https://www.eejournals.org Open Access
EURASIAN EXPERIMENT JOURNAL OF MEDICINE AND MEDICAL SCIENCES (EEJMMS) ISSN: 2992-4103
©EEJMMS Publications Volume 4 Issue 1 2023

The Use of Aloe Vera in Shelf Life Extension of Fresh Fruits

Ezeagba U.J.M.

Department of Pharmacy Kampala International University Uganda

ABSTRACT

In line with global preference for high-quality food, without chemical preservatives, and an extended shelf life, there is an increased effort to develop new natural preservatives and antimicrobials. Many storage techniques have been developed to extend the marketing distances and holding periods for commodities after harvest. One method of extending post-harvest shelf life is the use of the edible coatings. Edible coatings are thin layers of edible material applied to the product surface in addition to, or as a replacement for natural protective waxy coatings and provide a barrier to moisture, oxygen and solute movement for the food. Aloe vera is a well-known plant for its marvelous medicinal properties. Recently, researchers developed a gel based on Aloe vera that prolongs the conservation of fresh fruits. This gel is tasteless, colorless and odorless. This natural product is a safe and environmentally friendly alternative to synthetic preservatives such as sulfur dioxide. The gel operates through a combination of mechanics, forming a protective layer against the oxygen and moisture of the air and inhibiting the action of micro-organisms that cause food borne illnesses through its various antibacterial and antifungal compounds. Consequently, this paper reviewed Aloe vera gel properties, its preparation and its use as an effective preservative to improve the safety, quality and functionality of fresh fruits.

Keywords: Aloe gel, Fruits, Edible coating, Aloe vera, Micro organisms

INTRODUCTION

The word Aloe is derived from the word Arabic "Alloeh" or the Hebrew "Halal" meaning "bitter, shinny substance" [1]. Aloe vera is known as "plant of immortality" by the Egyptians due to its beneficial effect on human health. It is generally presumed that the origin is Arabia, Somalia, Sudan, and Oman. At present, Aloe vera is widely distributed throughout the tropics and subtropics. Aloe vera is a perennial plant. It's thick, thorn- edged leaves, ranging in color from gray to bright green, give aloe vera the appearance of a cactus, but, it is, in fact, a member of the lily family (Liliaceae). A typical Aloe vera plant produces two or three yellow tubular flowers, shaped much like those of the Easter Lily, and it flowers intermittently throughout the year [2]. It's thick leaves contain the water supply of the plant to survive long periods of drought. The leaves have a high capacity of retaining water also in very warm dry climates and therefore this plant can survive very harsh circumstances where most other vegetation disappears. Aloe vera is an unique plant which is a rich source of many chemical compounds. The plant is now reported to contain as many as 75 nutrients and 200 active compounds including sugar, anthraquinones, saponins, vitamins, enzymes, minerals, lignin, salicylic acid and amino acids [2]. In today's society many people have food allergies or personal preferences that would prevent them from ingesting these items. Therefore, Aloe vera is a great dietary source to meet those amino acids needs. Many storage techniques have been developed to extend the marketing distances and holding periods for commodities after harvest. Different preservation methodologies have been developed. One method of extending post harvest shelf life is the use of the edible coatings [3]. Edible coatings are thin layers of edible material applied to the product surface in addition to or as a replacement for natural protective waxy coatings and provide a barrier to moisture, oxygen and solute movement for the food . They are applied directly on the food surface by dipping, spraying or brushing. Edible coatings are used to create a modified atmosphere and to reduce weight loss during transport and storage. Recently, researchers

©Ezeagba, 2023
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

developed a gel based on Aloe vera that prolongs the conservation of fresh fruits. This gel is tasteless, colorless and odorless. This natural product is a safe and environmentally friendly alternative to synthetic preservatives such as sulfur dioxide. The gel operates through a combination of mechanics, forming a protective layer against the oxygen and moisture of the air and inhibiting the action of micro-organisms that cause food borne illnesses through its various antibacterial and antifungal compounds. This paper therefore analysed Aloe vera gel properties, its preparation and its use as an effective preservative to improve the safety, quality and functionality of fresh fruits.

Components of Aloe Vera

Class	Compounds
Anthraquinones	Aloin/Barb-aloin, Isobarba-aloin, Aloe-emodin, Emodin, Aloetic acid, Ester of cinnamic acid, Anthranol, Chrysophanic acid, Resistannol Anthracene, Ethereal oil.
Vitamins	B1, B2,B6, A-Tocopherol, β–Carotene, Choline, Folic acid, Ascorbic acid
Enzymes	Cyclo-oxygenase, Oxidase, Amylase, Catalase, Lipase, Alkaline-phospahatase, Carboxy-peptidase
Miscellaneous	Cholesterol, Steroids, Tricylglycerides, β –Sitosterol, Lignins, Uric Acid, Gibberellin,Lectin like substances, Salicylic Acid, Arachidonic Acid
Saccharides	Mannose, Glucose, L-Rhamnose, Aldo-pentose
Carbohydrates	Cellulose, acetylated mannan, Arabinogalactan, Xylan, Pure mannan, pectic substance, glucomannan, Glucogalc-tomannan, Galactan
Inorganic Compunds	Calcium, Sodium, Chlorine, Manganese, Zinc, Chromium, Copper, Magnesium, Iron
Non-essential Amino acids	Histidine, Arginine, Hydroxyproline, Aspartic Acid, Glutamic Acid, Proline, Glycine, Alanine
Essential Amino Acids	Lysine, Threonine, Valine, Leucine, Iso-leucine, Phenyl-alanine, Methionine

Preparation of Aloe Vera Gel Matrix

Fresh Aloe vera leaves were harvested. Aloe gel matrix lies underneath the green outer leaf rind. The gel matrix was separated from the outer cortex of leaves and this colorless hydroparenchyma was ground in a blender. The resulting mixture was then filtered to remove the fibers. The liquid obtained was the fresh Aloe gel (AG; 100%). The Aloe gel was pasteurized at 70°C for 45 min [4]. It was then cooled immediately at ambient temperature. To facilitate coating the gel was thickened using 1% gelling agent. This gel finally applied to coat fresh fruits or vegetables by means of brushing, spraying or dipping.

Antimicrobial Activity of Aloe Vera Gel

An antimicrobial is a substance that kills or inhibits the growth of microbes such as bacteria (antibacterial activity), fungi (antifungal activity), viruses (antiviral activity), or parasites (anti-parasitic activity)[5]. Found that Aloe vera gel has inhibited the growth of both gram positive and gram negative bacteria. Aloe gel composed of a wide range of constituents which are mainly responsible for this antimicrobial activity against various microorganisms. Anthraquinones presented antimicrobial activity against Staphylococcus aureus strains and against Escherichia coli, through inhibition of solute transport in membranes. Emodine has been reported to be effective against several gram positive bacteria . There are some reports on the antifungal activity of Aloe vera gel against several fungi including Colletotrichum sp. According to [6], Aloe vera gel showed good antibacterial activity against some food borne pathogenic microorganisms such as Bacillus cereus, Salmonella typhimurium, Escherichia coli, Klebsialla pneumonia etc.

Aloe Vera Gel as an Alternative to Synthetic Preservative

Sales of seasonal fruits ripened and made fresh with harmful chemicals possess a serious threat to public health. A section of unscrupulous traders use carbide in fruits like bananas, pineapples, oranges, grapes, apricots, papayas etc to keep them fresh. They also use textile dye in papaya, pomegranate and other fruits. Harmful plant growth hormones and chemicals are also indiscriminately used in fruit orchards. To ripen faster, papaya fruits are dipped into calcium carbide and ethephone. These chemicals are highly toxic and pose great risk to consumer's health. Although a number of edible coatings have been developed to preserve food freshness, the new coating is believed to be the first to use Aloe vera, according to study leader Daniel Valero of the University of Miguel Hernandez in Alicante, Spain. Valero and his associates found that Aloe vera gel is edible, invisible, odorless and does not affect the taste of fruits and vegetables on which it is applied. It also poses

©Ezeagba, 2023
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

no risk to human health. It holds the potentiality to preserve fruits effectively due to its anti-microbial action, which is described in the beginning.

Decay percentage was used to observe the effectiveness of coated material on fruit in retarding fruit disease. A. vera gel was successful in reducing microorganism proliferation in table grape, the effect being higher for yeast and molds than for mesophillic aerobics [7]. Interestingly, the Aloe vera gel coating was effective in controlling microbial growth of 'Starking' cherry and 'Crimson' table grape without incorporation of other antimicrobial compounds such as garlic oil, potassium sorbate and nisin to increase the activity [8]. In case of Aloe vera coated papaya fruits, no disease signs were observed until 1 week after the beginning of the storage period. At the end of the storage period, 100% disease incidence was observed in uncoated fruits, whereas for Aloe gel coated fruits disease incidence was only 27% [8]. This was due to the anti-microbial potentiality of coated materials which has been discussed earlier.

Effect of Aloe Vera Gel Coating on Physico-chemical Properties of Fruit Decay Percentage Color

Visual assessment is the first impression and a key feature in the choice of fruits. Color is one of the most important visual attributes of fruits. According to [9], Aloe vera gel treatment delayed the green color loss on the fruit skin of apples stored at 2°C for 6 months. Skin color of table grapes showed lower increases in Aloe treated than in control (untreated) fruits. Table grapes are rich in anthocyanin compounds, which account for their red color. The ripening process of table grapes has been correlated to the anthocyanin content [9]. At the end of cold storage (1°C, 95% RH), control fruits exhibited a redder and darker color than Aloe-treated ones, showing the aspect of overripe fruit, which is considered to be detrimental to color quality [7]. The modified atmosphere created by the Aloe vera gelcoating material retarded the ethylene production rate, therefore, delaying ripening, chlorophyll degradation, anthocyanin accumulation and carotenoid synthesis thus ultimately delaying color change of fruits [10]. Color also retain in Aloe gel (100%) treated papaya fruit. Moreover, the A. vera coating imparted an attractive natural-looking sheen to table grapes [7], papaya which was correlated to lower changes in both skin color and dehydration.

Firmness

Texture is a critical quality attribute in the consumer acceptability of fresh fruit and vegetables. The rate and extension of firmness loss during storage are the main factors determining fruit quality and postharvest shelf life. Fruits softening considerably occur as a result of degradation of the middle lamella of cell wall. Changes in cell wall structure and in their composition is mainly due to joint action of enzymes hydrolases, particularly polygalacturonase (PG), pectinestarage (PE),β-Galactosidase (β-Gal), pectate lyase (PL) and cellulose (Cel). Aloe treatment significantly reduced the firmness losses of table grapes during cold storage (1°C, 95% RH) whereas losses of >50% were detected in control grapes after 21 days of cold storage plus 4 days at 20°C. Papaya treated with 100% Aloe gel and control fruits presented similar initial flesh firmness values during the storage period of eight days at 25°C-29°C and 82-84% RH. At the end of the storage, control fruits decayed and the coated fruits were slightly soft but did not differ significantly [11]. This indicated that the ripening of coated fruits was delayed by delaying softening. Aloe vera gel has been proved to maintain the texture of fruit efficiently. This may be due to the effect of A. vera gel on the reduction of â-galactosidase, polygalacturonase, and pectinmethyl-esterase activities [12].

Respiration Rate

It is known that the environmental temperature affects the fruit respiration and the respiration affects the fruit temperature in return. When the temperature around the fruit rises, the respiration increases which leads to the increase of the temperature inside the fruit. The lower the respiration rate during storage the higher the shelf life of fruits and vice versa. The Aloe vera gel coating has significantly reduced the breathing rate. According to [13], 'Arctic Snow' nectarines was treated with Aloe gel and stored at 20 ± 1°C to evaluate the ripening and quality attributes. Initially, Aloe vera gel coated and uncoated fruit did not exhibit any significant change in respiration rate. Later on, the control fruit's respiration rate increased more rapidly and exhibited a 41% higher respiration rate compared to the Aloe vera gel coated fruit. In case of Aloe coated table grapes (1°C, 95% RH+ 4 days at 20°C, 90% RH), a controlled respiration rate has been observed than the uncoated fruits [7]. Application of a surface coating has been reported to increase resistance of fruit skin to gas diffusion and the creation of a modified internal atmosphere [14]. The reduced respiration in Aloe vera gel coated fruit may be ascribed to the hygroscopic properties that enable the formation of a barrier to diffusion of gasses and water vapour between fruit and environment. Similarly, reduced respiration rate has been observed in Aloe vera gel coated sweet cherry.

©Ezeagba, 2023
This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Total Soluble Solid, Titrable Acidity and Ascorbic Acid

Fruits are essential for the proper maintenance of human health. Fruits are foods rich in vitamins, minerals and supply arrays of colors, flavor, texture and bulkiness to the pleasure of eating. [14] reported that A. vera led to a lower increase in TSS (Total Soluble Solid) and greater T A content (Titrable Acidity) retention of coated berries, which indicated that control (uncoated fruits) fruits presented a more pronounced maturation development than coated berries during storage periods (1°C, 95% RH+ 4 days at 20°C, 90% RH). In case of Aloe coated and uncoated oranges (12 ºC, 96-98%RH), there were no significant differences in TSS and TA content of fruits during storage periods. The value of ascorbic acid content for coated oranges was found to be higher than that of uncoated fruits. [8] found that ascorbic acid content was higher in Aloe coated papaya fruits (86.55 mg) than the control fruits (61.10 mg) during the storage period at temperatures 25°C-29°C and 82-84% RH. A similar result was found in Aloe gel coated nectarines. This was due to low oxygen permeability of coating which delayed the deteriorative oxidation reaction of ascorbic acid content. Also [15] reported that coating reduces respiration of the fruits and retains the ascorbic acid in the fruits.

CONCLUSION/RECOMMENDATION

Fruits face tremendous loss due to old-fashioned preservation practice and ignorance about the preservation strategies. To effectively extend the shelf life of postharvest fruits and vegetables, Aloe vera gel-based coating as a relatively convenient and safe measure, is more and more concerned in food industry in recent years. Another advantage of this coating is totally harmless to the environment. In fact it can be considered as a green alternative to synthetic coatings and other postharvest chemical treatments.

REFERENCES

1. Gage, D., Aloe vera: Nature's Soothing Healer, Inner Traditions/Bear, USA, 1996.
2. Dureja, H., Kaushik, D., Kumar, N. and Sardana, S., "Aloe Vera. The Indian Pharmacist IV", 38. 9-13. 2005.
3. Baldwin, E.A., Nisperos, M.O., and Baker, R. A., "Edible coatings for lightly processed fruits and vegetables", HortScience. 30-35. 1995.
4. Maughan, R. G., "Method to increase color fastness of stabilized aloe vera.", US Patent 4,465,629. 1984.
5. Habeeb, F., Shakir, E., Bradbury, F., Cameron, P., Taravati, M.R., Drummond, A.J., Gray, A.I., Ferro, V.A., "Screening methods used to determine the anti-microbial properties of Aloe vera inner gel methods," Methods, 42 (4). 315-320. 2007.
6. Shelton, R.M., "Aloe vera: Its chemical and therapeutic properties", International Journal of Dermatology, 30 (10). 679-683.1991.
7. 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, 32 (3). 235-245. 2004.
8. Pranoto, Y., Salokhe, V.M., Rakshit, S.K., "Physical and antibacterial properties of alginate-based edible film incorporated with garlic oil", Food Research International, 38 (3). 262-272. 2005a.
9. Ergun, M. and Satici, F., "Use of Aloe Vera gel as Biopreservative for Granny Smith and Red Chief Apples", The Journal of Animal and Plant Sciences, 22 (2). 363-368. 2012.
10. Carrillo-Lopez, A., Ramirez-Bustamante, F., Valdez-Torres, J., Rojas-Villegas, R., & Yahia, E., "Ripening and quality changes in mango fruit as a_ected by coating with an edible film", Journal of Food Quality, 23 (5). 479-486. 2000.
11. Brishti, F.H., Misir, J. and Sarker A., "Effect of Biopreservatives on storage life of Papaya fruit (Carica Papaya L.)", Intermational Journal of Food Studies, 2 (1). 126-136. 2013.
12. Cock, I.E., "Antimicrobial activity of Aloe barbadensis Miller leaf gel components". The Internet Journal of Microbiology, 4 (2). 2008.
13. Ahmed, M. J., Singh, Z., & Khan, A.S., "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 (5). 1024-1033. 2009.
14. Banks, N.H., Dadzie, B.K. & Cleland, D.J., "Reducing gas exchange of fruits with surface coating", Postharvest Biology and Technology, 3 (3). 269-284. 1993.
15. Srinu, B., Vikram, K.B., Rao, L.V., Kalakumar, b., Rao, T.M. and Reddy, A.G., " Screening of antimicrobial activity of Withania somnifera and Aloe vera plant extracts against food borne pathogens", Journal of Chemical and Pharmaceutical Research, 4 (11). 4800-4803. 2012.

Ezeagba U. J. M. (2023). The Use of Aloe Vera in Shelf Life Extension of Fresh Fruits. *Eurasian Experiment Journal Of Medicine And Medical Sciences 4 (1) : 1-4.*

©Ezeagba, 2023

This is an Open Access article distributed under the terms of the Creative Commons Attribution License (http://creativecommons.org/licenses/by/4.0), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.