 x 2.0 cm, were obtained from each wedge. The cubes were then dipped in 1% of calcium lactate as a treatment for 1 minute. According to (Garcia and Barrett, 2002; Lamikanra and Watson, 2004; Zainal Abidin *et al*., 2013), the post cut calcium treatment can improve the firmness, maintain cell turgor, membrane integrity and inhibit lipase activity in Cantaloupe fruits. The fresh-cut cantaloupe cubes were prepared and treated with 2°C of deionised water (Zainal Abidin *et al*., 2013). Each container contained eight melon cubes accompanied by a water absorbent (Supasorb PE F2/2, Thermarite, Malaysia). All the containers were stored at 2°C and 87% RH. The whole sample from each of three containers was measured on alternate days. Analyses were carried out immediately after sample preparation and at 3±1 day intervals, for up to 18 days. The analyses included firmness, colour, Total Soluble Solids (TSS), Titratable Acidity (TA), pH, and microbiological analysis (total plate count (TPC)).

Packaging condition and storage

The melon cubes were placed in polypropylene (PP) cups of 350 ml capacity (TLT containers, T-12, Malaysia). In each cup, nine cube pieces of melon approximately 200 g were placed into each container and heat sealed with sealer machine (WY-802D, Guangzhou Verly, China). For Sample 1 (S1) the containers were sealed with PP film only and Sample 2 (S2) where the film was sealed and covered with lid cover. For control samples, Polypropylene (PP) containers close with lid cover (PP) without sealing film as shown in Figure 1.



(1) Control: Polypropylene (PP) container without film and close with lid cover (PP)
(2) S1:Polypropylene (PP) container sealed with 40µm Polypropylene (PP) film without close lid cover (PP)
(3) S2:Polypropylene (PP) container sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

Figure1. Diagram of the samples used for three different conditions of packaging

All of the containers contained water absorbent (Supasorb PE F2/2, Thermarite, Malaysia). The fresh cut cantaloupe was stored for 18 days at 2 °C and

87% RH. For each treatment and sampling day, three replicates were used. The diagram below (Figure 1) shows the three different types of packaging for fresh cut cantaloupe.

Texture analysis

A TA.XTPlus Texture Analyser (Stable Micro Systems, Surrey, UK) with a 5 mm diameter (P/5) cylindrical probe attached was used to determine tissue firmness of the fresh-cut cantaloupe. Initially, a 5 kg load was set on the equipment for calibration. A two-cycle compression test was performed with the settings as follows: preset speed, 2 mm/s; test speed 1 mm/s; post-test speed 2 mm/s; distance as 30% strain; time 1 s; trigger force 20 g (Lamikanra and Watson, 2007; Zainal Abidin *et al.*, 2013). The result was recorded as maximum load in Newtons (N). The results of three replications were averaged to acquire a single value.

Colour

Colour measurement was performed by using a colour reader (CR 10 Tristimulus Colorimeter Konica Minolta, Japan). The measurement simply measures the target. After one second the colour difference is expressed as $L^*a^*b^*$. Three melon cubes from each of the three containers were measured on each evaluation day. Luminosity (L^*), greenness (a^*) and yellowness (b^*) values were recorded while chromaticity $C^*=[(a^*)^2 + (b^*)^2]0.5$ and hue angle hab = $\tan^{-1}[(b^*) \times (a^*)^{-1}]$ were calculated.(Machado *et al.*,2008 ;Zainal Abidin *et al.*, 2013).

Total soluble solid (TSS), titratable acidity (TA) and pH

The stored fruits were initially extracted with juice extractor to obtain juice. A drop of each fruit juice was pipetted onto a screen panel of digital Abbe refractometer (AR2008, KRUESS, Germany) to determine its soluble solids content. The results were recorded as degree Brix. As for the determination of pH, 10 ml of the fruit juice was added with 40 ml distilled water to form a mixture solution and was titrated (Model 785 DMP Titrino, Metrohm, Switzerland) with 0.1 mol/L NaOH until the pH reached 8.5.The TA was calculated as a percentage citric acid by the equation:

$$TA\% = [(EP1) \times (0.064) \times (C30) \times (100)] \times COO\text{-}1 \quad (1)$$

where EP1 is the end point of NaOH in ml when the pH reached 8.5, C30 is the molarity of NaOH, and COO presents the sample volume in ml.

Microbiological analysis

Microbiological growth in the melon cubes was observed as total plate count (TPC). The following method was applied by referring to (Luna-Guzma´n and Barrett, 2000). From each replicate, three random melon cubes of 10 g were collected using sterile techniques from a polypropylene container and homogenized (Stomacher, Seward 400, United Kingdom) with 90 ml of sterile Ringer solution (Oxoid, Basingstoke, Hampshire, England) in a sterile stomacher bag (Labchem Technology Centre, Malaysia) for 1 minute. The serial dilutions needed for sample plating were prepared in 9 ml of ringer solution. The pour plate method was performed using the following media and culture conditions: Plate Count Agar (Difco, Becton Dickinson Company, France) for TPC. The media of the TPC at 35±2°C for 48 hours, respectively. The microbial counts were expressed as log10(cfu g^{-1}).

Statistical analysis

The data collected was analyzed by using Microsoft Excel and the SAS 9.0 system (SAS Institute Inc., Cary, NC, USA) for analyzing the mean, standard error, variance (ANOVA), and least significant difference test (t-test) ($P<0.05$) to compare differences among treatment and sample storage time.

Results and Discussion

Firmness

Texture is an important characteristic that is highly desirable because consumers typically associate texture with freshness (Huxsoll and Bolin, 1989; Szczesniak, 1998, Fillion and Kilcast, 2002). Indeed, if consumers touch the fruit and observe that it is soft or limp, they will reject it (Barry *et al.*, 2007). Firmness and softening are both textural characteristics (Barry *et al.*, 2007). Firmness is affected by the growing conditions, including the environmental surroundings and the production practices (Sams, 1999). Figure 2 shows the firmness (N) of fresh cut cantaloupe during storage at 2°C and 87% RH for 18 days. Storing the fruit for 18 days at 2°C reduced the firmness where the percentage of loss (expressed as a percentage of the initial value) was 31.8% (control), 28% (S1) and 34% (S2). The initial value of firmness for all the samples was approximately 11 N-12 N. It was found that the firmness of all the samples decreased throughout the 18 days of storage. From the results, fresh cut Cantaloupe packed with a PP lid with 40 µm film (S1) shows the lowest percentage loss compared to other treatments for which the maximum and

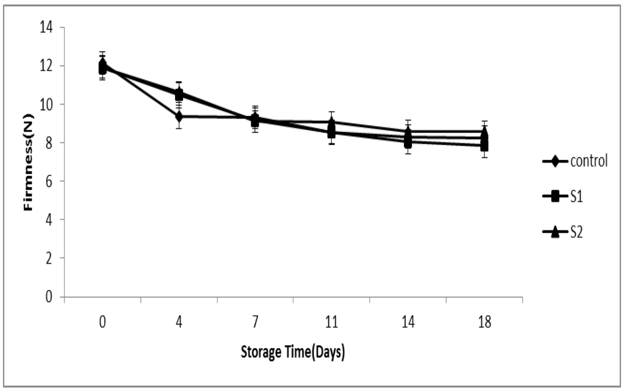


Figure 2. Means for firmness of fresh-cut cantaloupe stored for 18 days (2°C and 87% RH). (All samples were packed in Polypropylene (PP) container with three different conditions;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

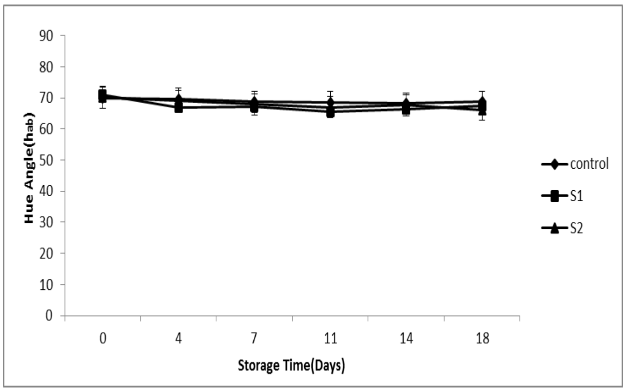


Figure 4. Means for Hue angle (h_{ab}) of fresh-cut cantaloupe stored for 18 days (2°C and 87% RH). (All samples were packed in Polypropylene(PP) container with three different conditions;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

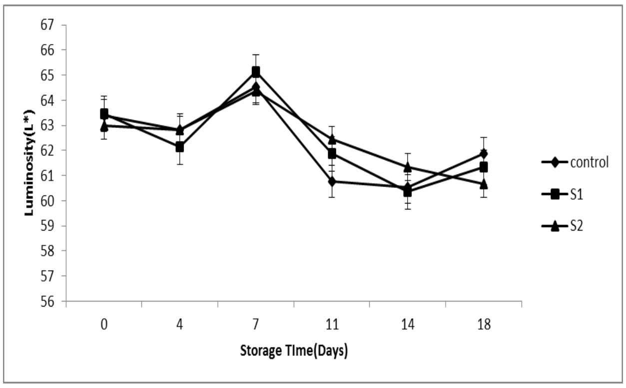


Figure 3. Means for Luminosity (L*) of fresh-cut cantaloupe stored for 18 days (2°C and 87% RH). (All samples were packed in Polypropylene (PP) container with three different conditions ;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

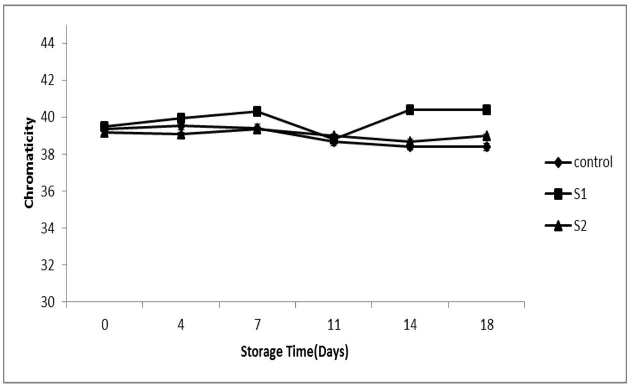


Figure 5. Means for Chromaticity of fresh-cut cantaloupe stored for 18 days (2°C and 87% RH). (All samples were packed in Polypropylene(PP) container with three different conditions;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

minimum average value of firmness is 12.58-8.26 N. The textural changes of fresh cut cantaloupe take place due to cutting the plant tissue, which increases the respiration rate, which in turn induces the ethylene production and is responsible for the major tissue disruption (Watada and Qi, 1999; Toivonen and De-Ell, 2002). Zainal Abidin *et al.* (2013) and Portela and Cantwell (2001) were both stated that, during the first four days of storage, the initial firmness of the fresh cut cantaloupe was very high, and decreased throughout the storage of 18 days. This indicated that the packaging can maintain the texture quality over 18 days of storage period.

Colour

The fruits are very attractive and eye-catching because they contain large amounts of pigments (Garcia and Barret, 2002). Colour has been considered as one of the primary criteria affecting product appearance (Kays, 1999; Olivas and Barbosa-Canovas, 2005) because it is assumed by consumers to influence the taste and sweetness (Clydesdale, 1993). Consumers will first look at the colour of a fruit to judge the product. Browning is a common problem for fresh-cut fruit, which lessens the attractiveness of products (Shewfelt, 1994). The results of surface colour measurement are shown in Figure 3, Figure 4 and Figure 5. Decreasing the L* values is related to the development of translucency. The presence of translucency in fresh cut samples reduces the quality of the appearance of the samples (Zainal Abidin *et al.*, 2013). Figure 3 shows the Luminosity (L*) of the fresh-cut cantaloupe during storage at 2°C and 87% RH for 18 days. The maximum and minimum average values of L* were 64.53-60.53 (control), 65.13-60.36 (S1) and 63.97-61.50 (S2). The initial

Table 1. Means for Total Soluble Solids (TSS), pH, and Titratable Acidity (TA) of fresh-cut cantaloupe stored for 18 days (2 °C and 87 % RH). (All samples were packed in Polypropylene(PP) container with three different conditions;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

Samples	Storage Time (Days)	Total Soluble Solids (TSS)(°Brix)	pH	Titratable Acidity (TA) (g citric 100 mL^{-1})
Control		9.07a	6.46a	0.087a
S1	0	9.30b	6.49b	0.082a
S2		10.73c	6.48c	0.082a
Control		9.47a	6.24a	0.090a
S1	4	9.63b	6.18b	0.097a
S2		9.27c	6.49c	0.165a
Control		8.57a	5.63a	0.145a
S1	7	9.50b	5.75b	0.085b
S2		9.53c	6.50c	0.146c
Control		7.77a	5.75a	0.104a
S1	11	8.83b	6.74b	0.076b
S2		8.57c	6.34c	0.163c
Control		7.20a	5.91a	0.197a
S1	14	7.87b	6.21b	0.099b
S2		8.27c	6.64c	0.194c
Control		8.20a	6.19a	0.205a
S1	18	7.63b	6.16b	0.126b
S2		7.37c	6.82c	0.203c

*Means followed by the same letter are not significantly different at P<0.05 for each column

L* value, as lightness, was 63 as shown in Figure 3.The Luminosity (L*) of the three samples decrease during the first 4 days. Then, the next 4 days until 7 days, the value for three samples increase. The fruit flesh is not uniform in colour which is probably due to different stages of maturity throughout the whole fruits.

From day 7 to day 14, the Luminosity (L*) decreased significantly at the level of (p<0.0.5). Although the L* values of fresh-cut cantaloupe decrease after day 7, there was no tissue browning in the sample which would be indicated by the reduced of L*. After day 14 up to day 18, control and S1 increased significantly at the level of (p<0.0.5) but S2 samples decreased significantly at the level of (p<0.05). These results show that dipping in calcium lactate combined with film-sealed containers will maintain the colour of the samples. Maintenance of colour is very important in the fresh-cut produce industry, where visual appearance on the shelf may be a key factor for extended shelf life purchases (Boynton, 2004).

Hue angle is the main property which describes a dimension of the colour of the fresh-cut samples. High lightness and a bright orange colour were observed for high quality cube surfaces (Bai *et a*l., 2001). Hue angle, hab and chroma are the parameters associated with a* and b* values. Patras *et al.* (2009) stated that the Hunter L, a* and b* or some combinations of a* and b* are the physical characteristics used to

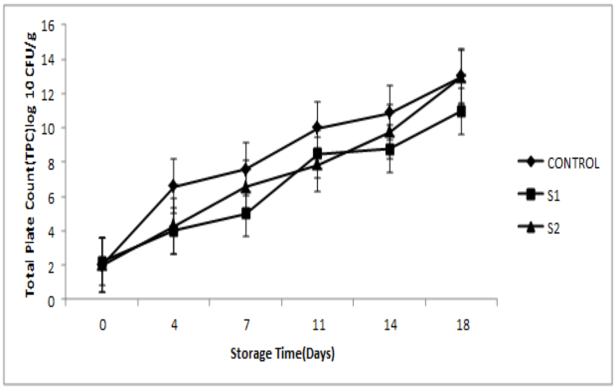


Figure 6. Means for Total Plate Count (TPC) of fresh-cut cantaloupe stored for 18 days (2°C and 87% RH). (All samples were packed in Polypropylene(PP) container with three different conditions;Control- close with lid cover (PP) without film, S1- sealed with 40µm Polypropylene (PP) film without close lid cover (PP), S2- sealed with 40µm Polypropylene (PP) film and close with lid cover (PP)

indicate the visual colour. Figure 4 shows the effect of three types of packaging on the hue angle from day 0 to day 18, where hue angle, hab maximum and minimum average values for control samples were 70.00 and 68.23, for S1 and S2 the values were 70.99 and 65.69, 72.32 and 66.77 respectively. From day 0 to day 4, all of the samples were decreased. There was no significant difference (p<0.05) between the three samples throughout the 18 days as the values were not affected by the type of packaging. According to Machado *et al.* (2008), the hab value of the fresh-cut cantaloupe remained stable at approximately 67 over the 18 days of storage at 5±1°C.

Chromaticity is the quality of the colour. The importance of chromaticity in fresh-cut fruit is to determine the colour saturation or intensity or purity. Figure 5 shows the chromaticity of the fresh cut cantaloupe, where the maximum and minimum average value for the control was 39.53 and 38.39, S1 was 40.40 and 38.81 and S2 was 41.03 and 39.02. From day 0 until day 11, the values of the three samples were constant and there is no significant difference at (P<0.05) between the samples. Studies from Zainal Abidin *et al.* (2013), stated that the chromaticity of fresh-cut cantaloupe whilst in storage, there was no significantly different and did not affect the surface browning and loss of yellow colour. This indicates that the colour of fresh cut cantaloupe became less saturated with increasing storage time. From day 11 until day 18, sample of S1 increased significantly at (p<0.05) meanwhile the control and S2 samples remained constant and no significant difference. In previous studies, Portela and Cantwell (2001) stated that a decrease in chroma and L* values of fresh cut cantaloupe was related to the development of a translucent or water soaking symptom. Low O_2 and elevated CO_2 atmosphere can also slow down the rates of surface browning (Soliva-Fortuny and Martı´n-Belloso, 2003). Hence, the type of packaging can influence the translucence and colour of the orange cube samples.

Total soluble solids (TSS), titratable acidity (TA) and pH analyses

Table1 shows the mean of Total Soluble Solid (TSS) for fresh-cut Cantaloupe at 2 °C and 87 % RH during 18 days of storage. Beaulieu and Gorny (2001) indicated that the best sugar level for fresh-cut Cantaloupe is between 10-13 °Brix. For the control sample, the minimum and maximum average value of TSS was 7.20-9.47 ºBrix meanwhile the other samples recorded 7.63-9.63ºBrix (S1) and 7.37-10.73 ºBrix (S2) throughout the 18 days of storage. From the results obtained, all of the three samples increased significantly by 95 % ($p<0.05$) from day 4 until day 18. At the end of the storage during, control samples remains at high level of TSS. The soluble solids content was affected by temperature and the storage period (Rivera-López *et al*., 2005). Cantaloupe fruits are categorized as climacteric fruits (Lyons *et al*., 1962) whereby climacteric behaviour with ethylene plays a major role in the regulation of the ripening process (Pech *et al*., 2008). During the maturing and ripening of fruits, the total soluble solids or the concentration of sugar usually increases and it can act as an indicator of maturity and the stage of ripeness. There were no significant effects of packaging material and storage time between the samples.

The pH of the fresh cut cantaloupe during storage is 2°C and 87% RH. The pH gives a measure of the acidity and alkalinity of the food product. Processing and storage conditions, such as high levels of CO_2, can affect the pH of the samples (Ke *et al.*, 1993; Barry *et al*., 2007). The approximate pH for Cantaloupe ranges from 6.1 to 6.6 (Parnell *et al.*, 2003; Corbo *et al*., 2010). Table 1 shows the pH of the fresh cut cantaloupe during storage at 2°C and 87% RH. The results of the experiment showed that the maximum and minimum average value of the pH for the control was 6.46-5.63, meanwhile for (S1) it was 6.74-5.75, and for (S2) values of 6.82-6.18 were recorded throughout the 18 days of storage. The samples for control and S1 decreased from day 0 until day 7 meanwhile for S2, the pH value remains constant, but after day 7 it started to increase at the significance level of 95% ($p<0.05$) for control sample and S2 but for S1,the sample decreased at ($p<0.05$). A rapid decrease of acid content and also the conversion to sugars during respiration is the major factor for the pH values to decrease (Barth *et al.*, 2009). Another factor that is related to the pH is browned, the activity of PPOs (polyphenol oxidases) (Barry *et al*., 2007).

From Table 1, the titratable acidity (TA) of the fresh cut cantaloupe during storage at 2°C and 87 % RH can be seen. Acidity is an essential indicator of fruit maturity and ripeness in post-harvest. The flavour quality of fruits is mainly balanced between sugar and acid content. The purpose of titratable acidity is to determine fruit maturity and to know the amount of acid present in the fruits. The maximum and minimum average values of the total acidity for the control was 0.205-0.087, (S1) 0.126-0.082, and (S2) 0.203-0.082.From day 0 to day 18 control samples and S2 increased but did not significantly. Meanwhile, for S1 the value was increased significantly at ($p<0.05$) from day 14 until day 18. The organic acid content in the fruit has decreased (Zainal Abidin *et al.*, 2013). The packaging has an effect on the fresh-cut cantaloupes in terms of titratable acidity.

Microbiological analysis

An increase in the population of mesophilic aerobic microorganisms is due to the process of slicing, trimming and shredding procedures and the ultimate temperature during storage (Nguyen-the and Carlin, 1994). The most common disease that attacks cantaloupe fruits is salmonellosis (Doyle, 1990; Tamplin, 1997). *Salmonella* is responsible for many cases of illness. Fresh produce becomes contaminated through contact with water during the process of handling by infected workers, and the disease does not grow at temperatures lower than 7°C (James and Ngarmsak, 2010). To prevent the survival and growth of the microorganisms, the effect of the processing and storage conditions is an important consideration. Figure 6 shows the total plate count (TPC) of fresh cut cantaloupe during storage at 2°C and 87% RH. Total Plate Count (TPC) growth were low at initial days (0 days) were about 2.00 logs 10 CFU/g for three samples. TPC increased in all samples as storage time increased. The TPC counts increased significant at ($p<0.05$) from 2.00 to 12.98 log 10 CFU/g for control, 2.00 to 10.98 log 10 CFU/g for S1, and from 2.00 to 12.97 log 10 CFU/g for S2 respectively. From the results, TPC were higher for control compared to S1 and S2 throughout the storage. The quality of the cubes in control and S2 samples on day 14 of storage were not acceptable, because the value of TPC is exceeded 109. According to Nguyen-the and Charlin (1994), microbial counts in fresh-cut cantaloupe must not be exceeded 109. As could be expected, the packaging, PP materials did not affect reduced by TPC growth. S1 samples were effective in maintaining the microbial counts below than 10^9 in fresh-cut products for 14 days (2 weeks) of storage.

Conclusion

The packaging is important to maintain the quality of fresh cut cantaloupe. From the results, outstanding differences among the films used were not found. Fresh cut cantaloupe packed with a PP normal lid, which was the control sample, was found to be suitable for general use. In addition to this, packaging for the control sample was cheaper than for sample S1 and sample S2 which used a 40 µm PP film. The control samples (with only a PP lid without any film) gave better appearance and maintained the quality of the fresh cut cantaloupe during the 18 days of storage at 2°C and 87% RH. A significant difference occurred for the firmness, Luminosity (L),Chromaticity(C), pH, Titratable Acidity (TA) and Total Plate Count (TPC). However, no significant differences were detected for the Total Soluble Solid (TSS) and hue angle (h_{ab}). The use of calcium lactate is strongly recommended to maintain the firmness, avoid discolouration and increase the lightness of the fresh cut cantaloupe

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