Effect of Rosemary and Indian Clove essence, Putrescin, hot water treatment and Thiabendazol fungicide on post-harvest life of Mango (Mangifera indica c.v Langra)

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In order to evaluate the fungicide effect of medicinal plant essence and comparison their influence to chemical fungicides for rising of post-harvest life of mango (Mangifera indica c.v Langra), was performed an experiment in completely randomized design with 14 treatments and 10 replicates. The treatments were consist: control (without treatment), dipping in Putrescin (1, 3 and 6 mmol for 2 min), the essence of Indian Clove and Rosemary (500, 750 and 1000 mg/l) and warm water 54 °C and Thiabendazol fungicide (0.5, 0.75 and 1.0 mg/l for 3-5 min). After operating treatments, the fruits were stored in a refrigerator with 10 °C temperature and 85-90% relative humidity. 30 days after beginning storing, the characters such as weight loss percent, loss firmness percent, increasing vitamin C percent, loss total acid percent, increasing total soluble solid (TSS) percent and increasing pH percent was measured. Result showed that the qualitative and quantitative characteristics of mango c.v Langra influenced by the treatment type. According to the obtained results, the least weight loss percent was observed in Indian Clove 750 mg/l. Treatment type had significant influence on so that the least amount of firmness loss was in Rosemary 500 mg/l. The highest increasing amount of TSS was in hot water treatment and the least in Putrecin 6 mmol. The greatest increasing vitamin C was observed in Rosemary treatment.

Key words: Indian Clove and Rosemary essence, post-harvest life, Mango, Langra

Introduction

Mango (Mangifera indica) is a tropical fruit, which in regards to nutritional value and quality is recognized as the world's second most important fruit after Ananas. Mango cultivation in Iran is limited to Hormozgan and Sistan-Baluchestan provinces. Ripening process in mango fruit is fast because it is a climacteric fruit. For this reason, mango is a very perishable tropical fruit and in 10-15 °C has 2-4 weeks lifetime (Yahia et al., 1998). In commercial level, almost in the all produced mango fruits in Hormozgan and Sistan-Baluchestan provinces no treatment is done to improve post-harvest life and the harvested fruits will rapidly decline after import to the market. Therefore it is necessary studies done to increase the storage life and maintain quality of mango fruit during post-harvest. Application of natural compounds as natural extract or plant essences is including health and safety procedures for controlling the post-harvest diseases. Plant essences are the wide range of secondary metabolites that have anti-microbial, allopathic, anti-oxidant and bio-regulation properties. Essences are complex combinations, which there are different types of chemical materials such as hydrocarbons, alcohols, ketones, aldehydes and etc in their compounds. Some plant essences and their active chemical components have anti-bacterial effects and are used as anti-microbial agents (Muirhead, 1976). During study of Malek et al. (2006), application of poly-amines consisting Spermidin, Spermin and Putrecin on mango fruits caused to maintain fruit firmness and slow weight loss during preserving without significant reduction in ethylene production. Application of these poly-amines on mango fruits led to maintain of acidity and ascorbic acid while total carotenoids content reduced in comparison to control treatment and caused to increasing of mango storage life. Mukeraje (1979) in evaluation on increasing storing life of mango c.v Langra, harvested mango fruit in the physiologic ripening time and stored it in cool storage after thermotherapy by hot water 50 °C for 15 minutes and observed the fruit in 9-10.5 °C had 4 weeks lifetime. Application of ethanol extract of dried flower powdered of Indian Clove in
concentrations of 150, 300 and 450 mg/L on some qualitative properties and controlling of rotting in white seedless grape by Asghari et al. (1998) indicated that the treatments without undesirable effect on flavor and aroma had useful effects on other characteristics. It seems that the compounds available in extract in addition to anti-fungal effect with own anti-oxidant properties are delaying the senescence process. Due to the harmful effects of pesticide residues for the environment and consumers, in this study was used medicinal plants essence in order to controlling the fungal diseases.

Materials and Methods
Mature mango fruits c.v Lagra (having green-yellowish color) were harvested from a tree in a commercial garden in Chelow-Gavmishi (Minab township) and were transferred to laboratory of agricultural group of Islamic Azad University of Jahrom. Safe and free from any contamination and decay and uniform mangoes (having approximate weight 200 g) after surface disinfections by water and dish soap and drying were prepared for operation different treatments. Five fruits in 10 replications in each treatment for 2-3 minutes were dipped in the solutions containing Indian Clove and Rosemary essences 500, 750 and 1000 mg/L and Thiabendazol fungicide 0.5, 0.75 and 1.0 g/L and Putrecin 1, 3 and 6 mmol. For thermal treatment was used hot water 54 °C and the treated fruits were placed outdoor for 1-2 hrs in order to drying surface water on the fruits. A month storage period and storage temperature of 10 °C with a relative humidity of 85 to 90% was considered. In order to evaluate of qualitative characteristics, fifteen days after beginning of storing and also in the end of the storing duration, were measured the characters of pH, TSS, total acid (TA), vitamin C and fruit firmness. The obtained data was analyzed by using MSTAT-C software and the means were compared by Duncan’s multiple range test (DMRT).

Results
Weight loss percent
The greatest weight loss percent was observed in Thiabendazol fungicide 0.5 mgL\(^{-1}\) and the least in Indian Clove 750 mgL\(^{-1}\). Weight loss percent in the treated mango fruits by Indian Clove and Rosemary essences and Putrecin treatment was less than Thiabendazol fungicide although was not observed significant difference between some treatments (Table 1).

<table>
<thead>
<tr>
<th>Treatments</th>
<th>Characters</th>
<th>pH raising percent</th>
<th>Vitamin C raising percent</th>
<th>TSS raising percent</th>
<th>Fruit firmness loss percent</th>
<th>Fruit weight loss percent</th>
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Means in each column, followed by similar letters are not significantly different at p<0.01 according to Duncan’s test (DMRT).

Fruit firmness loss percent
The highest fruit firmness loss percent was relative to hot water treatment and the lowest was relative to Putrecin 6 mmolL\(^{-1}\) treatment. Fruit firmness loss percent was less in the treated fruits by Indian Clove and Rosemary essences and Putrecin treatment so that texture of these fruits was firmer than the treated fruits by Thiabendazol fungicide and hot water and control treatments (Table 1).

Total soluble solid (TSS)
The greatest TSS was observed in hot water treatment (40%), which increased in comparison with control treatment and then was Rosemary 50 mgL\(^{-1}\), and Putrecin 1 and 3 mmolL\(^{-1}\) treatments. The lowest TSS was relative to Putrecin 6 mmolL\(^{-1}\) treatment (13%) and then was observed in Indian Clove 1000 mgL\(^{-1}\) and Rosemary 1000 mgL\(^{-1}\) treatments (Table 1).

Vitamin C raising percent
According to the obtained results, the greatest vitamin C raising percent was observed in Rosemary 500 mgL\(^{-1}\) and the lowest in Indian Clove 1000 mgL\(^{-1}\) treatment (Table 1).

Total acid (TA) loss percent
The greatest TA loss percent was observed in Rosemary 1000 mgL\(^{-1}\) and the lowest in Rosemary 500 mgL\(^{-1}\) treatment. Data mean comparison showed that TA amount gradually decrease during preservation of the mango fruits in refrigerator (Table 1).


**pH raising percent**

Treatments had no significant difference on pH raising percent. Means comparison showed the greatest pH raising percent after 30 days was observed in Rosemary 1000 mgL$^{-1}$ (50%) and the lowest in hot water treatment (39%) (Table 1).

**Discussion**

Regards to the ripening process in mango fruit is fast, to find of suitable methods for delay in fruit ripening can be effective on increasing the storing life of mango fruits. The results of present study showed quantitative and qualitative characteristics of mango fruit affected by treatment type. From the viewpoint of fruit firmness, the highest fruit firmness loss percent was observed in the treated fruit by hot water treatment and the lowest in Rosemary 750 and 1000 mgL$^{-1}$ and Rosemary 750 and 1000 mgL$^{-1}$ treatments so that application of proper concentrations of medicinal essence and Putrecin led to the firmness of fruit texture and consequently caused to increasing of mango fruit shelf life. All applied treatments in this study, in comparison with Thiabendazol fungicide, by prevention of fungi and pathogenic agents and decay incidence, effectively caused to the maintaining of crop marketable and the fruits in the viewpoint of apparent form were in desirable situation. The results of this experiment are according to the findings of Zokae et al. (2007). It seems the controlling effect of essences in addition to direct effect on fungi is relative to simulate plants defensive responses. The greatest weight loss percent was observed in Indian Clove 500 mgL$^{-1}$ treatment. Because of TSS in mango fruit pulp increase during the ripening process and this increasing is arising to starch hydrolyze; the highest TSS was observed in Rosemary 500 mgL$^{-1}$ treatment. The less amount of TSS in Putrecin 6 mmolL$^{-1}$ and Indian Clove 1000 mgL$^{-1}$ indicate that application of high concentrations of essence and hormone (replacement application of chemical fungicides) had been effective on prevention of ripening process improvement (which change of TSS is one the important indexes of ripening process). This finding is conforming to the results of Zokae et al. (2007). Based on obtained results, the highest total acid loss percent was observed in Rosemary and Indian Clove 100 mgL$^{-1}$ and Putrecin 6 and 3 mmolL$^{-1}$. Treatment type had significant influence on vitamin C raising percent. The greatest vitamin C was observed in rosemary 500 and 750 mgL$^{-1}$ and the lowest in Indian Clove 1000 mgL$^{-1}$. The findings showed application of hot water is controlling postharvest diseases of mango fruit. Thermotherapy in addition to controlling of fruit fly is controlling the important postharvest diseases of mango fruits and is effective in preservation of mango fruit quality. This result was agreed to the findings of Mukerajee, 1979; Anonymus, 1994; Spalding (1988). On the other hand, it seems jointly application of Indian Clove and Rosemary essences and hot water treatment can be considered as the health and desired method for treatment of mango fruit postharvest.

**References**


Mcquire R. 1998. Concomitant decay reductions when mangoes are treated with heat to control infestation of caribbean fruit flies, Plant Disease, 75:9,946-949.


