J. Basic. Appl. Sci. Res., 3(6)24-27, 2013
© 2013, TextRoad Publication

ISSN 2090-4304
Journal of Basic and Applied Scientific Research
www.textroad.com

Edible Coating Effects on Storage Life and Quality of Apple

Mina Shariatifar*[1], EhsanJafarpour[2]

[1]Department of National Standardization of Organizaton of Iran, Isfahan, Iran
[2]Young Researchers Club, Najafabad Branch, Islamic Azad University, Isfahan, Iran

ABSTRACT

Fruits and vegetables continue to respire after harvest. A way for minimizing these problems is to coat the individual fruits and vegetables and to provide a protective film for prolonged freshness. The effect of application of Golden Delicious edible coating on weight loss, firmness and sensory characteristics was investigated for apple fruits. Apple coated with emulsion consists of sodium casein ate and glycerol then it was stored at 4◦C for up to 112 days. Coating significantly reduced weight loss of the apples.The firmness of the control fruits significantly ($P \leq 0.05$) decreased with the storage time. The application of coating delayed softening of apple fruit during 112 days of storage at 4◦C. Sensory characteristics of apples such as color, taste, tenderness, appearance and overall acceptability of coated apples were much better preserved while storing at 4◦C for 112 days. This report results indicated that usage of edible coatings with recognized emulsion from casein at, will be effective for apple fruits preserving and positive action of surface coatings in delaying ripening of fruits postharvest physiology and quality of coated commodities fruits are proved.

KEYWORDS : Edible coatings, quality, shelf life, weight loss, firmness, sensory quality and apple.

1-INTRODUCTION

Fruits and vegetables continue to respire after harvest, often this is called ripening. Respiration rate is controlled by regulation of oxygen and carbon dioxide in controlled atmosphere methods. Exposure to ordinary atmospheres also promotes desiccation or water loss which detracts from fresh quality and also promotes bacterial and fungal deterioration. An important approach to minimize or eliminate these problems is to coat the individual fruits and vegetables and to provide a protective film for prolonged freshness[4].

Edible films and coatings have received considerable attention in recent years because of their advantages including use as edible packaging materials over synthetic films. This could contribute to the reduction of environmental pollution. By functioning as barriers, such edible films and coatings can feasibly reduce the complexity and thus improve the recyclability of packaging materials, compared to the more traditional non-environmental friendly packaging materials, and may be able to substitute such synthetic polymer films[2].

Physico-chemical characteristics, and barrier properties to water vapor and gases(water loss, gas exchange, and modification of internal atmosphere) of edible coatings and action of surface coatings in delaying ripening of fruits and vegetables postharvest physiology and quality of coated commodities fruits and vegetables are investigated[3].

Edible films can be produced from materials with film forming ability. During manufacturing, film materials must be dispersed and dissolved in a solvent such as water, alcohol or mixture of water and alcohol or a mixture of other solvents. Plasticizers, antimicrobial agents, colors or flavors can be added in this process. Protein films such as casein are expected to be good oxygen barriers at low relative humidifies. Various types of protein have been used as edible films[2].

Edible films are cast from solutions of sodium or calcium caseinate and from emulsions of these proteins with acetylated monoglyceride, beeswax, and stearic acid can be used[1].

Free-standing sterilized edible films based on milk proteins, namely calciumcaseinate. Cross-linking of the proteins is achieved by the combination of thermal and radiative treatments. Physicochemical properties and bacterial resistance of these films are studied[10].

Effects of plasticizer hydrogen bonding capability and chain length on the molecular structure of sodium caseinate/glycerol and sodium caseinate/polyethylene glycol edible coating systems are reported[5].

γ-Irradiation is used to produce free-standing sterilized edible films based on caseinate. The effects of calcium ions and two plasticizers, namely propylene glycol and triethylene glycol, are investigated, as was the effect of the irradiation on both the gel formation and mechanical properties of the resulting films[7].

An optimal caseinate -acetylated monoglyceride edible coating produced a reduction in moisture loss from celery sticks. Similar edible coatings on apple fruits produced higher water vapor resistance[12].

Edible coatings and films are made from apple puree with various concentrations of fatty acids, fatty alcohols,beeswax and vegetable oil showed that the coating is novel method for extending the shelf life and improving the quality of fresh-cut apple[11].

***Corresponding Author:** Mina Shariati far, Department of National Standardization of Organizaton of Iran, Isfahan, Iranshariatifar_mina@yahoo.com

Sericina water-soluble globular protein derived from silk industry wastewaters investigated for coating of fresh-cut red delicious apples[14].

Apples are heat-treated before or after coating with chitosan and following treatment, and the effectiveness of the combined treatments on the ripeness, quality and decay is evaluated[13].

Five experimental coatings with different resistance to gas exchange are used with freshly apples and volatile evaporation rates are measured[8].

Double layers of buffered polysaccharide/lipid used for Cut apple pieces[6].The objectives of this study were to evaluate the effectiveness of edible coating in extending of the shelf life of apple and determine the effects on sensory quality, weight loss and firmness of coated apple.

2- MATERIAL AND METHODS

Apples were purchased from a cold storage about 2 weeks after harvest. About 20 kg of Golden Delicious apples with a minimum 8cm diameter were transported to Food laboratories of National Standardization of Organization of Iran-Isfahan, where they were stored at refrigerator with 4◦C and the test methods was planed.

The next day the apples divided into two parts, 14 kg coated with emulsion formulation and then stored in refrigerator with 4◦C and 6 kg without coating for blank.

2-1- Coating Formulation

Sodium caseinate were used to prepare emulsions which consisted of glycerol. These substances were food-grade approved and are used for emulsification and coating of diverse food products.

An emulsion was prepared by first dissolving 225 gr sodium caseinate in room temperature 1500 ml distilled water then heating the solution to 60℃ with constant stirring while adding 250 ml glycerol.After stirring the mixture was degassed under vacuum.

2-2- Coating Application

Coating were applied using the emulsions at room temperature. Apples were dipped in emulsion for 30s then dried at room temperature (≈23℃) by blowing air with a table fan and were held at refrigerator (4℃).About 30ml of emulsion were used to coat each kg of apples the coating became transparent and almost invisible after drying.

2-3- Sensory evaluation

During storage for 112 days coated apples were analyzed for sensory evaluation.Twelve sensory panelists were selected and for each sensory test panel 3 apples were washed then diced into 8 pieces and samples were presented in coded dishes.The panelists were given a hedonic questionnaire to test appearance,surface color, taste,tenderness, flavor and overall acceptability of coded samples of apples as a control, and after treatment with coating at each interval.

They were scored on a scale of 1–5 (1 = poor, 2 = fair, 3 = good, 4 = very good and 5 = excellent).

2-4- Weight loss

The weight losses of non-coated and coated apples during storage were compared.Coatings resulted in reduced weight loss during storage. The weight loss values within each group of samples during storage were significantly different (α=0.05) from each other.

Edible coating have been applied to reduce weight loss during storage and handling of fresh produced.The results are presentedin table1.

Table1- Weight loss and Firmness comparison in coated and non-coated apples

Test Factors	Weight loss(gr)						Fermness(kgf)					
Care type	Non-Coating			Coating			Non-Coating			Coating		
Repeat Test Factors	1	2	3	1	2	3	1	2	3	1	2	3
0 day	0	0	0	0	0	0	1/3	1/35	1/36	1/33	1/3	1/36
14 day	3/4	3/16	3/11	2/25	2/52	2/3	1/3	1/25	1/26	1/33	1/3	1/32
28 day	6/5	7/4	6/7	4/95	5/58	5/87	1/28	1/31	1/26	1/368	1/358	1/37
42 day	9/9	9/57	8/5	5/9	6/7	5/7	1/188	1/256	1/153	1/479	1/482	1/793
56 day	10/78	12	11/6	7/85	8/6	8/44	1/193	1/225	1/285	1/423	1/489	1/487
70 day	14/4	16/6	15/47	9/55	11	10	1/62	1/59	1/61	1/75	1/73	1/51
84 day	15/72	16	16/5	13/08	12/5	10/6	1/15	1/04	1/06	1/58	1/94	1/61
98 day	17	21/6	17/8	14/2	15/2	15/7	1/57	1/585	1/78	2/22	2/25	2/148

2-5-Firmness

An Instron Universal Testing Machine was used to measure apple firmness by a nondestructive test.Force readings were recorded at one point on the circumference of each of samples from coated and non-coated groups. The results provided in table1.

3- RESULTS AND DISCUSSION

Calcium ion crosslinking and combined effects of calcium ascorbate buffer (pH 4.6) reduced water vapor permeability of sodium caseinate films by 36%, 42%, and 43%, respectively. Calcium caseinate-beeswax emulsion films had water vapor permeabilities up to 90% lower than pure sodium caseinate films[1].

An optimal caseinate-acetylated monoglyceride edible coating consisting of 1.5% calcium caseinate and 1.5% acetylated monoglyceride produced a reduction (75%) in moisture loss from celery sticks. Similar edible coatings on apple fruits produced higher water vapor resistance[12].Increasing concentrations of lipids significantly improved the moisture barrier properties of films.Apple-based wraps significantly reduced moisture loss and browning in fresh-cut apples[11].This was explained in terms of protein/plasticizer aggregate size and changes to the conformation of the caseinate chain. In the film phase, glycerol caused more pronounced changes to the film tensile strength compared with polyethylene glycol. However, the effect of glycerol on film water vapor permeability was smaller[5].Cross-linking of the proteins was achieved by the combination of thermal and radiative treatments. The presence of proteins and pectin–agar in the film formulation enhanced ($P \leq 0.05$) the moisture barrier of the films by 18% [10].The coatings with intermediate gas resistance gave intermediate values of CO_2 and O_2 in the internal atmosphere in apples and the highest concentrations of butyl acetate and 2-methylbutyl acetate in the fruits. The coatings with the highest gas resistance caused high internal CO_2 and low O_2, resulting in anaerobic fermentation in apples and relatively high amounts of low-molecular-weight ethyl esters trapped within the fruit [9].

3-1- Sensory evaluation

Mean scores for sensory attributes during storage were determined and values with and without coating were compared. Note that the coating was removed from the apples when preparing samples for sensory tests. In order to confirm the role of coating as a keeping quality agent, sensory evaluation was carried out by 12 panelists.

Coded samples were introduced to panelists to evaluate surface color, taste, tenderness, appearance and overall acceptability of coated and uncoated apples at each interval. Sensory evaluation of coated and uncoated fruit at the end of the storage period revealed significant ($p \leq 0.05$) differences in color, taste, tenderness, appearance and overall acceptability. Results indicated that coatings increased the sensory quality acceptance of the apples.

3-2- Weight loss

The weight losses of non-coated and coated during storage were compared. The coating resulted in reduced weight loss during storage and control. The effect of coating on weight loss of apple fruits stored at 4℃ for different period of time (0-112 days) shows weight loss of the control fruits increased with storage time.

The comparison of the results in table1 showed that usage of edible coatings with recognized emulsion from caseinate will be effective for apple fruits weight loss.

The results obtained indicated that coating significantly ($p \leq 0.05$) reduced weight loss and acts as barrier against water loss.

3-3- Firmness measurement

The firmness of the control fruits significantly ($p \leq 0.05$) decreased with storage time. Coated fruits had significantly ($p \leq 0.05$) higher firmness values during storage than the control and the fruit firmness decreased gradually during the storage period. The results obtained indicated that coating significantly ($p \leq 0.05$) retained the firmness of the fruits and acted as a barrier against nutrients and water loss. At the end of storage time(112 days), control fruit clearly showed the lowest firmness. The comparison of the results in table1 showed that usage of edible coatings with recognized emulsion from caseinate, will be effective for apple fruits firmness.

The results of this study, showed that application of edible coating caused a significant delay in the loss of weight and firmness up to 112 days at 4◦C of storage temperatures.

In addition, sensory evaluation for taste, color, tenderness, appearance and over all acceptability showed that coating maintained the overall quality of the apple during storage. In conclusion, edible coatings seem to be an efficient way in extending shelf-life of apples.

REFERENCES

[1] Avena-Bustillos, R. J. and Krochta, J. M., 1993. Water vapor permeability of caseinate-based edible films as affected by ph, calcium crossing and lipid content. J. Food Sci. 58: 904-907.

[2] Bourtoom,T., 2008.Edible films and coatings: characteristics and properties. International Food Research Journal.,15(3):1-12.

[3]Cassandra ,A.N and Banks,H., 2010 .Postharvest Physiology and Quality of Coated Fruits and Vegetables, Horticultural Reviews., 26 : 161–238.

[4]Daniels, R.,1973 .Edible Coating and soluble packaging. F.d .Tech. Rev., 1(3): 66-95.

[5]Diana, C.W.,Siew, C.H.,Allan,J.E and Ralph, P. C., 1999. Solution and Film Properties of Sodium Caseinate/Glycerol and Sodium Caseinate/Polyethylene Glycol Edible Coating Systems .J. Agric. Food Chem., 47 (8):3432–3440.

[6]Dominic,W.S.W., Sandra, J.T., Hudson, J. S and avlath,A. E., 1994.Gas exchange in cut apples with bilayer coatings, .J. Agric. Food Chem., 42:2278–2285.

[7]Emna,M.,Giuseppe, D and Monique.L.,1998.Formation of Sterilized Edible Films Based on Caseinates: Effects of Calcium and Plasticizers, .J. Agric.Food Chem., 46 (1) 318–324.

[8]Ghadeer, F.M., Hamzah, M. A, Hifzi, A., and Barry, G., 2011.Antifungal Effectiveness of Potassium Sorbate Incorporated in Edible Coatings Against Spoilage Molds of Apples, Cucumbers, and Tomatoes during Refrigerated Storage . J .Food Sci., 76:210-217.

[9]Jinhe,B.R.,Hagenmaier, D and Elizabeth,A., 2002.Volatile response of four apple varieties with different coatings during marketing at room temperature. J.Agric. Food Chem., 50(26):7660–7668.

[10]etendre,M.,Aprano,G.,Lacroix,M.,Salmieri,SandGelais,D.,2002.Physicochemical properties and bacterial resistance of biodegradable milk protein films containing agar and pectin, J. Agric Food Chem., 50(21):6017-6022.

[11] McHugh,T.H, and Senesi, E., 2000.Apple Wraps:A novel method to improve the quality and extend the shelf life of fresh-cut apples. J. Food Sci., 65(3): 480–485.

[12] Roberto,D.J.A.B.,Krochta, J.M and saltveit, M.E., 1997.Water vapor resistance of red delicious apples and celery sticks coated with edible caseinate-acetylated monoglyceride films .J. Food Sci., 62:351-354.

[13]Shao,X.F.,Tu,K.,Tu,S and Tu,J., 2012. A Combination of heat treatment and chitosan coating delays ripening and reduces decay in"Gala" apple fruit. J. Food Quality.,35(2)83–92.

[14] Tipawan,T and Waree,T., 2011. Inhibitory effect of sericin on polyphenol oxidase and its application as ediblecoating, Int .J. Food Sci .Tech.,46(10): 2052-2061.