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Postharvest Application of Gum and Mucilage as Edible Coating on Postharvest Life and Quality of Strawberry Fruit

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Abstract

Strawberries have a very thin layer coating that easily disappears and are perishables a lot pre-harvest as such nearly 30 to 40 percent of strawberry fruits will be wasted at interval between harvest and consumption. In this study have been investigated the effect of using psyllium mucilage (Plantago psyllium) in concentrations of 6.25, 12.5 and 25 ml/l as well as Arabic gum and Arjan as edible coating in amounts of 0.5, 1 and 1.5 g/l on post-harvest life and quality of strawberry. Strawberry fruits of Kurdistan' type were immersed after preparing by above solution and then placed in containers PE at 4 ° C and on days 0, 2, 4, 6, 9 and 12 days after storage were measured their quality traits such as pH, anthocyanin, fresh weight, acidity, TSS, wrinkles. The results showed that fruits treated with 12.5 ml per liter psyllium mucilage had the highest rates of water and after treatments for Arabic gum0.5, Arjan 1, and 1.5 grams per liter and psyllium mucilage 25 ml per liter also showed a significant effect on retention of water. The conclusion after examined the quality of the fruit was that, gum treatments for Arjan 1 and 1.5 grams per liter, had the best quality fruit.

Keywords: Gum, Mucilage, Strawberries, Arjan, Psyllium, Post-harvest

Introduction

Scientific name of strawberry is Fragaria sp. belongs to red flower "Rosaceae" family and it seems that its original parents are F.virginiana from northeastern America with fragrant and small fruit of F.chiloensis from the west coast of North and South America with large fruit. The seeds resulting from cross-pollination between the plants, resulting in the production of strawberries Fraisier anqnos or strawberry pineapple and later became popular as F.ananassa which today, most large varieties of fruits have been derived of it and has 56 chromosomes (Behnamyan and Massiha, 2002). Strawberry fruit are prone to decay for high gentleness and sensitivity. The transport the fruits to distance are problematic because of this feature of fruits, so that the substantial amount of production lost at interval between pick up consumption of strawberries and/or the price will drastically drop due to low quality. Interest in the

possibility of using natural products to prevent microbial growth is increasing by consumers' pressure for reduction or elimination of chemical additives in fruit and vegetable (Lambert et al. 2001). Natural ingredients such as gums and mucilage are produced in large quantities in Iran, and prices of these materials are relatively small. A large group of polysaccharide is gums that their ability is determined by production high viscosity at low concentrations. The reason for segmentation gums and mucilage is that the first time they were separated from polysaccharides their solution was a slip mode which was called gum and other bunch of solutions which were slimy and sticky is called mucilage. But polysaccharide compounds can exist both slippery and sticky in terms of their structural changes. Arabic gum is among splinter gum with the features include lower viscosity increase, greater tendency to gel formation and slower film formation. Persian gum is a clear gum from Arjan tree (peanuts) belongs to red flowers family (Rosaceae) which in the Persian language it is called as Persian gum, Zedv, Zed, ezo, ezdo, gedu, Angum, or Qrasya gum in english and french respectively, is known as Gomme notras and gum zed. This gum is found in different colors due to its different chemical compounds. Like other resins Persian gum produce adhesive and viscous solution in water and have pharmaceutical, food, and industry applications (Abbasi and Rahimi, 2007). Mucilage is heteropoly polysaccharides containing galactose, xylose, arabinose, rhamnose and galacturonic acid with high molecular weight and insoluble in alcohol (omidbeygi2005). The mucilage is used as edible coatings for fruits and vegetables for increasing the shelf life of agricultural products (Park et al. 1994). Therefore, in this study were studied the effect of different levels of psyllium mucilage and Arabic gum and Arjan on some qualitative traits of strawberry fruit.

Materials and Methods

Materials

Strawberries were collected from a farm located in the city of Marivan. The average healthy fruits isolated and was used. Arjan gum was collected from peanut shrubs in Lorestan province and Arabic gum was obtained from Merck Co. Psyllium seed was prepared from a reputable selling herbs center in Tehran.

Method of testing

To evaluate the effect of different concentrations of gum Arabic and Arjan (0.5, 1 and 1.5 mg/ l) and Psyllium mucilage (6.25, 12.5 and 25 ml/ l) on postharvest strawberry quality traits, was performed an experiment in a completely randomized design with three replications and 3 fruits in every replications. To perform this experiment, fruits were washed first and in next phase were immersed in treatments for 5 minutes, then were laid on paper water retention for 30 minutes, after remove the excess moisture in polyethylene containers (volume 500 ml) were packed using cellophane wrap and were maintained in refrigerator at 4 ° C. Then were evaluated the following characteristics at intervals of 0, 2, 4, 6, 9 and 12.

Traits and ways of measuring

PH: Extracted smoothie of strawberry juice poured in basher and pH of the extracts was measured by pH meter. Acidity: Extract of strawberry juice filtrated and then made Titration with 0.1 normal NaOH by Titration method and acidity obtained based on consumed NaOH.

Soluble solids (Brix): We measured by ESR apparatus.

Anthocyanin: to measure Anthocyanin was used of Ankhla et al, 2005 approach.

Measuring the fresh weight: fruits were measured by a digital scale

The operation for measuring fruits quality was so that were arranged the numbers 1 to 4 to healthy fruit, low shrink, average wrinkled and high shriveled and much higher numbers had the fruits were lower quality.

Analysis of data

Data variance analysis was performed using SAS statistical software and comparison was applied by Duncan multiple range test at probability level of 5% and 1%.

Results and Discussion

1) The effect of treatments on fruit fresh weight

The results of analysis of variance (Table 1) showed that the effect of treatments in probability level 1% was significant on this trait and the effect of period showed a significant difference at the 5% level. The highest fresh weight mean was 12.5 for Psyllium mucilage and then treated Arabic gum 0.5, Arjan 1 and 1.5 grams per liter and 25 ml per liter of psyllium mucilage also showed a significant effect on water conservation and during the fourth and sixth days the water content remained constant and unchanged. The research results of Alikhani et al, 2011, were as follows that the treatment of mucilage Panyrak better controlled the percent of fruit weight loss by conserving juice which was consistent with the results of this study.

Table 1 - Analysis of variance of treatment effects on fruit fresh weight

Source of variation	Degrees of freedom	fruit fresh weight
Treatment	9	2.20**
Time	5	1.81*
Treatment *time	59	0.49^{ns}
Error	120	0.64
cv		15.58

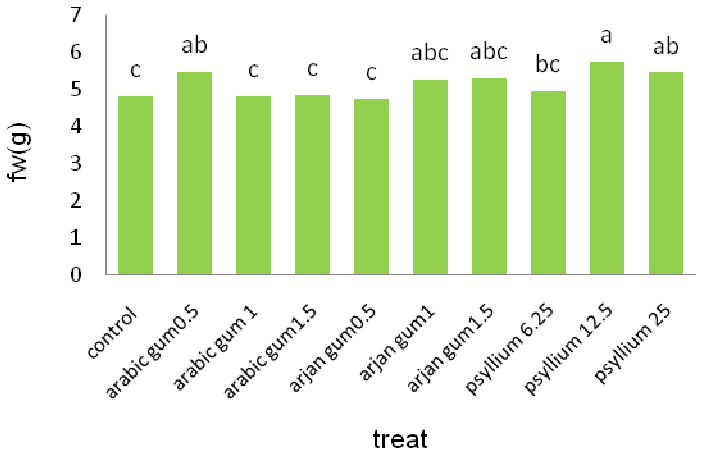

Figure 1 - Effect of treatments on fruit fresh weight

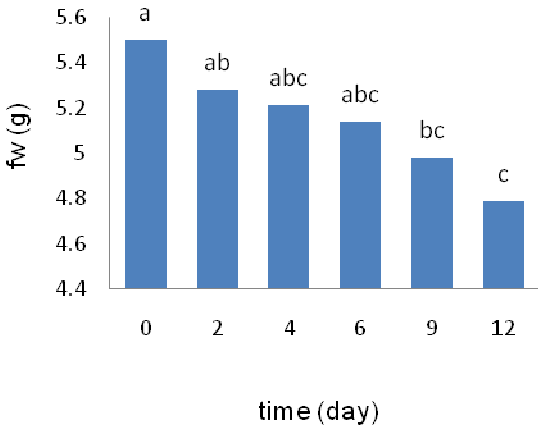

Figure 2 - Effects of time on fruit fresh weight

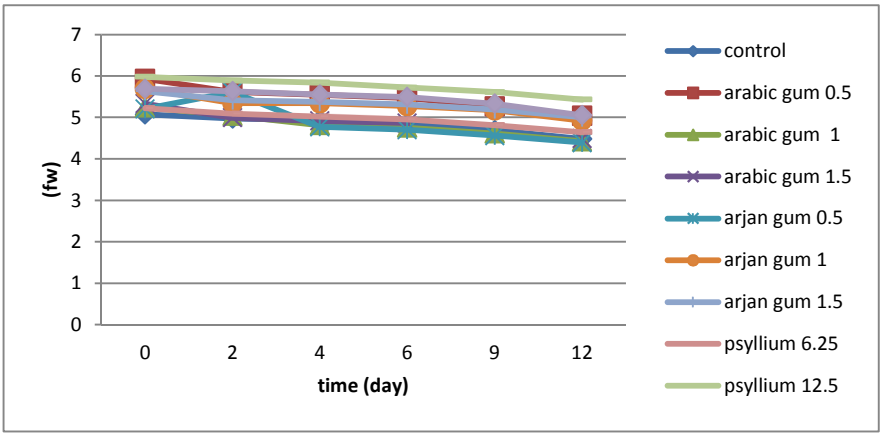

Figure 3 - Effect of treatment* time on the fresh weight of strawberry fruit

2) The effect of treatments on fruit quality

Treated Arjan gum 1 and 1.5 grams per liter had the highest quality of fruit. Psyllium mucilage 6.25 ml per liter, retained partially the quality of the fruit and by increasing concentration of psyllium reduced fruit quality as such 25ml per liter concentration was significantly lower quality; one of the reasons can be offered for this result is that the fungus requires a favorable environment for growth and among factors make a suitable content is moisture and as the results showed the psyllium will also retain moisture. Arabic gum, 0.5 and Arjan gum 0.5 grams per liter, were at significance level to control group. The result of Azizi and colleagues research showed that the use of mucilage nanoparticles (Astragalus gummifera), (Malva silvestris), basilicum) (Ocimum, (Plantago lanceolata), (Plantago psylium) and (Lallemantia royleana) as edible coatings, reduces mold and improve the quality of fruit in packing phase. Totally, the results of this study have shown that the mucilage derived from medicinal plants are a valuable polymer source and can be used them as an edible coating using nanotechnology.

Table 2 - Analysis of variance of treatment effects on fruit quality

Source of variation	**Degrees of freedom**	**fruit quality**
Treatment	9	1.52**
Time	3	1.21**
Treatment* time	39	0.49^{ns}
Error	80	0.20
cv		15.82

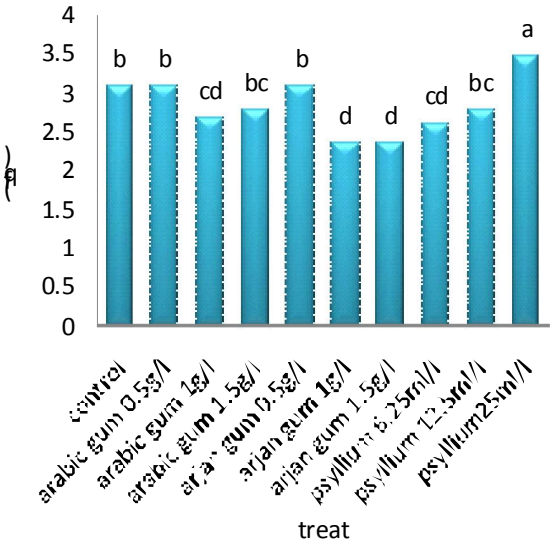

Figure 4 - Effect of treatments on fruit quality

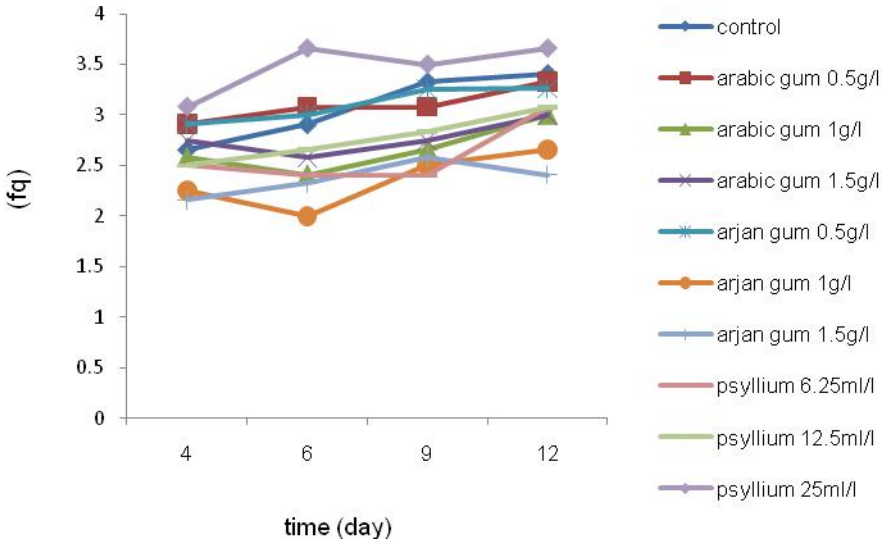

Figure 5 - The effect of time × treatment on fruit quality

Chart review for the effect of time × treatment determined that treatments of Arjan gum 1 and 1.5 grams per liter have minimal loss in quality during assessment days as such the Arjan gum 1 g per liter improved fruit quality within 4 to 6 days interval and in the sixth and twelfth day period resulted in reduced fruit quality, however, had the highest quality cuts in twelfth day and still, compared to the fourth day of control fruits were in better condition. Arjan performance at a concentration of 1.5 g per liter on fruit

quality was almost the opposite Arjan 1 g per liter, in other words between days 4 and 9 reduced fruit quality however, this decrease was less dramatic and fruit quality was improved within ninth to the twelfth day. Psyllium treatment 25ml /L from the fourth to the sixth day had the fast process in degradation of quality, and then from the sixth to the twelfth was relatively constant.

3) the effect of treatment on some quality traits

In addition to fresh weight and quality were also examined the effect of treatment on other traits; which the results are shown in the analysis of variance table.

Table 3 - Analysis of variance of treatment effect and time on quantitative characteristics of strawberry fruit

Source of variation	Degrees of freedom	PH	Acidity	TSS	Anthocyanin
Treatment	7	0.06^{ns}	1.3^{ns}	2.91^{ns}	0.56^{ns}
Time	3	0.1^{ns}	14.19**	91.71**	5.34^{ns}
Treatment *time	21	0.05^{ns}	0.88^{ns}	2.11^{ns}	1.92^{ns}
Error	64	0.04	0.77	1.70	1.65

Conclusions

The results indicate a significant effect of treatment (psyllium -25, and 12.5 ml per liter, Arabic gum 0.5 and Arjan gum 1and 1.5 g/ L) on fresh weight of strawberry fruits. But due to fruit quality assessment within 14 days of evaluation, it was observed that treatment of Arjan gum is maintained fruits in better condition. In other words, despite the fact that the highest fresh weight was for treated psyllium mucilage and increasing its concentrations was maintained the fresh weight of the fruits better over assessment time but as in one hand, it increases the fungus growth rate, it is concluded that Arjan gum treatments at concentrations of 1 and 1.5 g/ L is more appropriate in order to maintain both quality and fruits fresh weigh or it is better when using psyllium in order to retain juices used it in combination with a substance has anti-fungal properties which in this way, a treatment with two-fold purpose to prevent Fruit weight loss and fungal growth. However, given that can pay a small price to achieve much Arjan gum, using this combined plant are much more affordable economically than use of chemical pesticides and other natural ingredients.

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