REGULAR ARTICLE

ENHANCEMENT OF SHELF-LIFE OF TOMATOES USING HERBAL EXTRACTS

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SUMMARY

A study was taken up to enhance the shelf life of tomatoes by using Garlic (Allium sativum Linn) and Ginger (Zingiber officinale Rose) extracts at different concentrations viz, 1%, 5% and 10%. Tomatoes keeping quality was improved by spraying 10% garlic and ginger extracts, which reduced the spoilage, physiological loss and microbial load on the surface of the fruits. Among these, 10% garlic extract was more efficient in controlling spoilage microorganisms, enhancing shelf life and reducing physiological weight loss. This study revealed the possibility of utilization of Garlic (Allium sativum Linn) and Ginger (Zingiber officinale Rose) extracts to enhance the keeping quality of tomatoes.

Keywords: Shelf life, Allium sativum, Zingiber officinale.

1. Introduction

Many fruits and vegetables are perishable especially in tropical and subtropical regions without adequate refrigeration (Coursey, 1983). The magnitude of post harvest losses in fresh fruits and vegetables is estimated to be 25.80 % (Thirupathi, 2006). Tomatoes are cultivated throughout tropical and subtropical regions (Slunkhe and Desai, 1984). Most of the product is lost after the harvest because of inadequate handling and preservation methods (Wills et al., 1981; Liu and Ma, 1983) and also it is extremely difficult to harvest fresh tomatoes and vegetables without causing injury (Pantastico et al., 1975). The people in developing countries often cannot afford use the cold storage facilities (Liu and Ma, 1983) that may be because of lack of capital or lack of technical knowledge to small scale growers and retailers in these areas (Pantastico and Bautista, 1976).

Simple post harvest treatments are required for the preservation of tomatoes especially in the developing countries. Inaba and Crandall (1986) recommended the use of simple cold shock treatment to increase the shelf life of tomatoes without using cold storage. The extracts of many herbal plants showed antimicrobial activity (Sheik and Agnihothri, 1972). Kappo (1997) tested antifungal activity of fresh juice and aqueous extracts of turmeric and ginger against the fungi Aspergillus niger and Penicillium digitatum. There are some reports of using plant extracts as bio-preservatives to enhance the shelf life of tomatoes during storage. Hasabins and D’Souza (1988) showed the effect of natural plant products on storage rot of tomatoes,
where the fruits dipped in the plant extracts had reduction in the diseases incidence. Ayala-Zavala et al (2008) showed that antimicrobial treatments enhanced quality and bioactive compounds of fresh cut tomatoes. Hence, this study was taken up to evaluate the Garlic and Ginger extracts to enhance the shelf life of tomato during storage.

2. Materials and Methods

Ripened tomatoes were obtained from Yeshwanthpur vegetable market, retail shop from Mathikere and Sanjaynagar of Bangalore. The collected sample were placed in sterile polythene bags and made air tight. The tomatoes were subjected to microbiological analysis

The whole tomato was squeezed under aseptic condition and 10 gm of the sample was suspended in 90 ml of sterile physiological saline and serially diluted. The microbial load of the raw tomatoes was estimated by standard dilution method by using Nutrient Agar (For bacteria) and MRBA (For fungi) and the dominant microbial isolates were characterized up to genus level.

Plant extract preparation

Aqueous extracts of garlic (*Allium sativum* Linn) and ginger (*Zingiber officinale* Rose) were prepared by blending and squeezing of bulbs and rhizomes respectively by following the method described by Singh and Majumdar (2001). The bulbs of garlic and Rhizomes of ginger were cleaned and washed. The samples were blended by adding sterile in 1:1 (w/v) proportion to get fine texture. The blended material was then squeezed by using sterile muslin cloth to get extract. Further it was filtered through whatmann filter paper to have a clear solution this served as 100% concentration and then filter sterilized.

Screening of the plant extracts for their antimicrobial properties

The antimicrobial activity of the extracts on the microbial isolates from the tomato was studied by following modified media method. The extracts in different concentration were mixed with the Nutrient Agar and MRBA and were poured to sterile plates. Bacterial and fungal isolates inoculated onto NA and MRBA plates by streaking and point inoculation methods respectively. NA plates were incubated at 37 C for Two days and MRBA plates were incubated for Six days at room temperature. The observations were recorded in terms of resistance of growth in centimeters by measuring the colony diameter by taking average reading from four directions.

Shelf life studies on tomato

Matured, uniform sized, undamaged healthy ripened tomatoes were randomly selected and subjected to various treatments. The tomatoes were sprayed with the extract and then air dried. The untreated and treated tomatoes were bagged in a perforated polythene cover and kept at room temperature. Observations were recorded on the 1st, 3rd, 6th and 10th day. The spoilage percentage was calculated by following equation

\[ \text{Spoilage percentage} = \frac{\text{Number of tomatoes spoiled} \times 100}{\text{Total number of tomatoes}} \]

Physiological loss of weight (PLW) was calculated as percent loss of weight

\[ \text{PLW} = \frac{\text{Loss of weight of spoiled tomato}}{\text{Initial weight of tomato}} \times 100 \]

3. Results

The dominant bacteria isolated from tomato samples were *Bacillus*, *E.coli*, *Micrococcus*, *Staphylococcus*, *Erwinia*, *Pseudomonas*. *Rhizopus*, *Penicillium* and fungi were *Fusarium*, *Trichoderma*, *Aspergillus*, *Cladosporium* and *Alternaria*. The microbial isolates when treated with ginger and garlic extracts at different concentrations, the growth of these isolates was suppressed. The ginger extract at 1% concentration did not have much effect on both bacterial and fungal isolates but at 5% and 10% concentration the growth was suppressed. Garlic extracts comparatively
showed a good antimicrobial activity even at 1% concentration. At 10% concentration the microbial growth was completely inhibited.

The spoilage percent of the tomatoes treated with 10% extract after 10 days was 26.60 whereas, spoilage percent of the tomatoes treated with 1% and 5% was 53.00 and 33.33 respectively. Tomatoes treated with 10% ginger extract the spoilage percent was 33.33 after 10 days of storage whereas, with 5% ginger extract the spoilage percent was 60 but 1% ginger extract did not show any significant affect. Physiological loss of weight (PLW) of 0.63% observed in the tomatoes treated with 10% Garlic extract after 10 days of storage followed by 0.95% PLW of tomatoes treated with 10% ginger extract, 1.01% PLW of tomatoes treated with 5% garlic extract, 1.3% PLW of tomatoes treated with 1% garlic extract, 2% PLW of tomatoes treated with 5% ginger extract, 3.9% PLW of tomatoes treated with 1% ginger extract and 4.2% was recorded in the untreated tomatoes.

4. Discussion

The fruits normally exposed to large number of microorganisms of soil born, air born or may be introduced from the surface of plant (Andrews and Hirano, 1992). The spoilage of the fruits during post-harvest storage is due to infection by these microorganisms which gain entry through stomatal openings, lenticels, growth cracks or surface injuries (Wills, et al, 1981).

Several plant extracts or plant products have broad spectrum antimicrobial properties. They can be recognized as bio-preservatives having no harmful effects on human health. Therefore herbal extracts are promising for use with fruits to enhance the shelf life. They are safe and non-toxic, their application is simple and do not lose their efficacy at normal storage temperature. The use of herbal extracts has opened a new avenue for the control of spoilage (Shivpuri et al 1977). The extracts of garlic and ginger in 10 % concentration were inhibitory for most of bacterial and fungal isolates except for Rhizopus and Aspergillus in the present study. It is also noticed that as concentration of the extract increases, the effectiveness of extracts also increased. This type of results was observed by Sharma and Bohora (2003) with leaf extracts of Barelaevia diffusa, Salvadora
Dubey and Dwivedi (1991) reported the antifungal properties of garlic extracts on *Macrophoma phaseolina*. The extracts of *Azadirachta indica*, *Ocimum sanctum* and *Ricinus communis* were most effective in controlling banana rot (Singh *et al.*, 1993). The extracts of turmeric and ginger were effective in arresting growth of *Aspergillus niger* and *Penicillium digitatum* (Kappo, 1997).

The Tulsi leaf extracts contain polyamine biosynthesis inhibitor which block ornithine decarboxylase pathway which could be exploited to control fruit rots (Patil *et al.*, 1992). Spraying of tomato fruits with 10% garlic and ginger extract showed lesser spoil percentage. This significantly reduced the extent of spoilage. These results were on par with the observations of Hasabnis and D’Souza (1998) they recorded a spoil percent of 23 in alphanso fruits dipped in 10 % garlic extract. Significantly lower PLW percentage was recorded in the tomato fruits sprayed with 10% garlic extract followed by 10% ginger extract. There was a direct relationship was observed between the cumulative physiological weight loss and spoilage i.e. a high rate of PLW attributed to the spoilage of fruits (Gupta and Mukherjee, 1990).By the use of natural antimicrobials like herbal extracts can enhance the shelf-life and bioactive compounds of fresh-cut tomatoes, maintaining or increasing the contents of lycopene, ascorbic acid and total phenolic compounds (Ayala-Zavala, 2008). Application of garlic and ginger extracts can enhanced the helf life of tomato and this low cost technology can be better utilized for preservation of raw tomatoes.

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References


