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Research Article

Muntingia calabura Mucilage as a Antibacterial Coating for Grape fruits

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Abstract

The antibacterial potential of the *Muntingia calabura* mucilage is evaluated with bacterial strain of *Bacillus cereus*, *Proteus vulgaris*, *Salmonella typhi* and *Staphylococcus aureus*. The ethanolic extract of the *Muntingia calabura* mucilage is performed and applied for the grape fruits as a natural coater. The antibacterial potential is evaluated it is showed that *Staphylococcus aureus* bacteria shows highest antibacterial potential of the natural coater. The natural coater when applied to these grape fruits, the postharvest shelf-life of fruits increased, while due to presence of the antibacterial potential of these *Muntingia calabura* mucilage the further deterioration of the fruit during the storage of postharvest period of grape is useful in the improvement of the shelf-life and freshness of the grapes during the course of marketing. Thus the application of *Muntingia calabura* mucilage coating is beneficial for the postharvest of the grape fruit in future.

Keywords: Antibacterial Activity, Post Harvest Physiology

Introduction

Muntingia calabura L. belong to family Muntingiaceae. It is native of Southern Maxico, it is a shrub with spreading branches. It is locally known as cherry. Fruit an edible berry, red at maturity about 1.5 cm wide. Young fruit contain large amount of mucilage. The fruits are edible and in some cases sold in market as can be eaten raw or processed as jam [1].

The applications of edible coating to various fleshy fruits extend the shelf-life and protect them from various environmental effects. Thus the edible coating improves the food quality and extend the shelf-life of fresh produce. It is effective in preventing the microbial contamination [1]. The edible coating technology has been considered as one of the potential approaches to protect the losses of fruits during post-harvest handling [2]. The application of natural polymers as a coating to fruits and vegetables improve structural integrity and prevent the moisture, loss oxidative reactions.

Material and Methods

Antibacterial activities

Preparation of media

The nutrient agar medium was prepared by accurately weighing 10 gm of peptone, 10 gm of beef extract, 5 gm of NaCl and 23 gm of agar in 1 lit distilled water. The bacterial suspension (1 ml) was seeded in sterile nutrient agar medium and poured into petri dish to solidify for a time such that the temperature was not high enough to kill the bacteria.

Determination of antibacterial activity by agar well diffusion method

Agar well diffusion method described by [3] was employed for determination of antibacterial activity. The aqueous extract of mucilage with concentration (100 mg/ml, 50 mg/ml, 25 mg/ml,

12.5 mg/ml) were used to evaluate antimicrobial activity. Four wells of 9 mm were bored on previously seeded nutrient agar plates. Each well was filled with 100 µl plant extract with various concentrations same procedure was carried out for standard antibiotics Streptomycin and Cephalotoxin (25 µg/ml) used for this activity. The plates were then incubated at 37oC for 24 hr prior for the observation of inhibition zone (mm). The statistical analysis of the data was carried out by "Analysis of Variance" method of [4].

Post harvest physiology

Coating of raisins was done as per the method of [5]. The couted fruit were kept at room temperature and at 10 ^{0}C in fridge 1, 2, 4, 8, and 12 days. The absorbance were taken after every 1st day, 4th day, 8th day and 12th day and used for calculation of water content, Relative water content, Succulence and Osmotic potential were calculated.

Result and Discussion

The antibacterial potential of *Muntingia calabura* obtained from fruits of this plant is shown in Table no.01. It is noticed that the zone of inhibition is ranging from 5 to 10 mm for 100% for 100 µg/ml extract concentration, which is slightly lower than the commercial antibiotic Streptomycin and Cephalotoxin. The pathogenic bacterium *Bacillus cereus* was highly susceptible to the ethanol extract of mucilage from various plant parts in 100% concentration of *Muntingia calabura* showing 5.40 mm zone of inhibition. Zone of inhibition of *Proteus vulgaris* due to natural polymer of *Muntingia calabura* was 7.46 mm, as compared with other concentrations (50%, 25% and 12.50%). Zone of inhibition of *Salmonella typhi* due to natural polymer *Muntingia calabura* mucilage shows 4.43 mm. In case of *Staphylococcus aureus* the extracts of *Muntingia calabura* mucilage shows 9.40 mm, zone of inhibition.

The effect of natural coating of mucilage on post harvest storage of Grape is shown in figure 1 and table 2, 3. It is evident from table that the water content, Relative water content, succulence and osmotic potential is significantly increased due to coating of mucilage. It is also noticed that the fresh fruits of grape and tomato coated with mucilage kept in fridge and room temperature maintenance better turgidity and water relations, than the uncontrolled coated fruits.

Sr No.	Name of Species		Zone of Inhibition (µg/ml)			
			100 (µg/ml)	50 (µg/ml)	25 (µg/ml)	12.50 (µg/ml)
1	*Bacillus cereus*	*Muntingia calabura*	5.400 ± 0.100	4.433 ± 0.058	3.400 ± 0.100	2.367 ± 0.153
		Streptomycin +ve control	14.553 ± 0.006			
		Cephalotoxin +ve control	7.560 ± 0.010			
2	*Proteus vulgaris*	*Muntingia calabura*	7.467 ± 0.058	2.067 ± 0.058	2.100 ± 0.100	4.400 ± 0.100
		Streptomycin +ve control	13.550 ± 0.010			
		Cephalotoxin +ve control	42.553 ± 0.06			
3	*Salmonella typhi*	*Muntingia calabura*	4.433 ± 0.115	4.433 ± 0.153	1.520 ± 0100	1.500 ± 0.100
		Streptomycin +ve control	9.553 ± 0.006			
		Cephalotoxin +ve control	25.560 ± 0.010			
4	*Staphylococcus aureus*	*Muntingia calabura*	9.400 ± 0.100	4.533 ± 0.058	4.433 ± 0.058	3.333 ± 0.153
		Streptomycin +ve control	22.540 ± 0.010			
		Cephalotoxin +ve control	38.550 ± 0.010			

Table 1: Effect of different concentration of mucilage on bacterial growth.

*** All result show significant difference from control both at 5% and 1% level of significance for Streptomycin and Cephalotoxin.

Treatment EC (mS cm^{-1})	*Muntingia calabura*			
	Control	4	8	12
Water content (% of D.W.)	368	412	486	509
Relative Water Content (%)	54.32	62	74.19	81.04
Succulance	3.22	4.1	5.2	6.53
Osmotic potential	-11.45	-12.18	-12.60	-13.01

Table 2: Effect of Mucilage extract coating on Grapes berries stored in fridge.

Treatment EC (mS cm^{-1})	*Muntingia calabura*			
	Control	4	8	12
Water content (% of D.W.)	344	367	414	455
Relative Water Content (%)	48.12	52	62.19	69.06
Succulance	2.91	3.16	4.62	5.16
Osmotic potential	-11.12	-11.44	-12.09	-13.19

Table 3: Effect of Mucilage extract coating on Grapes berries stored at room temperature.

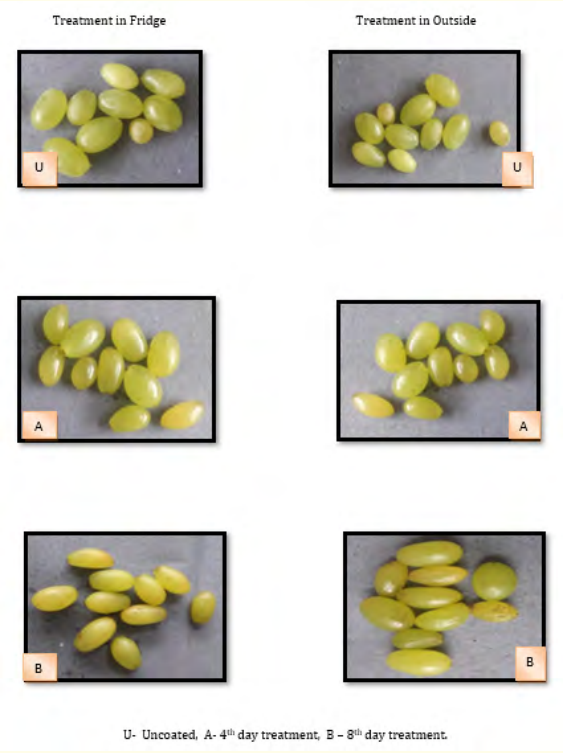

Figure 1: Effect of Muntingia calabura fruit mucilage extract capacity on Post harvest shelf life of Grape berries stored in fridge and at room temperature.

In the present study the mucilage isolated from *Muntingia calabura* were tested for its antibacterial potential.

In the present study it was noticed that mucilage of *Muntungia calabura* was found effective against the *Staphylococcus aureus* bacteria. Thus, if this mucilage are used for the tablet coating or as emulsifiers for the antibacterial formulations then it will definitely improves the quality and delivery of drug and also helps to avoid the side effects of synthetic polymers. In the present study a good potency in terms of inhibition zones against all tested bacterial strains were observed and this ability was more pronounced against the mucilage extract of *Muntingia calabura* exhibits antibacterial potential against *Staphylococcus aureus.* Thus the broad spectrum of antibacterial activity of mucilaginous extract indicates that this mucilage powder might be applied for the coating of disintegrants, binder in pharmaceutical products which are mainly prepared for antibacterial potential of the pharmaceutical products.

The natural coater was prepared with the application of mucilage powder along with protein, lipid complexes the natural coater prepared from *Muntingia calabura* mucilage improves the water content, Relative water content, Succulence and Osmotic potential [6-9] of grape fruits. This will helpful to maintain the turgidity of fruits. Turgidity is a sign quinon of freshness of vegetables and fruits the application of various concentrations of natural coater to

grape fruit significantly improves the turgidity and water content of fruits. This will helps to maintain the freshness and shelf life of these fruits. Thus the application of mucilage as a natural polymers, extracted from the waste fruits would be helpful in maintaining the quality of harvested fruits as well as it might be helpful to reduces the losses caused during post harvest transport and it will post pond the deterioration of these fruits during storage and transport.

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