

Review Article

A Review on Plant Extracts for Improving Shelf Life of Apple (*Malus domestica*) and Banana (*Musa acuminata*)

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ABSTRACT

Keywords

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Self life, Edible
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friendly, Natural,
Storage

The present review paper is mainly focused on improving the shelf life of fruits by using plant extracts. It means coating the fruits with plant extracts. The shelf life was limited in the case of fruits like an apple (*Malus domestica*) and banana (*Musa acuminata*) that intended to transport. So, improving their self-life is an important task. There are many methods to store them like cold storage and early harvesting etc. And also people use different chemicals to increase their self-life. But, in the case of storing organic produce that uses natural methods to produce chemicals is not an option. So, many researchers had suggested diverse methods to overcome this problem. Using plant extract is one of them. The major advantage of this method is they are extracted naturally and they are edible. They are also eco-friendly in nature.

Introduction

Origin of apple can be found in Central Asia, (*Malus sieversii*), a wild ancestor of it can be found today. Apples are propagated through rootstocks. Due to the wide number of their cultivars that are nearly 7500 type's people can enjoy various types of apples with different characteristics. (*Malus pumila*) is an important temperate fruit that can be observed in India. Their cultivation can be observed in Himalayan states like Jammu Kashmir, Himachal Pradesh which is considered an apple bowl of India. It's a temperate crop. Hence, it cannot be produced everywhere. The shelf of apples is important as they needed to be transported.

Nutrition:

Carbohydrates: - 13.81g
Sugars: - 10.39g
Protein: - 0.26 g

And contain Vitamins like Calcium, Iron, Magnesium, Sodium, and Zinc. Eating an apple can prevent certain types of cancers as researchers suggest. (Boyer J, Liu RH, *et al.*, 2008).

Banana: - Cultivation of banana can be first observed in papa New Guinea (Lahav E. ET al.1995). Certain varieties of also needed to be transported.

Nutrition: - It contains high amounts of vitamin B6 and B12, also as magnesium and potassium.

Both apple and banana have high nutritional value and apple is expensive in comparison to other fruits. Their packing transport and export require much more time. So, improving their shelf life period is crucial.

Plant extracts are extracted from specific plants that have some medicinal properties like Neem and Aloe Vera. Then they applied as a coating around the fruits which forms a protective coating and acts as a barrier and prevents direct contact with the atmosphere. And also they are edible in nature. The plant extracts are extracted from the plant parts like fruits, bark, leaves, and roots. Drying them is followed process after extraction to make them fine powder. Then this powder mixed with equal amounts of water to make a thick paste to apply as a coating around the fruits.

In general, chemicals are used to coat the fruits. Chemical forms coating around the fruits which restrict the biological activity. But, they are harmful to both environment and humans.

Organic produce which strictly restricted in using natural fertilizers and storage methods. They need an alternate method for storage and transportation.

Advantages of using plant extracts:

- They can be used for organic produce without concern.
- Increases shelf life of fruits equal to chemical coatings.
- Eco-friendly.
- They require less skill in applying than chemicals.

Importance of plant extracts:-

Consumers of fruits have raised concerns about their health and also the quality of fruits (Lin and Zhao, 2007). And also rapid change in the environment increases health concern among people (Bhat *et al.*, 2011).

Post-harvest loss of fruits is increasing due to reasons like delayed harvesting, long transportation, and careless packing. Which not only affect their quality but also their shelf -life. Quality of fruits decides the market price (Yahia *et al.*, 1998).

After harvesting fruits lose their shelf life due to biological activities like respiration as well as pathogenic activity (Baldwin, E. a, Nisperos, *et al.*, 1995). Study on different fruits show that they have pathogenic activity on their surface. Pathogen such as *Staphylococcus* spp and *pseudomonas* spp was found on the surfaces of apple and banana (Gulhane *et al.*, 2018).

The rapid degradation of fruits is due to their direct contact with atmospheric moisture and the exchange of Oxygen. When they coated with chemicals or any plant extract it forms a layer around it. (Tunc *et al.*, 2003).

This kind of coatings will restrict the movement of air and also prevents the contact of pathogens to some extent (Avena-Bustillos *et al.*, 1997; Mchugh and Senesi, 2000)

Need to preserve the apples and bananas:

Apple and bananas need more periods of shelf life. Apples grow only in temperate zones they needed transport to extreme distances. During their transportation, they lost their shelf life. This is due to the direct interaction between the atmospheric Oxygen and moisture with apple. To prevent this they are generally coated with available coatings to reduce as much as contact between the apple and surroundings Water vapor

permeability varied from 69 to 125g mm/kPa d m². This kind of coatings preserve the internal moisture of fruits and also helps in preserving colors for up to 12 days (McHugh, E. Senesi). To prevent loss of their quality plant extract coatings are important. It prevents the degradation of fruits by increases their shelf life

The application of plant extracts is proven to increase the shelf-life and overall quality of fruits.

Some plant extracts perform the specific roles as follows.

Table.1 Plant extract and its purpose

Plant extract	Purpose	Reference
Guar Gum	Antimicrobial	Mahajan, Caleb, Singh, Geyer <i>et al.</i> ,2014
Soya bean gum	Overall quality	Mahajan, Caleb, Singh, Geyer <i>et al.</i> ,2014
Aloe Vera gel	Overall quality	Mahajan, Caleb, Singh, Geyer <i>et al.</i> ,2014
Chitosan	Overall quality	Mahajan, Caleb, Singh, Geyer <i>et al.</i> ,2014

Several plants extract including Aloe Vera and protein-based have shown desirable attributes on fresh produce with good edible properties and can form barriers without residual odor or taste and efficient antimicrobial activity. (Dhall RK *et al.*, 2013).

Quality will help in the grading of fruits. And also packing patterns can be changed based on their quality.

In general coating materials help the increased shelf life of fruits up to 3 weeks.

In the case of banana coating of edible solutions like Guar Gum improves self-life.

In conclusion, plant extracts that are from plants improve the shelf life of apples and banana regardless of the season. After coating their packing, storage and transportation will be easy. Plant extracts are relatively cheap when compared with other

chemicals that are used for storage. And also basic parameters like color can be maintained for long period. They can act as antimicrobial and protect overall quality. As they are edible people can eat them regardless of age. They are also eco-friendly by nature. They can be prepared at home.

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References

- Ayranci, E., Tuncs., "A method for the measurement of oxygen permeability and the development of oxygen permeability and the development of edible films to reduce the rate of oxidative reactions in fresh foods" Food Chem., Vol. 80, pp. 423-431, 2003.
- Avena-Bustillos, R.J., Krochta, J.M., Saltveit, M.E., "Water vapor resistance of red delicious apples and celery sticks coated with edible caseinate-acetylated monoglyceride films", Journal of food science, Vol. 62, pp.351-354,1997.
- Bai, R.K., Huang, M.Y., Jiang, Y.Y., "Selective permeabilities of chitosanacetica acid complex membrane for oxygen and carbon dioxide" Polym. Bull., Vol. 20, pp. 83-88, 1998.
- Baldwin, E.A., Nisperos- Carriedo, M.O., Baker, R.A. "Use of edible coatings to preserve the quality of lightly (and slightly) processed products. Critical Reviews in Food Science and Nutrition", Vol. 35, pp. 509-524, 1995.
- Bhat, R., Alias, A.K., Paliyath, G. "Essential Oils, and Other Plant Extracts as Food Preservatives", Progress in Food Preservation. New Jersey, John Wiley & Sons. pp. 539-580, 2011.
- Chauhan, S., Gupta, K.C., Agrawal, M., "Efficacy of natural extracts on the storage quality of Apple", International Journal of Current Microbiology and Applied Sciences, Vol. 3 Issue 3, pp. 1-6, 2014.
- Lin, D., Zhao, Y. 2007. "Innovations in the development and application of edible coatings for fresh and minimally processed fruits and vegetables", Comprehensive Reviews in Food Science and Food Safety, Vol.6 Issue 3, pp. 60-75, 2007.
- Lowings, P.H., Cutts, D.F. "The preservation of fresh fruits and vegetables", in Proc. Inst. Food Sci. Technol., Annual Symposium, Nottingham, UK, 1982.
- Mchugh, T.H., Senesi, E. "Apple wrap: A novel method to improve the quality and extend shelf life of fresh-cut apples", Journal of Food Science, Vol. 65 Issue 3, pp. 480-485, 2000.
- Perkins, Cyndi. "Is Aloe a Tropical Plant?", SFgate.com. Retrieved 13 February 2016.
- Puri, H. S. "Neem: The Divine Tree. Azadirachta indica", Amsterdam: Harwood Academic Publications. ISBN 90-5702-348-2., 1999.
- Tripathi, P., Dubey, N. "Exploitation of natural products as an alternative strategy to control postharvest fungal rotting of fruit and vegetables", Postharvest Biology and Technology, Vol. 32 Issue 3, pp. 235-245, 2004.
- Whistler R.L., Hymowitz T., "Guar: agronomy, production, industrial use and nutrition", Purdue University Press, West Lafayette, 1979.
- Yahia, E. "Modified and controlled atmospheres for tropical fruits", Horticultural Reviews, Vol. 22, pp. 123-183, 1998.
- Bhat, R., A. K. Alias, G. Aaliyah. Essential Oils and Other Plant Extracts as Food Preservatives. Progress in Food Preservation. New Jersey,

- John Wiley & Sons. Book Chapter. pp. 539-580.
- Boyer J and Liu RH. Apple phytochemicals and their health benefits. *Nutrition Journal*. 2004; 3:5. *J Food Compost Analysis*. 2008; 215: 396- 401.
- Laura Massini¹, Daniel Rico, Ana Belen Martin Diana, and Catherine Barry-Ryan. Valorization of Apple Peels. *European Journal of Food Research & Review* 2013; 31: 1-15.
- Sun JIE, Chu Y-F, Wu X, Liu RH. Antioxidant and antiproliferative activities of common fruits. *J Agri Food Chem*. 2002; 5025:7449-7454.
- Tajkarimi, M., S. A. Ibrahim. 2012. Phytochemicals as Anti-microbial Food Preservatives. *Dietary Phytochemicals and Microbes*. Online article. DOI: 10.1007/978-94-007-3926-0_7. pp. 07-235.
- Lipinski B, Hanson C, Lomax J, Kitinoja L, Waite R, Searchinger T. 2013 Reducing Food Loss and Waste. Working Paper, Instalment 2 of Creating a Sustainable Food Future. Washington, DC, USA.
- Warriner K, Huber A, Namvar A, Fan W, Dunfield K. 2009 Recent advances in the microbial safety of fresh fruits and vegetables. *Adv. Food Nutr. Res*. 57, 155–208.
- Caleb OJ, Mahajan PV, Al-Said FA, Opara UL. 2013 Modified atmosphere packaging technology of fresh and fresh-cut produce and the microbial consequences: a review. *Food Bioprocess Technol*. 6, 303–329. (doi:10.1007/s11947-012-0932-4)
- Olaimat AN, Holley RA. 2012 Factors influencing the microbial safety of fresh produce: a review. *Food Microbiol*. 32, 1–19. (doi:10.1016/j.fm.2012.04.016)
- Schirra M, D'Hallewin G, Ben-Yehoshua S, Fallik E. 2000 Host-pathogen interactions modulated by heat treatment. *Postharvest Biol. Technol*. 21, 71–85. (doi:10.1016/S0925-5214(00)00166-6)
- Lurie S. 1998 Postharvest heat treatments. *Postharvest Biol. Technol*. 14, 257–269. (doi:10.1016/S0925-5214(98)00045-3) .
- Tahir II, Johansson E, Olsson ME. 2009 Improvement of apple quality and storability by a combination of heat treatment and controlled atmosphere storage. *HortScience* 44, 1648–1654.
- Hong P, Hao W, Luo J, Chen S, Hu M, Zhong G. 2014 Combination of hot water, *Bacillus amyloliquefaciens* HF-01 and sodium bicarbonate treatments to control postharvest decay of mandarin fruit. *Postharvest Biol. Technol*. 88, 96–102. (doi:10.1016/j.postharvbio.2013.10.004).
- Maxin P, Weber RWS, Pedersen H, Williams M. 2012 Control of a wide range of storage rots in naturally infected apples by hot-water dipping and rinsing. *Postharvest Biol. Technol*. 70, 25–31. (doi:10.1016/j.postharvbio.2012.04.001).
- Gol NB, Patel PR, Rao TVR. 2013 Improvement of quality and shelf life of strawberries with edible coatings enriched with chitosan. *Postharvest Biol. Technol*. 85, 185–195. (doi:10.1016/j.postharvbio.2013.06.008) 13.
- Dhall RK. 2013 Advances in edible coatings for fresh fruits and vegetables: a review. *Crit. Rev. Food Sci. Nutri*. 53, 435–450. (doi:10.1080/10408398.2010.541568)

- Mohebbi M, Ansarifar E, Hasanpour N, Amiryousefi MR. 2012 Suitability of Aloe Vera and gum tragacanth as edible coatings for extending the shelf life of button mushroom. *Food Bioprocess Technol.* 5, 3193–3202. (doi:10.1007/s11947-011-0709-1)
- Ghasemnezhad M, Zareh S, Rassa M, Sajedi RH. 2013 Effect of chitosan coating on the maintenance of aril quality, microbial population, and PPO activity of pomegranate (*Punica granatum L. cv. Tarom*) at cold storage temperature. *J. Sci. Food Agric.* 93, 368–374. (doi:10.1002/js.5770)
16. Farkas J. 2014 Food technologies: food irradiation. *Encycl. Food Safety* 3, 178–186.
- Ferrier P. 2010 Irradiation as a quarantine treatment. *Food Policy* 35, 548–555. (doi:10.1016/j.foodpol.2010.06.001)
- Mahto R, Das M. 2013 Effect of gamma irradiation on the physicochemical and visual properties of mango (*Mangifera indica L.*), cv. Dushehri and Fazli are stored at 20°C. *Postharvest Biol. Technol.* 86, 447–455. (doi:10.1016/j.postharvbio.2013.07.018)
19. Pandey N, Joshi SK, Singh CP, Kumar S, Rajput S, and Pranitha A. Gulhane, Namrata G. Shukla and Ashok V. Gomashe "Natural plant extracts: A novel therapy for shelf life extension and quality retention of fruits" (Doi 10.5281/zenodo.1147482) Gulhane *et al.*, 7(1): January 2018.