

Influence Of Different Herbal Edible Coatings On Fruits Crops

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ABSTRACT: *One of the serious problems faced by our nation is the post-harvest losses of fresh produce due to rapid deterioration of the fresh produce during both pre and post-harvest conditions, and in turn affecting the quality of fruits. Herbal edible coating is a novel or unique solution to this problem. The major purpose of the above invention is to increase the shelf life of fresh fruits through the application of herbal natural coating on the fruit surface. It is an effective method to improve the quality and thus, increase shelf-life of the fruits. They can be consumed safely as a part of our food because of their antimicrobial properties. Presently there is increasing demand for use of extracts obtained from herbs like that of neem, lemongrass, aloe, tulsi, cinnamon, mint and clove as edible material for coating on fruits due to their nutraceutical and beneficial properties. They are developed from corn starch by incorporating it into aqueous Tulsi (*Ocimum sanctum*) leaf extract. Corn starch is a polysaccharide derived from Maize (*Corn-Zea mays*) and beeswax is a lipid based material that has the ability to prevent the moisture and gases loss. Tulsi used for medicinal purposes from many years, its leave extract have numerous health benefits such as antidiabetic, anticancer, antimicrobial, antioxidant and many others in addition to acts as a natural preservative. Tulsi (*O. sanctum*), corn starch and beeswax are natural components of herbal edible coating which is fit for human consumption. It have been shown to prevent water loss, control ripening process, delay oxidative browning, controls respiration rate, & reduces microbial growth in fruits such as papaya, grapes, orange, apple & mango. These herbal edible coatings increases the storage time at low temperatures and it also increase the shelf-life of fresh produce whereas all uncoated fruits will be decayed. Thus, herbal extracts are being studied increasingly as an additive in edible coatings on fruits as an innovative approach for the commercial application and as an alternative for the post-harvest treatments with chemicals on fruits resulting in increased shelf-life.*

Key words: *Herbal edible coatings, Fruits, Tulsi, Neem, Cinnamon.*

1. INTRODUCTION

Prevention of the postharvest losses of fruits is of global importance in order to raise income, improve food security and combat hunger in the world (Phan, 2008). It is a basic component of a healthy diet due to the advantages such as low caloric value and the ability to uphold fruits (Raybaudi-Massilia *et al.*, 2007). The fresh fruits consumption increases day by day due to their unlimited health benefits (Huxley *et al.*, 2004). Some of the organizations like FAO, USDA, WHO recommended increasing the fruit consumption to avoid disease incidence (Gatto, 2011).

Around 40% of fruits lose shelf life during storage (Kumar & Bhatnagar, 2014). Fruits being living entities contain a moisture percentage of 75-90% and respire and produce heat at the expense of food (Mishra & Gamage, 2007). Even after harvest the fruits cannot replenish carbohydrates or water. The fresh produce uses stored sugars or starch in the process of depleting food reserves through respiration. In the process the ageing culminates in death and senescence (FAO, 1993).

The process of edible coatings during storage prevents gases which deplete O_2 and CO_2 and moisture in the controlled atmosphere (Park, 1999).

Edible coatings:-

Edible coatings can be defined as a thin layer that improves quality and enhances the surface of food and that could be consumed as whole food and considered as safe if edible coating is used (Baldwin, 1994; Ahvenainen, 1996; Kester and Fennema, 1986).

These coating materials which are edible can be used to enhance the shelf life of cut or whole fruits. These coatings are developed for the quality evaluation and stop any variation in color, texture and taste (Tharanathan, 2003). Polysaccharides, lipids and proteins; starch, modified starches, chitosan, alginates, gums, cellulose derivatives and pectins are the edible coatings usually made up of polysaccharides used in edible coatings (Krochta & Johnson, 1997).

Edible coatings act as a barrier to external elements and thus enhance the quality of produce (Guilbert et al., 1996) which gives less water loss and exchange of gas. It has been used since the 1930s to increase the shine and color of fruits, in addition to that of fungicide carriers (Saltveit, 2003). One more problem that can be controlled with the use of edible wax coatings is the loss of water from fruits. These waxes that are edible also offer protection against damage due to cold weather (Debeaufort et al., 1998).

Edible coatings Extracted From Herbs:-

Herbal edible coating can be prepared by incorporation of aqueous extract of Tulsi (*Ocimum sanctum*) leaves into corn starch and beeswax edible coating solution. Beeswax is a lipid based edible coating; it is used as an edible coating from ancient times for orange and apple preservation. The corn starch is a polysaccharide based edible coating which is highly used in manufacturing of many food products in the food industry and tulsi extract is used for medicinal purposes. Aqueous tulsi leaves extract is prepared from tulsi leaves powder by Soxhlet extraction. The preparation of herbal edible coating is a novel process which includes several steps i.e. washing, drying, grinding, sieving of tulsi leaves powder, extraction, evaporation of tulsi extract, preparation of corn starch and beeswax coating solution, addition of tulsi leaves extract into coating solution for the preparation of herbal edible coating.

This prepared herbal edible coating is applied on fresh fruits for increasing the life of fruits in storage. This edible coating consists phytochemicals, antioxidants and vitamins. The incorporation of aqueous tulsi leaves extract in corn starch and beeswax edible coating for manufacturing of "Herbal edible coating" is a unique characteristic of this invention. The innovative step of this invention is addition of antimicrobial, antioxidant and preservative agent into corn starch and beeswax edible coating in the form of tulsi extract. This research improves the quality of fruits and increases shelf life.

Herbal edible coating containing corn starch, beeswax and tulsi extract having many health benefits. This coating acts as a good barrier against moisture and gases; they act as antimicrobial, antioxidant and natural preservative that is why they play an important role in enhancing the freshness of fruits and vegetables for long time. This property makes it unique to this invention. The research will be described with the following examples of preparation of Herbal edible coating from tulsi extract.

Thyme (*Thymus vulgaris*), cinnamon (*Cinnamomum cassia*), Lemon grass (*Cymbopogon citratus*), Oregano (*Origanum vulgare*), Neem (*Azadirachta indica*) and *Aloe vera* (Chauhan et al., 2014; Padmaja & Bosco, 2014; Zinoviadou et al., 2009) are manufactured by the using extracts of herbs. The extracts used were having antimicrobial, antioxidant and therapeutic properties and works as nutraceutical. It has been observed that the films contained lemon grass, cinnamon oil, and oregano had lower oxygen permeability rather with Citral, cinnamaldehyde and Carvacrol antibacterial compounds respectively (Rojas-Grau et al., 2006 and Rojas-Grau et al., 2007a). The herbs used in edible coatings were as follows

Neem (Azadirachta indica):

Neem is a medicinal as well as non-toxic plant with excellent antimicrobial properties in it. Baswa et al., (2001) and Mahfuzul Hoque et al., (2007) reported the neem oil and neem extract comprise of antibacterial properties and are considered mainly as components which are active against pathogenic micro-organism such as Salmonella, Staphylococcus, E. coli, Vibrio and other microbes. Azadirachtin, Nimbidin and Nimoid are active components. Neem extracts as an antimicrobial agent.

Extract used as neem oil is applied on fruits to increase shelf life used as biodegradable edible coating on fruits (Rao, 1990). Chauhan et al., (2014) simulated that neem extract which is having antimicrobial effect extends the storage of Apple.

Tulsi (Ocimum sanctum):

Tulsi having therapeutic potential is considered as sacred herbal plant of India and commonly known as “Queen of Herbs” and belongs to Lamiaceae family (Kumar et al., 2011). Tulsi comprise of many constituents like alkaloids, saponins, tannins, glycosides along with some compounds of aromatic importance and helps in treating many diseases. The tulsi leaf extracts containing polyamine biosynthesis inhibitor blocked ornithine decarboxylase pathway, which could be exploited to control fruit rots (Patil et al., 1992). Linalool, Eugenol, carvacrol, camphor, methyl cinnamate and β -caryophyllene are important constituents of tulsi extract and tulsi oil. Therefore, it was used in enhancement of shelf-life of fruits (Reuveniet et al., 1984 and Kayastha, 2014). Therapeutic uses of Tulsi extract or oils are as old as 4000-5000 BC; and are found to be safe and effective due to their easy produce and marketability (Kumar et al., 2011; Monga et al., 2011). It has extract along with oil which were having many useful properties and considered as anti-viral, anti-bacterial anti-fungal and antioxidative, insecticidal and act as antioxidative agents (Chogoet al., 1981; Reuveniet al., 1984 and Kayastha, 2014). It has excellent medicinal properties which are helpful for treatment of diseases like common malaria, dengue, headaches, stomach ache, cold and inflammation and skin problems (ChitraMani & Kumar, P. (2020); Sharma, M., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020); Naik, M., & Kumar, P. (2020); Kumar, P., & Naik, M. (2020); Kumar, P., & Dwivedi, P. (2020); Devi, P., & Kumar, P. (2020); Kumari, P., & Kumar, P. (2020); Kaur, S., & Kumar, P. (2020); Devi, P., & Kumar, P. (2020); Sharma, K., & Kumar, P. (2020); Kumar, S. B. P. (2020); Devi, P., & Kumar, P. (2020); Chand, J., & Kumar, P. (2020).

Cinnamon (*Cinnamomum cassia*):

Cinnamon is a flavor and it has great antimicrobial, antioxidative and inhibitory properties against pathogenic organisms. It is regular nourishment added substance utilized as enhancing operator and additive which forestall the development of microorganisms and parasites (Roller and Seedhar, 2002). Cinnamon mostly contains are cinnamaldehyde, Eugenol, camphor and caryophyllene oxide. Cinnamon as an antimicrobial operator has been assessed in the cuts of new cut apple (Muthuswamy et al. 2008).

The cinnamon bark comprises of ethanol extract (1.5-2%) and cinnamon aldehyde, which decreased the gram-positive and gram-negative microbes in crisp cut cuts of apples and expanded the capacity life for 12 days at 6°C (Muthuswamy et al. 2008).

The microbial decay of kiwifruit and crisp cut melon were diminished by the utilization of Cinnamic corrosive and Carvacrol. Treatment with carvacrol or cinnamon acid also reduced the viable count of kiwifruit by 1.5 and 4 log CFU/g at a storage temperature of 4°C & 8°C for 5 days, respectively (Roller & Seedhar, 2002).

Aloe vera:

At present Aloe vera separate is utilized in palatable coatings for enormous scope to improve the timeframe of realistic usability of organic products (Martinez-Romero et al., 2006). Aloe vera a semi-tropical plant has remedial properties. The Aloe vera had two kinds of gel one is yellow shaded latex (exudate) and other is a reasonable gel (adhesive) that is found in the parenchymatus cells (Ni et al., 2004).

It contain many beneficial complex components including lignins, glycoproteins, polysaccharides, amino-acids, salicylic acids, saponins, phenolic compounds, vitamins, and enzymes which prove the beneficial properties of *Aloe vera*. The key components of Aloe vera extract are "Aloin and Aloe-emodin". Aloe vera extract is utilized as hostile to parasitic, against bacterial, calming (Serrano et al. (2006). The Aloe vera gel based palatable coatings have great dampness and gas hindrance properties (Kumar, P. (2019); Kumar, D., Rameshwar, S. D., & Kumar, P. (2019); Dey, S. R., & Kumar, P. (2019); Kumar et al. (2019); Dey, S. R., & Kumar, P. (2019); Kumar, P., & Pathak, S. (2018); Kumar, P., & Dwivedi, P. (2018); Kumar, P., & Pathak, S. (2018); Kumar et al., 2018; Kumar, P., & Hemantaranjan, A. (2017); Dwivedi, P., & Prasann, K. (2016). Kumar, P. (2014); Kumar, P. (2013); Kumar et al. (2013); Prasann, K. (2012); Kumar et al. (2011); Kumar et al. (2014).

Chauhan et al., (2014) watched the impacts of biodegradable covering of Aloevera gel on Grapes foods grown from the ground the antifungal and antibacterial properties of Aloe gel against pathogenic organisms. Aloe vera gel upgrades the surface of natural products accordingly stifling the pace of breath, lessening microbial development and holding unstable flavor parts; it likewise expands the timeframe of realistic usability of grapes for around 40 days.

It likewise forestalls mellowing, oxidative searing and diminished the danger of microbial tainting in the natural products, for example, apple, banana, grapes, fruits and papaya (Valerde et al. (2005); Marpudi et al. (2011); Martinez-Romero et al. (2006).

S.no	Herb name	Active component	Properties	References
1	Neem Oil & Extract	Nimbidin & Azadirachtin	Antimicrobial	Bostid, 1993
2	Thyme oil & Extract	Carvacrol	Antifungal and Antibacterial	Kokate et al (2009)
3	Citrus essential oil	Citral	Antifungal	Shah et al (2011)
4	Cinnamon extract	Cinnamaldehyde & Eugenol	Antimicrobial	Vangalapati et al (2012)
5	Oregano extract and oil	Rosmarinic acid, Carvacrol	Antioxidant	De Falco et al (2013)

6	Aloe vera	Aloin and aloe-emodin	Antimicrobial	Eugene Sebastian et al (2011)
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Marigold flower extract:

The flowers of Marigold (*Tagetes erecta*) are very versatile. The marigold flowers were collected from a nearby nursery. The petals were removed and are kept under shade till they completely dry without any moisture content. With the help of blender these petals were then ground into a fine powder. The Aqueous solution of marigold extract was prepared by soaking the required quantity of this pulverized material with an equal quantity of water and left all night.

Guar gum:

Guar was purchased from a local market. The guar extract was prepared by cutting the guar and placing it in shade to remove the moisture completely. It was then blended into a fine powder. 2% of guar gum was added for the preparation of coating solution.

Ginger, Turmeric and Garlic:

The extracts of garlic and ginger @ 10% concentration have inhibitory effect for most of the bacterial and fungal isolates except for the microbes like *Rhizopus* and *Aspergillus* (Shivpuri et al., 1997). The aqueous extracts and fresh juice of turmeric and ginger have antifungal activity against the fungi *Penicillium digitatum* and *Aspergillus niger* has been reported (Kapoor, 1997). Due to the impact of natural products obtained from plant on the storage rot of mangoes, (Hasabnis and Souza, 1988), when the fruits dipped in the plant extracts showed the reduction in the disease incidence.

Other important extracts:

Aloe vera separate are "Aloin and Aloe-emodin". Aloe vera extricate is utilized as hostile to parasitic, against bacterial, calming reported by Serrano et al (2006). The Aloe vera gel based palatable coatings have amazing dampness and gas hindrance properties.

Chauhan et al., (2014) watched the impacts of biodegradable covering of Aloevera gel on Grapes products of the soil the antifungal and antibacterial properties of Aloe gel against pathogenic microorganisms. Aloevera gel upgrades the surface of organic products in this way smothering the pace of breath, lessening microbial development and holding unpredictable flavor segments; it likewise builds the timeframe of realistic usability of grapes for around 40 days.

It additionally forestalls relaxing, oxidative carmelizing and diminished the danger of microbial tainting in the natural products, for example, apple, banana, grapes, fruits and papaya (Valerde et al. (2005); Marpudi et al. (2011); Martinez-Romero et al. (2006).

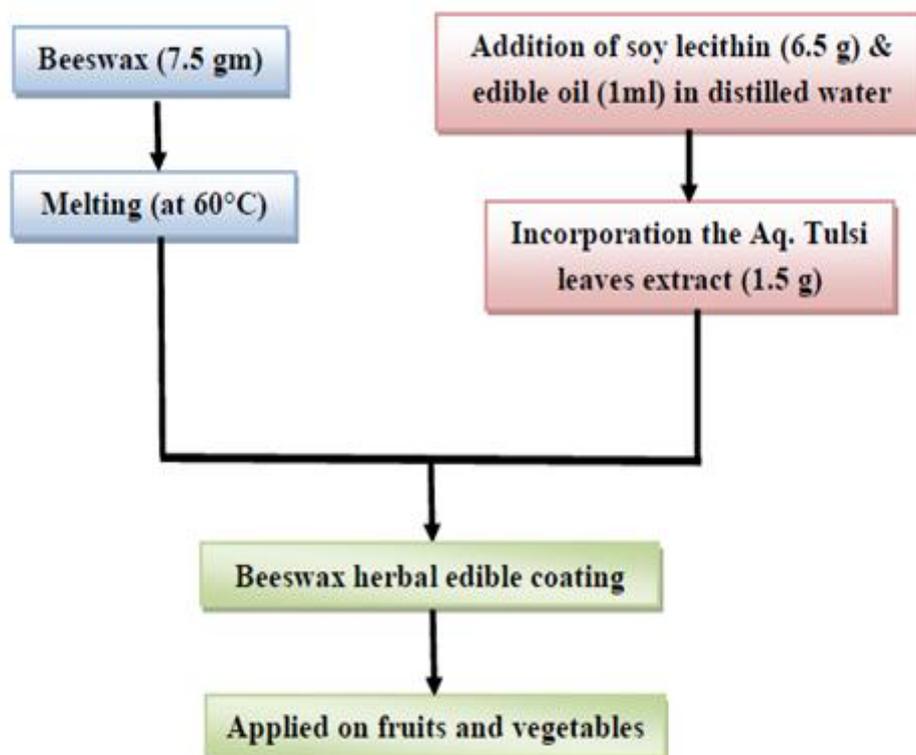
Different herbs like thyme, mint, lemongrass, peppermint oil, green tea extricate, clove oil and basil separate are likewise utilized as coatings on organic products (Baranauskien et al., 2007; Chauhan et al., 2014; Chiu and Lai, 2010; Del Toro-Sánchez et al., 2010). It improves timeframe of realistic usability, stockpiling time for 20-35 days at low temperature and great obstruction properties towards gases and dampness (Kumar and Bhatnagar, 2014). It also improves the quality of fruits (Chiu & Lai, 2010; El-Moneim et al., 2015).

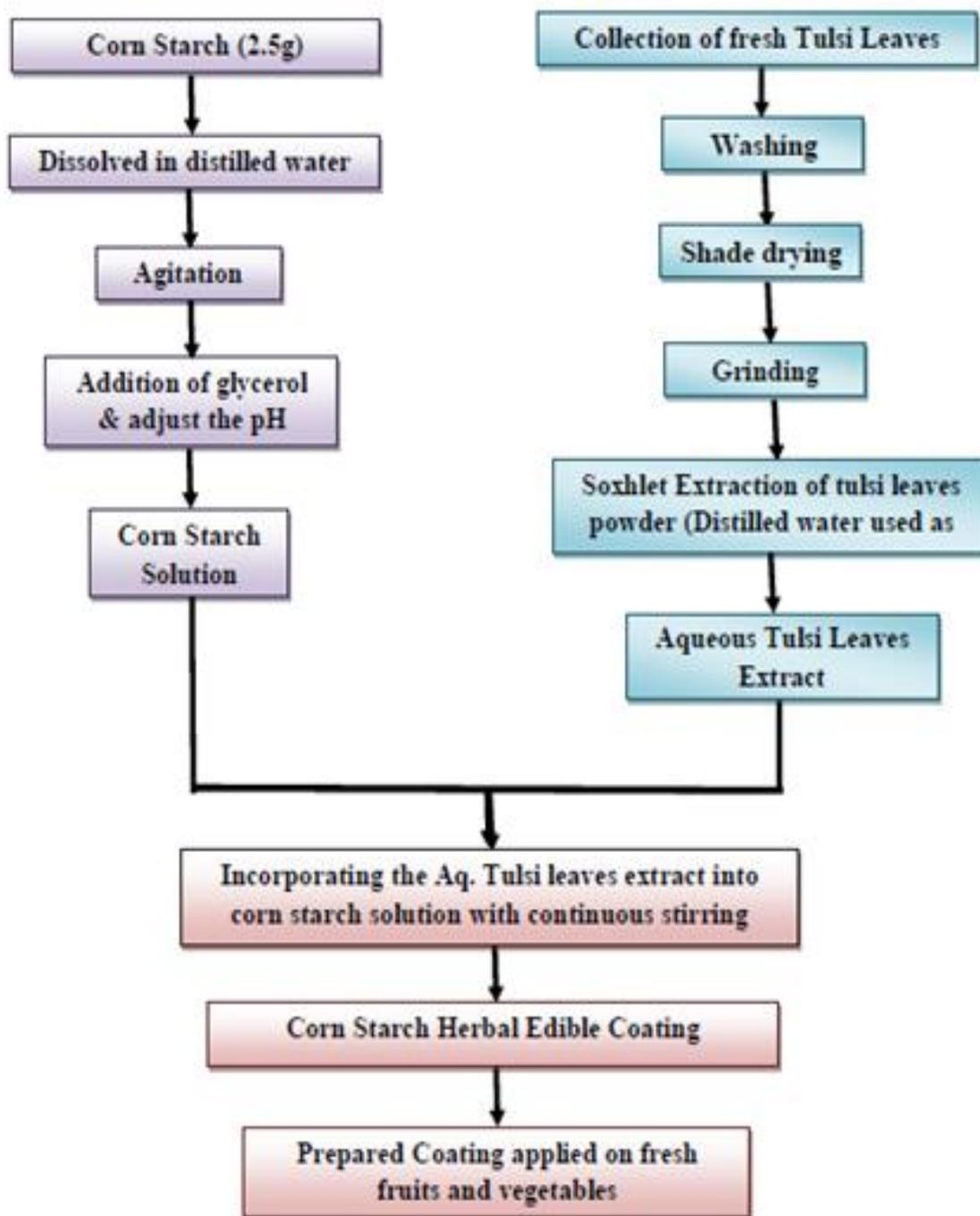
Examples:

S.No.	Fruit name	Herbal coatings	Reference
1	Grapes	<i>Aloe vera</i>	Chauhan et al., (2014)
2	Apple	Neem oil, Marigold flower extract and <i>Aloe</i>	Chauhan et al.,

		<i>vera</i>	(2014)
3	Apple	Guar gum	Ghader et al., (2011)

Procedures:





2. CONCLUSION:-

Herbal edible coating is a novel technique and is considered as an alternative source in order to decrease postharvest losses and enhance the shelf life of the fresh produce in comparison to other techniques because of their safe and environmental friendly nature. These coatings not only act as a good barrier against moisture and oxygen but also increase their safety due

to the presence of natural bioactive compounds during processing and storage. Herbal coatings such as neem, oregano, cinnamon, clove, mint, *Aloe vera* & peppermint were applicable on fresh produce and have several effects and contains many medicinal values and properties. It has been reported that minimize microbial growth specially & delay oxidative browning, prevents water loss, control respiration rate & ripening process in fruits. The use of herbal coatings in fruits like papaya, cherry, apples, oranges, oranges and grapes are studied in various scientific reports. It provides assured and desired effects. Different characters of herbal edible coatings increased the market value of fruits. It has been found that herbal coatings which are edible in nature are found to be more effective because of on-dangerous and eco-accommodating nature and being less harmful.

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