International Journal of Scientific Engineering and Technology (ISSN : 2277-1581)
Volume No.3 Issue No.8, pp : 1016- 1019 1 Aug 2014

Novel edible coating based on Aloe Vera Gel to Maintain pistachio Quality

Maryam Vanaei[1] ,Naser Sedaghat[2], Hossein Abbaspour [2],Mehdi Kaviani [2],Hamid Reza Azarbad[2]
1.Department of Biology, Damghan Branch Islamic Azad University, Damghan, Iran.
2. Department of Food Science and Technology, Faculty of Agriculture, Ferdowsi University of Mashhad, Mashhad, Iran

Abstract :-

Pistachio has a crucial economic value, but show loss of quality due to unfavorable conditions during storage. Active packaging is a relatively novel concept of packaging that changes the conditions of the packaged food to extend its shelf-life and improve its safety. Because Aloe vera gel has been recently explored as edible coating, the objective of the present study was to evaluate the ability of this gel to reduce/control the loss of post harvest fresh pistachio quality, compare with a natural polysaccharide-chitosan, as an established coating material with antifungal activity. Freshly harvested pistachio fruits were coated with water for control, A. vera gel (100% and 50%), chitosan (.05%, .5% and 1%), mixture of them (50%A. vera gel+ 1%chitosan), and(50%A. vera gel+ 0.5%chitosan). The coated and uncoated pistachio was stored at 4ºC for 1 month. The parameters analyzed included physiological water conservation (PWC), sensory analysis for pistachio quality (colour and marketability), degree of spoilage, and Peroxide value of oil extracted from them. Results indicate that chitosan and A. vera gel are potential candidates to preserve post-harvest quality of pistachio; either showed that for coating of pistachio, chitosan .05% is better than other coating that followed with A. vera gel 50%+ Chitosan .5% coating. At last A. vera gel 100% is undesirable for coating of pistachio.

Keyword:-

Pistachio, Coating, Aloe vera gel; Chitosan; Marketability

Introduction

The traditional concept of a packaging is to preserve the quality of the product with a minimal product/packaging interaction, however, in recent years, a wide variety of packages have been employed for interaction with products to provide desirable effects (Silveira et al., 2007). Active packaging technology is a relatively novel concept that is aimed for extending the product shelf-life, maintaining its nutritional and sensory quality, as well as providing microbial safety (Cha & Chinnan, 2004). The ability of edible film or coating as a type of active packaging to carry some products additives such as antioxidants, antimicrobials, colorants, flavors, fortified nutrients and spices are being studied (Han, 2001; Pena & Torres, 1991).

Chitosan, a natural carbohydrate copolymer [-(1–4)-2-acetamido-d-glucose and _-(1–4)-2-amino-d-glucose units], which is yielded from deacetylation of chitin [poly-(1–4)-Nacetyl- 2d-glucosamine]; is harmless to humans, pets, wildlife, and the environment; and has been studied for efficacy in inhibiting decay and extending shelf life of fruits (Aider, 2010; No, Meyers, Prinyawiwatkul, & Xu, 2007). Chitosan and its derivatives have been shown to inhibit the growth of a wide range of fungi (Aider, 2010; No et al., 2007), so one of interest application of this biopolymer is products preservation because of its ability to be used as coating materials to extend the shelf life of different products (Moreira, Pereda, Marcovich, & Roura (2011); Sanchez-Gonzalez, Chafer, Hernandez, Chiralt, & Gonzalez-Martinez (2011)).

Recently, the use of Aloe vera gel as an edible coating has been reported to prolong the shelf life and to delay the changes in the parameters related to deterioration of quality (Martinez- Romero et al., 2006; Serrano et al., 2006).

Aloe vera, a cactus-like plant, is a perennial succulent belonging to the Liliaceae family which grows in hot and dry climates (Choi & Chung, 2003). The plant has triangular, fleshy leaves with serrated edges, yellow tubular flowers and fruits containing countless seeds.

For centuries, the yellow latex (exudate) and clear gel (mucilage), exuded from the large leaf parenchymatic cells of Aloe vera, has been employed for medical and pharmaceutical purposes such as anti-inflammatory effects, treatment of skin burns, protection of the skin against UV and gamma radiation damage, treatment of frostbite and psoriasis, supporting and enhancing the immune system, antiviral and antitumor activity, laxative effects, and, last but not least, wound healing (Wani et al., 2010). However, the main use of Aloe vera gel is mainly in the cosmetology and medication; more recently, it has found its place in the food industry as a source of functional foods in ice-cream, drinks and beverages (Moore & MacAnalley, 1995), and, due to antifungal activity of Aloe vera gel, as an unique edible coating (plain or in combination with other components) to extend the post-harvest storage of arctic snow (Ahmed, Singh, & Khan, 2009), apple slices (Chauhan, Raju, Singh, & Bawa, 2010), sweet cherry (Martinez-Romero et al., 2006), papaya fruits (Marpudi, Abirami, Pushkala, & Srividya (2011)) and table grapes (Serrano et al., 2006; Valverde et al., 2005).

A. vera gel based edible coatings have been shown to prevent loss of moisture and firmness, control respiratory rate and maturation development, delay oxidative browning, and reduce microorganism proliferation in fruits such as sweet chery, table grapes and nectarines 11-13. There are no reports presently on the post-harvest application of Aloe gel and chitosan coating on pistachio; therefore, the objective of this research was to elucidate the role of Aloe vera gel edible coating on the storage life of pistachio in comparison to chitosan coating.

Materials and methods

Preparation of Coating Solutions

Chitosan and Aloe vera gel coatings were prepared according to the method of Marpudi etal., 2011.

Sample preparation and coating application

Fresh pistachios were purchased from a garden in Damghan, and then randomly distributed into five groups with three replicates. First group immersed in water as the control (F0), Four other groups immersed in solutions of chitosan 1% (F1), chitosan 0.5% (F2) chitosan .05% (F3), Aloe vera gel 100% (F4) and Aloe vera gel 50% (F5), chitosan 0.5%+ Aloe vera gel 50% (F6), chitosan 1%+ Aloe vera gel 50% (F7) . After 5 min; pistachios were dried at 25 °C until their coatings became non-sticky to touch. Each of Fifteen groups was placed into plastic bag and was stored at 4 °C for one month.

Physiological water conservation (PWC)

After one month, the samples were dried in an oven. Then water conservation was calculated in terms of PWC by the following equation:

$$100 - \frac{(A-B)}{A} * 100$$

Where, A is the initial weight of Fresh pistachios after the storage period and B is oven dried pistachios.

Sensory evaluation

Sensory analysis was applied to determine quality of the differently coated pistachios stored for one month. A taste panel of 8 panellists participated in the sensory evaluation of pistachios. The sensory quality of each batch of coating was evaluated visually in terms of pistachio bark colour (5- ≥75% bright, 4- ≥50% to ≥75% bright, 3- 50% bright, 2- ≤50% to ≥25% bright, 1- ≥75% dark) and Marketability (5-Excellent, 4-Good with slight defects, 3-Fair and moderate defects, 2-Marketability limited, l-Not marketable).

Fruit Disease Index (FDI)

The differently coated pistachios were visually observed for fungal spoilage. The number of pistachios infected was recorded to assess the effect of the different coating on retarding fruit spoilage. Degree and Rate of Fruit Spoilage was reported as percentage disease index and calculated as follows:

$$\%\ Disease\ index = \frac{(0xa)(1xb)(2xc)(3xd)(4xe)}{a+b+c+d+e} * \frac{100}{x}$$

Disease index- Where 0,1,2,3,4,5 are infection categories(o- no lesions, 1- 5 to ≤15%, 2- ≥15% to ≤5%, 3- ≥25% to ≤50%, 4-≥50% to ≥75%, 5-≥75%); a,b,c,d,e are number of pistachios that fall into the infection categories and X-maximum number of infection categories(Marpudi etal., 2011).

Oil extraction

Each sample of coated pistachio was ground in a mill, and then oil extraction was carried out using a Soxhlet extraction system with hexane as solvent. An extraction time of 8 hours was chosen. After extraction, the extracts were evaporated on a rotary evaporater (Laborota 4001, Germany), and the samples were stored with the exclusion of light.

Peroxide value (PV)

Peroxide value of extracted oils was determined with the spectrophotometric method of the International Dairy Federation as described by Shantha and Decker (Schulte 2004) (thiocyanate method).

Statistical Analysis

Data were analyzed by one-way analysis of variance (ANOVA) using Excel and SPSS version 13 software. Duncan test was used to determine the difference at 5 percent significance level. All tests were done in three replicates.

Result

PWC

The effect of selected edible coatings on PWC can be seen in Fig. 1. PWC was found to be significantly (P<0.05) different among five different coatings. PWC was observed to be 85.43%, 85.9%, 86.7%, 90.3%, 85.9%, 88.1%, 87.6% and 85.5% for F0, F1, F2, F3, F4, F5, F6 and F7, respectively. Among the coated groups, F3 had significantly highest water preservation, and then PWC of F5 was higher than other groups, followed by F6, F2, F1, F7 and F0. Effects of F4, F1 and F7 on water preservation approximately were similar and the difference was to a lesser extent in these two coating groups compared to control (F0).

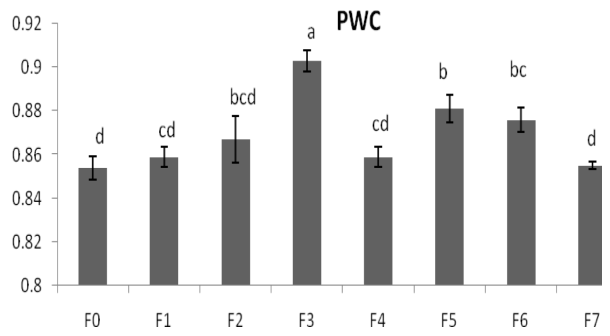

Figure 1. Effect of selected edible coatings on PWC.

Sensory Analysis

Colour and firmness, the major sensory attributes, were scored by panel members (Fig. 2) Colour was evaluated based on the bark colour with 5 as a score for bright to a score of 1 for complete dark. Bright colour of bark changed to dark during storage in both control and coated fruits, but degree of darkening was varying in samples. The F3 had shown a greater degree of darkness. At the end of one month colour was found to be better for F7 coated samples, followed by F6, F5, F2, F3, F0, F1 and F4 coating.

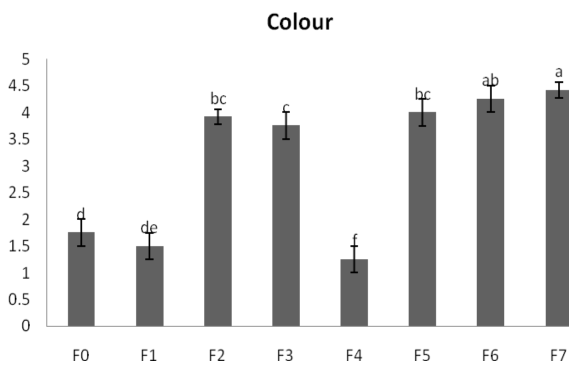

Figure 2. Effect of selected edible coatings on colour.

Marketability

Marketability values were found to be 2.5, 2.33, 3.33, 2.667, 1, 2.833, 3.66 and 3.41 for F0, F1, F2, F3, F4, F5, F6 and F7, respectively. At the end of one month marketability was found to be better for F4 coated samples, followed by F1, F0, F5, F3, F5, F2, F7 and F6 coating.

International Journal of Scientific Engineering and Technology (ISSN : 2277-1581)
Volume No.3 Issue No.8, pp : 1016- 1019 1 Aug 2014

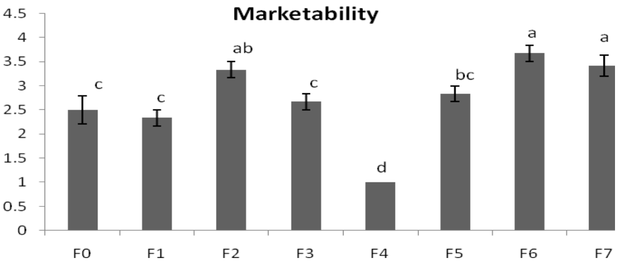

Figure 3. Effect of selected edible coatings on marketability.

Fruit Disease Index (FDI)

FDI was used as a measure to indicate the effect of selected coatings on the microbial quality of product. FDI was observed to be 9.5, 6.125, 3.58, 0.92, 1.135, 1.565, 0.476 and 7.075 for F0, F1, F2, F3, F4, F5, F6 and F7, respectively (Fig.4). Coated groups had lesser extent FDI compared to control (F0), but among them, F7 had higher FDI than other coating groups, followed by F2, F5, F4, F3 and F6. Thus effect of F6 for retarding pistachio spoilage is greater than other coatings.

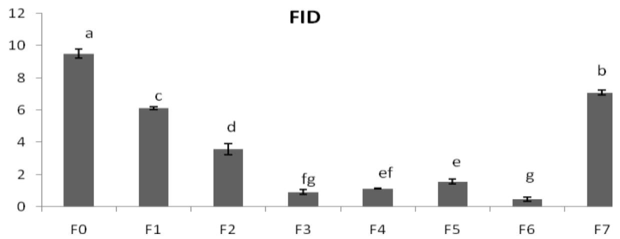

Figure 4. Effect of selected edible coatings on FDI.

Peroxide value (PV)

The PV shows the degree of oxidation in the substance and measures the amount of total peroxides as a primary product of oil oxidation. As be seen in Fig. 5, samples of F4 had Highest PV (even more than F0), followed by F1, F0, F7, F2, F5, F6, F2 and F3. These samples of F3 had least PV.

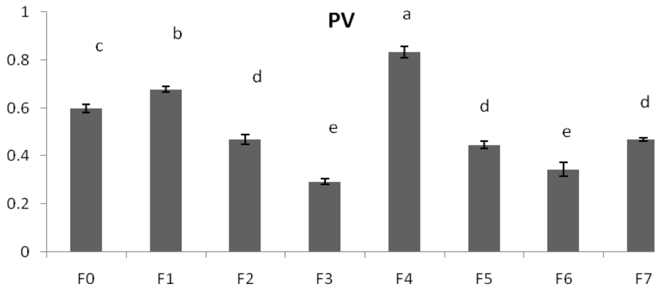

Figure 5. Effect of selected edible coatings on PV.

Discussion

The results have proved the ability of chitosan and *A.vera* gel coatings used in the present study to extent the post-harvest quality preservation of pistachio. At the end of storage time, results showed that .05% chitosan coating had the maximum effect in retarding the change in quality of pistachio (bark Colour darkening, lessen of marketability, decay and oil oxidation), to a greater extent than 50% *A.vera* gel, .5% chitosan and 100% *A.vera* coatings respectively. The retardation of physiological changes in the coated samples, indicates the ability of the selected coatings to maintaining the quality of the fruits (Marpudi etal., 2011).

Maintenance of bark firmness and marketability could be related to higher PWC, as reported earlier in sweet cherry treated with edible coatings (Yaman & Bayondirli 2002) and Aloe gel coated nectarine fruits (Ahmed et al., 2009).

In the present study, .05% chitosan and A.vera gel coatings showed the low disease index. A vena gel based coatings have been reported earlier to reduce microorganism proliferation in sweet cherries and table grapes (Valverde et al., 2005)

The oxidative stability is an important indicator for the quality of oil. Study on the oxidative stability of vegetable oils is required to measure the content of the primary and secondary oxidation products over time. Generally, these two measurements correlate well with each other, but in some studies no correlation has been found (Przybylski et al., 1993); which has been considered together with the peroxide value, as a classical index of primary oxidation products (White, 1995). Peroxide value (PV) is one of the most frequently determined quality parameters during oil production, storage, and marketing. The PV shows the degree of oxidation in the substance and measures the amount of total peroxides as a primary product of oil oxidation (Farhoosh R., Moosavi 2008). As be seen in Figures least oil oxidation of coated pistachios is related to .05% chitosan, followed by 50% A.vera gel, .5% chitosan, control and 100% A.vera respectively. PV of 100% A.vera gel coated pistachio was even rather than control. These results showed that since surface coating increase resistance of fruit skin to gas permeability, creating modified internal atmosphere (Banks et al., 1993) and reducing the respiration rate; maybe can said that each coating that reduced oil oxidation is more suitable for coating, rather than other coatings.

Result of this study showed that 100% A.vera since reduced quality of pistachio is not suitable for coating of pistachio; maybe due to its high concentration that can't penetrate in bark of pistachio. At the other hand, .05% chitosan and 50% A.vera since had greatly delayed the physiological changes, are suitable for coating and can be used for transport of fresh pistachio for long distance.

REFRENCES

i. *Ahmed M. J, Singh Z. & Khan A. S. (2009). Postharvest Aloe vera gel-coating modulates fruit ripening and quality of 'Arctic Snow' nectarine kept in ambient and cold storage. International Journal of Food Science and Technology, 44: 1024–1033.*

ii. *Aider M. (2010). Chitosan application for active bio-based films production and potential in the food industry: review. LWT-Food Science and Technology, 43(6): 837–842.*

iii. *Banks N. H., Dadzie B. K., & Cleland D. J., (1993) Reducing gas exchange of fruits with surface coating, Posthanest Biol Technol, 3: 269-284.*

iv. *Cha D.S. & Chinnan M.S. (2004). Biopolymer-based antimicrobial packaging: a review. Critical Reviews in Food Science and Nutrition, 44: 223–237.*

v. *Chauhan O. P., Raju P. S., Singh A. & Bawa A. S. (2010). Shellac and aloe-gel-based surface coatings for maintaining keeping quality of apple slices. Food Chemistry, 126: 961–966.*

vi. *Choi S. & Chung M. H. (2003). A review on the relationship between Aloe vera components and their biological effects. Seminars in Integrative Medicine, 1(1): 53–62.*

vii. *Choi S. & Chung M. H. (2003). A review on the relationship between Aloe vera components and their biological effects. Seminars in Integrative Medicine, 1(1): 53–62.*

viii. *Farhoosh R., Moosavi S. M. R. (2008).Carbonyl value in monitoring of the quality of used frying oils quality. Anal. Chim. Acta, 617, 18–21.*

ix. *Han J. H. (2001). Edible and biodegradable films/coatings carrying bioactive agents. Available from URL: www.den.davis.*

x. *Marpudi S. L., Abirami L. S. S., Pushkala R. & Srividya N. (2011). Enhancement of storage life and quality maintenance of papaya fruits using Aloe vera based antimicrobial coating. Indian Journal of Biotechnology, 10(1): 83–89.*

xi. *Martinez-Romero D., Alburquerque N., Valverde J. M. Guillen F., Castillo S., Valero D., et al. (2006). Postharvest sweet cherry quality and safety maintenance by Aloe vera treatment: a new edible coating. Postharvest Biology and Technology, 39: 93–100.*

xii. *Moore E.D., & MacAnalley B.H. (1995). A drink containing mucilaginous polysaccharides and its preparation. US Patent, 5: 443- 830.*

xiii. *Moreira M. D., Pereda M., Marcovich N. E. & Roura S. I. (2011). Antimicrobial effectiveness of bioactive packaging materials from edible chitosan and casein polymers: assessment on carrot, cheese, and salami. Journal of Food Science, 76(1: M54–M63.*

xiv. *No H. K., Meyers S. P., Prinyawiwatkul W., & Xu Z. (2007). Applications of chitosan for improvement of quality and shelf life of foods: a review. Journal of Food Science, 72: 87-100.*

xv. *Pena D. C. R., & Torres J. A. (1991). Sorbic acid and potassium sorbate permeability of an edible methylcellulose palmitic acid films: water activity and pH effects. Journal of Food Science, 56(2): 497-499.*

xvi. *Przybylski R., Malcolmson L. J., Eskin N. A. M., Durance-Tod S., Mickle J., & Carr R. (1993). Stability of low linolenic acid canola oil to accelerated storage at 60_ C. Food Science and Technology, 26: 205–209.*

xvii. *Sanchez-Gonzalez L., Chafer M., Hernandez M., Chiralt A. & Gonzalez-Martinez C. (2011). Antimicrobial activity of polysaccharide films containing essential oils. Food Control, 22(8): 1302–1310.*

xviii. *Schulte E. (2004). Economical micromethod for determination of polar components in frying fats. Eur. J. Lipid Sci. Technol., 106: 772–776.*

xix. *Serrano M., Castillo S., Valverde J., Martianez-Romero D., Guillean F. & Valero D. (2006). Use of Aloe vera gel coating preserves the functional properties of table grapes. Journal Agricultural and Food Chemistry, 54: 3882–3886.*

xx. *Silveira M. F. A., Soares N. F. F., Geraldine R. M., Andrade N. J., Botrel D. A., & Gonçalves M. P. J. (2007). Active film incorporated with sorbic acid on pastry dough conservation. Food Control, 18(9): 1063-1067.*

xxi. *Valverde J M, valero A, Martinez-Romero D, Guillen F. (2005). Castillo set al, Novel edible coating based Aloe vera gel on to maintain table quality and safety, J Agric Food grape Chem, 53 7807-7813.*

xxii. *Wani, M. Y., Hasan, N. & Malik, M. A. (2010). Chitosan and Aloe vera: two gifts of nature. Journal of Dispersion Science and Technology, 31(6): 799–811.*

xxiii. *White P. J. (1995). Conjugated diene, anisidine value and carbonyl value analysis. In K. Warner & N. A. M. Eskin (Eds.), Methods to assess quality and stability of oils and fat-containing foods (pp. 158–178). Champaign: AOCS Press.*

xxiv. *Yaman o & Bayondirli L. (2002). Effects of edible coating and an cold storage on shelf life and quality of chemes,LWT-Food Sci Technol, 35:146-150.*