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POSTHARVEST QUALITY AND SAFETY MAINTENANCE OF *Daucus carota L.* FRUITS BY NEEM OIL AND MORINGA OIL TREATMENT

* Adetunji C. O[1], Fawole O.B[4] Arowora K.A[1], Nwaubani S.I [1], Oloke J.K[3], Adetunji J.B [2], Ajani A.O[1]

[1]Nigerian Stored Product Research Institute, Km 3 Asa dam road, P.M.B. 1489, Ilorin,
[2]University of Ilorin, Department of Biochemistry, P.M.B. 1515, Ilorin, Kwara State.
[3]Ladoke Akintola University of Technology, Department of Pure and Applied Biology P.M.B 4000, Ogbomoso, Oyo State.
[4]University of Ilorin, Department of Agronomy, P.M.B.1515, Ilorin, Kwara State.

*corresponding author: E-mail:charliguitar@yahoo.comTel:08039120079.

ABSTRACT

Biodegradable edible coatings from Moringa oil(MO) and Neem oil (NO) was applied to carrot fruits in order to provide environmentally friendly, healthy treatments (with which to better preserve fresh fruit quality) and safety during postharvest storage at ambient temperature of 27± 3°C and relative humidity of 50-60% . Physical properties like weight loss and texture were determined throughout the storage period of 6 weeks. The coatings had a significant effect on the development of quality variables.The overall results showed the superiority of the coatings in extending the shelf-life of carrot fruit as compared to controlin the following order Moringa Oil>Neem Oil>Control.

Keywords: Edible Coatings, *Moringa Oil*, Neem Oil, Carrot, Firmness and Weight Loss.

INTRODUCTION

The demand for safer and more natural food has been increasing since consumers have become more concerned with chemical residues in food, so natural compounds such as spices and herbal oils are alternatives to chemical food preservatives because they have antimicrobial or antifungal properties. Furthermore, they do not have any significant medical or environmental impact Rodrigues *et al.* (2007).

Various materials can be used to make edible coatings or films, such as carbohydrates, proteins, lipids or a combination of these. Different materials have unique properties, for example, polysaccharide edible coatings or films are hydrophilic and generally with poor water barrier properties. In contrast, lipid edible coatings are hydrophobic and generally have better water barrier properties but less mechanical strength (Veiga-Santos *et al*., 2005; Han, 2007; Lin and Zhao, 2007). Though edible coatings containing antimicrobial

agents have a great potential to reduce specific microorganisms on the surface of minimally processed foods, the antimicrobial migration in different coating matrix should be considered (Han and Floros, 1998; Ouattara *et al*., 2000; Appendini and Hotchkiss, 2002; Quintavalla and Vicini, 2002; Suppakul *et al*.,
2003).

The most well known and oldest coating technique was the application of natural waxes and lipid coatings on specific fruits and vegetables to reduce dehydration, fungi attack, and abrasion during processing and to improve appearance by adding glossiness (Paull and Chen 1989, Drake and Nelson 1990, Baldwin 1994, Hagenmaier and Baker 1994, Baldwin and others 1997). Limitations to their use are poor mechanical properties and oily appearance in some products (Baker and others 1994, Baldwin and others 1997).

Carrot (*Daucus carota L.)* belongs to the family *Umbelliferae*. The carrot is believed to have originated in Asia and now under cultivation in many countries. The carrot is an important vegetable because of its large yield per unit area throughout the world and its increasing importance as human food. It is orange-yellow in color, which adds attractiveness to foods on a plate, and makes it rich in carotene, a precursor of vitamin A It contains appreciable quantities of nutrients such as protein, carbohydrate, fiber, vitamin A Potassium, Sodium, thiamine and riboflavin, and is also high in sugar. Its use increases resistance against the blood and eye diseases. It is eaten raw as well as cooked in curries and is used for pickles and sweetmeats (Ahmad *et al.*, 1994; Ahmad *et al.*, 2005; Hassan *et al.*, 2005).

Neem oil with the main constituent of Azadirachtin is used as insect repellent, feeding inhibitors, egg laying deterrents, growth retardants and sterilants among others. It has both contact and systemic action on plants for controlling fungal diseases (Rao, 1990).

Moringa oleifera, (Moringaceae) commonly referred to as moringa is the most widely cultivated specie of the genus Moringa. It belongs to the family of Moringaceae. Moringa is an exceptionally nutritious vegetable tree with a variety of potential uses, such as medicinal, nutritional, industrial uses, etc. The Moringa seeds yield 38 to 40% edible oil (called Ben oil from the high concentration of behenic acid contained in the oil) that can be used in cooking, cosmetics and lubrication. The refined oil is as clear as any other botanical oil (FAO, 1999). It is pale yellow in colour with a flavour often described as mild and nutty. It is resistant to rancidity, which may be because it contains powerful antioxidants that act as natural preservatives.

The present study determined the effect of Edible coatings from Moringa and Neem oil on physical properties of carrot during storage at ambient temperature..

MATERIALS AND METHODS

Source of the Fruits and Coating Materials

Carrot fruits (Daucus carota), were purchased from Ipata market in Ilorin on the day after harvest and were immediately placed in ambient storage (27°C ± 3).Uniformity in size, color and absence of damage and fungal infection were the parameters used in selecting carrot for this study. *Moringa oleifera*seeds and Neem seeds were obtained from Nigeria stored products research institute (NSPRI) garden

Extraction of Neem Oil

The processing of neem seed involved cleaning, dehulling and oil extraction. The cleaning process was dry cleaning. The seeds were dehulled with a mortar and pestle and then winnowed. The dehulled seeds were milled using hammer mill and 500 g of the resultant powder was extracted. The oil was extracted manually using hand to knead the paste with occasional addition of cold water until the oil started coming out. 175 ml (representing 35%) of oil was obtained and sieved to remove impurity. The oil obtained was yellow in colour with characteristics neem seed flavour.

Extraction of Moringa Oil

The dried moringa seeds were dehulled using mortar and pestle while the kernels were milled using harmer mill. 500 g of the powder thus obtained was used for the oil extraction. 125 ml (representing 25%) oil was extracted manually by kneading the moringa paste with hands with occasional addition of cold water; the pale yellow with characteristic moringa seed flavour oil extracted was then sieved to remove impurity and was finally packaged.

Coating processes

Carrots were dipped in coating solutions of MO and NO oil respectively for 30secs, the excess coating was drained and the coated carrot was dried in a forced-air dryer (20 °C) for 30 min. Carrots dipped in distilled water was used as a control. After the coating process, the carrots were stored at ambient temperature of 27 ± 3°C and 50-65% Relative Humidity for 6weeks. For each treatment and storage time, 40 fruits were coated. Firmness and Percentage weight losswere determined during the 6weeks storage period.

Treatments

T_o (control):-Untreated carrot;

$T_{1:-}$Carrot coated with Moringa oil (MO);

T2:-Carrot coated with Neem oil (NO)

The treated and untreated fruits were packed in small plastic baskets and each basket contained 20 carrot fruits. The baskets were stored at ambient temperature and relative humidity (27±2°C and 55-60%).

Physiochemical analyses of fruits: The following parameters were determined throughout the six weeks storage period.

Weight loss: To evaluate weight loss, separate samples in 3 replicates of each treatment were used. The same samples were evaluated for weight loss each time at weekly intervals until the end of experiment. Weight loss was determined by the following formula:
Weight loss (%) = [(A-B)/A] x 100
Where A indicates the fruit weight at the time of harvest, B indicates the fruit weight after storage intervals. (A.O.A.C., 1994)

Firmness: - Firmness was measured as the maximum penetration force (N) reached during tissue breakage, and determined with a 5 mm diameter flat probe. The penetration depth was 5 mm and the cross-head speed was 5 mm s^{-1} using a TA-XT2 Texture Analyzer (Stable Micro Systems, Godalming, UK), MA. Carrots were sliced into halves and each half was measured in the central zone.

Ascorbic acid: - Ascorbic acid content was measured using 2, 5-6 dicholorophenol indophenols' method described by A.O.A.C (1994).

Statistics

All results are means ± S.E., SPSS software (version 12.0, SPSS Inc., US) was used for all statistical analysis for Analysis of variance. The significance level used was 0.05.

RESULTS AND DISCUSION

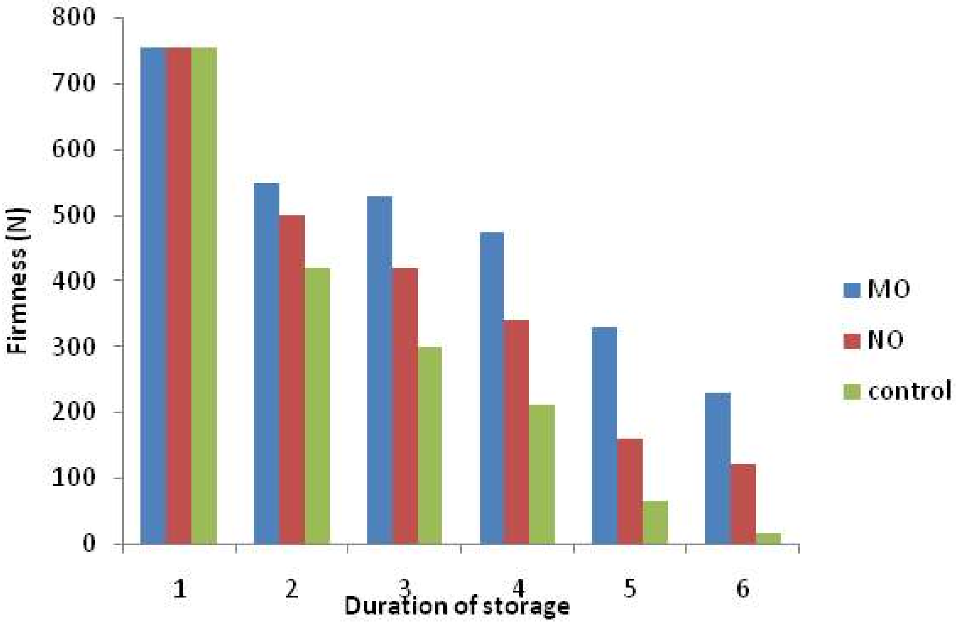

Fig 1: The effect of edible coatings from MO and NO on Firmness of carrot stored at ambient temp

The effects of edible coatings from MO and NO on firmness of carrot fruits stored at ambient temperature are shown in Fig.1 above .The mean ± SE values for the firmness of coated MO and NO carrot were 2869.19±74.77 lb/kg/N and 2296.72 ±234.11 lb/kg/N respectively while the mean±SE value for the firmness of uncoated carrot was 1765.23± 110.42 lb/kg/N. Our results are similar to the findings by Yaman and Bayoindirli (2002) for cherries coated with Semperfresh™. The retention of firmness can be explained by retarded degradation of insoluble protopectins to the more soluble pectic acid and pectin. During fruit ripening, depolymerization or shortening of chain length of pectin substances occurs with an increase in pectinesterase and polygalactronase activities (Yaman and Bayoindirli, 2002).Low oxygen and high carbon dioxide concentrations reduce the activities of these enzymes and allows retention of the firmness during storage (Salunkhe *et al*., 1991).

Percentage Weight loss

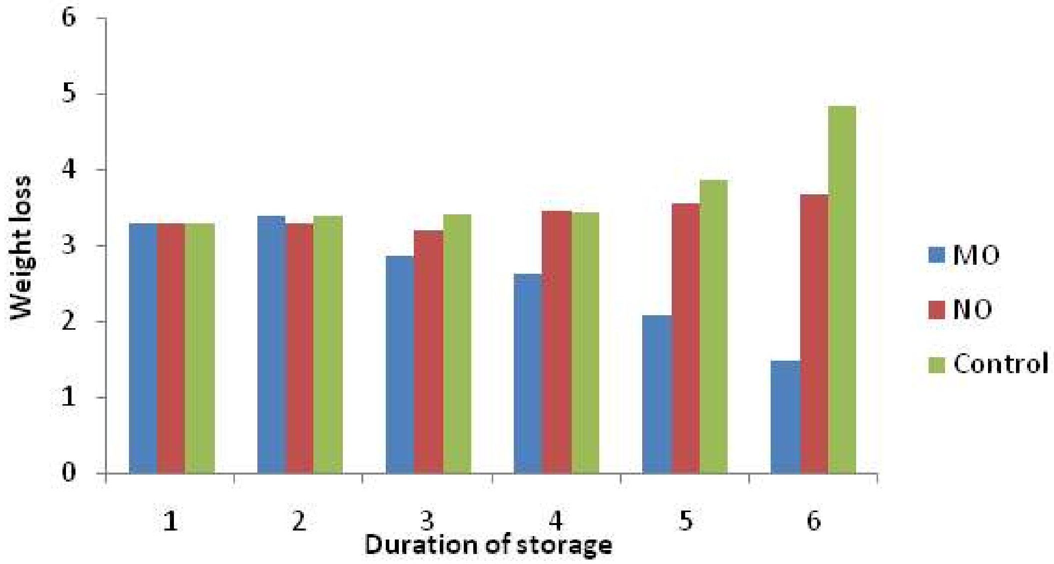

Fig 2: Effect of edible coatings from MO and NO on Firmness of carrot at ambient temp

The effects of edible coatings from MO and NO on weight loss of carrot fruits stored at ambient temperatureare shown in Fig.2 above.The mean±SE value for the weight loss of ME and NO were 3.36±0.01g and3.40±0.02g while the mean±SE value for the weight loss of uncoated carrot was 3.46±0.04g.

The obtained results are in agreement with the findings by GarcÂ´ia *et al*. (1998a, b) for strawberries coated with starch-based coatings and those of Joyce *et al*. (1995), who reported that waxing extended the storage life of avocado both through a reduction in water loss and a modification of the internal atmosphere .Weight loss is an important index of post harvest shelf-life of fresh produce. It is mainly attributed to the loss of water during metabolic processes like respiration and transpiration. The coating helps to reduce this further by forming a film on the top of the skin acting as an additional barrier to moisture loss (Togrul and Arslan, 2004). This barrier produced by coatings from (ME and NO) also reduces the oxygen uptake by the fruit which in turn slows down the rate of respiration associated with weight loss from the fruit surface.

The primary mechanism of moisture loss from fresh fruits and vegetables is by vapor-phase diffusion driven by a gradient of water vapor pressure at different locations (Yaman and Bayoindirli, 2002). The coatings (ME and NO) caused a significant (p=0.05) decrease in weight loss compared to control sample.

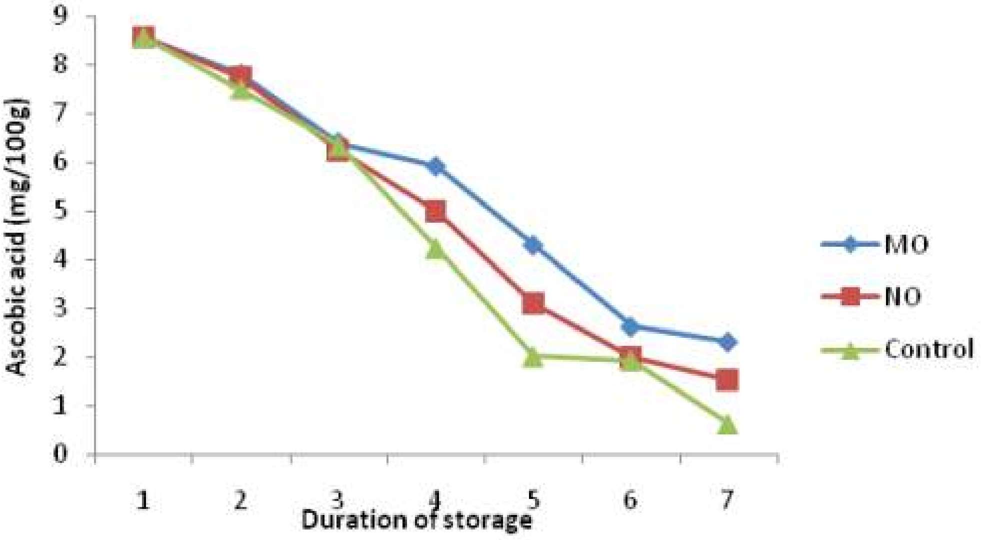

Fig3: Effect of edible coatings from MO and NO during storage at ambient storage.

Fig 3 shows the effect of edible coatings from MO and NO on ascorbic acid. There was a significant decrease in ascorbic acid values of coated fruits along with storage. However, the rate of decrease in ascorbic acid was significantly higher in untreated control fruits compared with coated fruits Present studies showed that ascorbic acid was mostly high in mature but unripe carrot fruits and it decreased as the ripening progressed. The reason for high ascorbic acid content in coated fruit could or may be attributed to slow ripening rate of the treated fruit. Oxidation of ascorbic acid may be caused by several factors including exposure to oxygen, metals, light, heat and alkaline pH (Sritananan *et al*., 2005). Coatings served as a protective layer and control the permeability of O_2 and CO_2 (Srinivasa *et al*., 2002). The results are in line with the findings of Jiang *et al*., (2004) who narrated that ascorbic acid content decreased when longan fruit was coated with chitosan at low temperature of 2°C.

CONCLUSION

Results indicated the importance of storage treatment and its effect on slowing the decline in qualitative properties of carrot during storage at ambient temperature. *MO and NO*applied as edible coating on carrots fruit had beneficial effects in retarding the ripening process in carrot. This treatment was effective as a physical barrier and thus reduced the weight loss during postharvest storage. In addition, MO and NO delayed softening and maintained the quality of carrot fruits during ambient storage. Textural analysis showed that

*MO and NO*applied as edible coating could have a protective effect on carrot,reflected by the greater firmness of coated samples duringstorage, which could reduce economic losses due to spoilageproduced from mechanical damage during handling and transportation.

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