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Effect of different packaging treatments on some chemical constituents of Anardana

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ABSTRACT

A study was conducted to screen out best packaging treatment to retain some chemical attributes of dried wild pomegranate arils (Anardana) during storage. The fruit arils were pre-treated to check the browning reactions in mechanical cabinet drier at a temperature of 60 $\pm$ 2°C. Different packaging treatments with or without humectants (NaCl or sucrose powder sachets) were given to store dried arils under ambient conditions (18 to 25°C) for six months. Among all packaging treatments aluminium laminated package containing NaCl as moisture absorber retained better total soluble solids, total solids, pH and residual SO_2 during storage. No significant differences were seen in starch and ash content of arils during storage as well as among different packaging treatments. Putting of moisture absorber (humectant) along with the arils inside the primary package will also be a better choice to retain the good quality of dried wild pomegranate arils during storage.

Keywords: Wild pomegranate; dried arils; drying; storage; packaging

INTRODUCTION

Wild pomegranate is found wild in forests of western Himalayan regions of India and is locally called Daru. It is a relic fruit and is known for potential antioxidant activities due to its biological components like organic acids, vitamin C, anthocyanins and phenols (Thakur et al 2010, Thakur et al 2011). Besides these it also contains other nutritional constituents like fruit sugars, pectin, starch and fibre (Bhat 2007, Thakur et al 2011). Researchers believe that an improved form of this fruit benefits heart health largely due to high levels of polyphenols (tannins, anthocyanins and punicalagins) that have powerful antioxidant and anti-inflammatory effects. When pomegranate juice was compared to other antioxidant drinks like red wine, blueberry, green tea and grape juice it outperformed its competition (Anon 2015). Arils of this fruit are used in dried form commonly known as Anardana in India. Anardana is used in many traditional medicinal formulations to cure neurological disorders, stomach and cardiac infections and kidney disorders (Jalikop et al 2002). The dried arils help in improving digestion and mouth feel due to its high acid content (Singh and Kingsley 2008). Anardana is used as a condiment especially in Indian and Pakistani cuisines and as a substitute for tamarind and mango powder. Its arils are also used in several culinary preparations such as topping for fruit salads, yoghurt and ice-cream. Farmers and rural women of Himalayan regions generally collect wild pomegranate fruits from forest areas, dry them in open sun and store as such in jute bags. During high humid conditions dried arils become susceptible to degradation which leads to loss in quality. Thus present investigation was aimed at evaluating the effect of different packaging treatments on some quality attributes of Anardana during storage.

MATERIAL and METHODS

Harvested wild pomegranate fruits were procured from Mandi, HP and brought to the Department of Food Science and Technology, Dr YS Parmar University of Horticulture and Forestry, Nauni, Solan, HP. Extraction of arils was done manually after thorough washing in water. Extracted arils were pre-treated by steam blanching for 0.5 minutes followed by sulphuring with sulphur powder (0.3%) for one hour before carrying out the dehydration (Thakur et al 2010). The pre-treated arils were dried at a temperature of 60 $\pm$ 2°C inside a mechanical cabinet dehydrator up to a constant weight. Different packaging treatments (T) were given to dehydrated arils viz T_1 (dried arils in aluminium laminated package), T_2 (dried arils in polyethylene package), T_3 (dried arils in thermofoam tray package), T_4 (dried arils in aluminium laminated package with 5% sucrose), T_5 (dried arils in polyethylene package with 5% sucrose), T_6 (dried arils in thermofoam tray package with 5% sucrose), T_7 (dried arils in aluminium laminated package with 5% NaCl), T_8 (dried arils in polyethylene package with 5% NaCl), T_9 (dried arils in thermofoam tray package with 5% NaCl). These packed arils were stored at ambient temperature (18-25°C) for a period of 6 months for storage studies. The observations for different chemical parameters were recorded at 0, 3 and 6 months (M) interval of storage.

TSS was measured by hand refractometer and expressed in degree Brix (°B) or per cent (%). The total solids (TS) of cabinet dried arils was determined by drying the weighed arils to a constant weight in hot air oven at 70 $\pm$ 1°C. TS was calculatedin terms of percentage. The pH of dried arils was estimated by using a digital pH meter (CRISON Instrument Ltd, Spain). The residual SO_2 was measured in dried samples by using the modified Ripper titration method as described by Ranganna (2009). Calculated SO_2 is expressed in parts per million (ppm). Starch was estimated by the method given by Ranganna (2009) and is expressed in per cent (%). Total ash content was determined at a temperature of 550°C in muffle furnace to obtain a carbon free white ash with a constant weight (Ranganna 2009). The data on chemical characteristics of dried arils were analyzed by CRD (Cochran and Cox 1967). Experiments were replicated three times to reduce experimental error.

RESULTS and DISCUSSION

Fig 1 shows general decrease in TSS with the advancement of storage period. While comparing different packaging treatments maximum (40.80°B) TSS in the dried arils were recorded in aluminium laminated package + 5 per cent NaCl (T_7). However the minimum (40.26°B) TSS was observed in thermofoam tray package (T_3) during storage. A significant change in TS of dried arils was seen during storage of six months (Fig 2). Maximum TS (89.76%) was observed in T_7 and minimum (89.76%) in T_3. General decrease in TSS and TS might be due to the moisture uptake by arils during storage. It is evident that decrease in TSS and TS content was significantly much less in $T_{7,}$ T_4 and T_1 as compared to other packaging treatments. It might be because of the pin holes in the aluminium foil of the aluminium laminated package which might have given the way for the slighter movement of moisture and air inside the pouch as compared to other packaging treatments. NaCl and sucrose powder inside the pouch might have also restricted the moisture penetration into Anardana because of their higher moisture absorbing properties and that is why dried arils retained higher TSS and TS as compared to the other packages. This trend of results is in conformity with the findings of Thakur et al (2012), Kumar (2013) and Bhat et al (2014). The pH of the dried arils experienced an increase during storage. Minimum (3.79) increase was seen in T_7 and maximum (3.92) in T_3 after six months of storage (Fig 3). The magnitude of increase in pH was less in arils packed in T_7 than the arils packed in other treatments. The increase in pH of arils during storage might be due to decrease in TS and TSS. However arils packed in $T_{7,}$ T_4 and T_1 showed minimum changes in the soluble constituents as a result of the conditions created inside the pouch. NaCl and sucrose in the respective packages might have absorbed the moisture inside the aluminium laminated package instead of arils thus helping in retaining the higher TSS and lower pH in the arils. Similar trend of results has also been reported by Bhat (2007), Kumar (2013) and Pritika (2015). Data pertaining to changes in residual SO_2 are presented in Fig 4 which reveal that residual SO_2 of dried arils decreased significantly during storage. The maximum residual SO_2 (185.80 ppm) in the dried arils was retained in T_7 and the minimum (96.40 ppm) in T_3. The decrease in residual SO_2 was significantly less in arils packed in $T_{7,}$ T_4 and T_1 than the arils packed in other packaging material. Reduction of SO_2 during storage might be due to its escape from the packaging material. However retention of

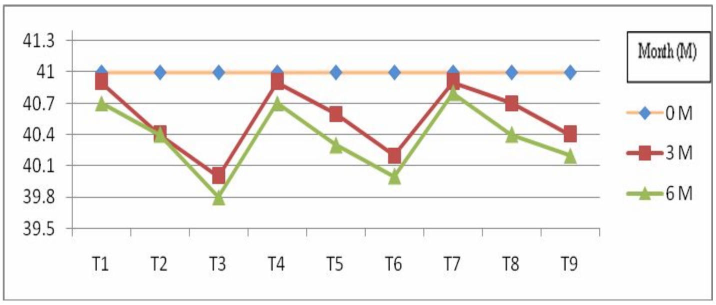

Fig 1. Effect of different treatments on TSS (^{o}B) of Anardana during storage

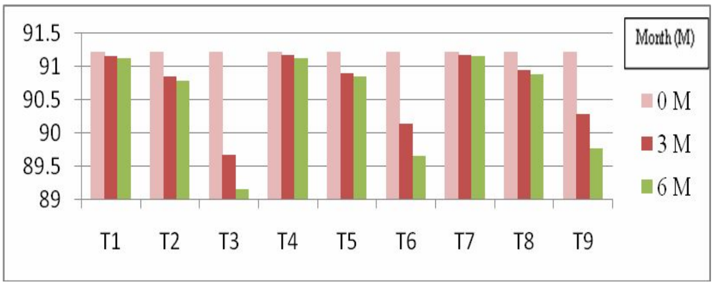

Fig 2. Effect of different treatments on TS (%) of Anardana during storage

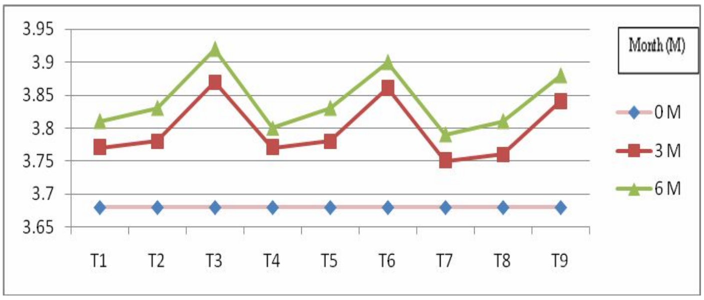

Fig 3. Effect of different treatments on pH of Anardana during storage

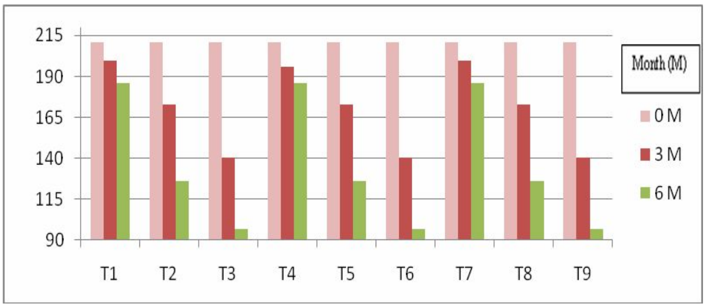

Fig 4. Effect of different treatments on residual SO_2 (ppm) of Anardana during storage

more SO_2 in aluminium laminated package might be due to minute changes in TS and TSS of the aluminium laminated package which hindered the exchange of gases and created a better barrier for the removal of SO_2. NaCl and sucrose powder inside the aluminium laminated package might have not contributed much in the reduction of SO_2 to a maximum extent. Present results are in accordance with those of Bhardwaj and Lal (1990) and Bhat (2007). The data pertaining to changes in starch and ash of dried arils during storage are presented in Figs 5 and 6 which indicate that there was a negligible decrease in starch as well as the ash content of arils during storage. Slight decrease in starch and ash content during storage in different packaging materials might be due to the changes in TSS, TS, pH and residual SO_2 content. However with the advancement of storage slight decrease in starch and ash content might be attributed to the participation of metal ions in non-enzymatic reactions. The trend of results obtained for starch and ash content is similar to the results reported by

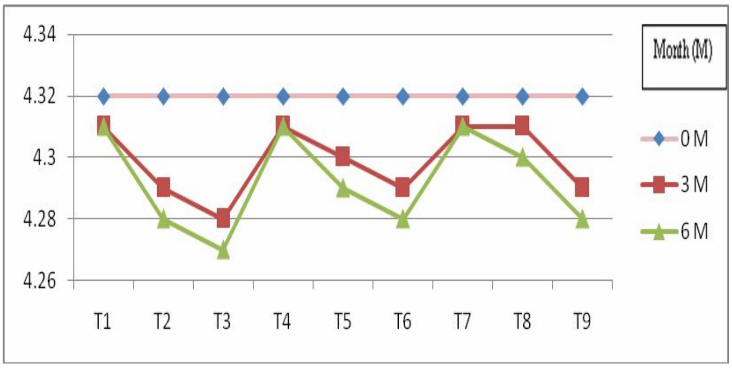

Fig 5. Effect of different treatments on starch (%) content of Anardana during storage

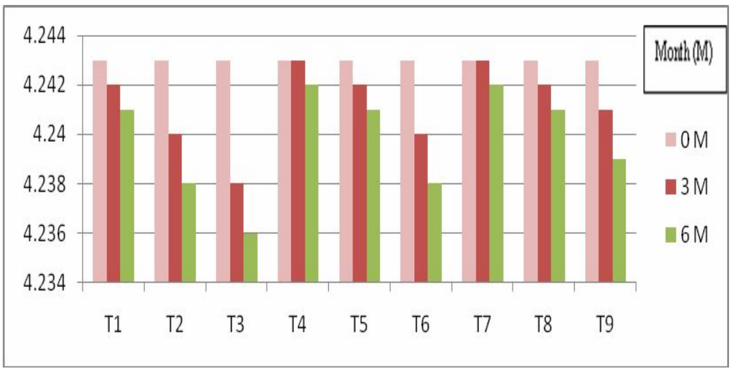

Fig 6. Effect of different treatments on ash (%) content of Anardana during storage

Sharma et al (2002), Bhat (2007), Kumar (2013) and Pritika (2015).

CONCLUSION

It can be concluded from these studies that total soluble solids, total solids, pH, starch and residual sulphur dioxide can be retained better in aluminium laminated package with or without NaCl and sucrose powder in comparison to polyethylene and thermofoam tray packaging after six months of storage under ambient storage conditions (18-25^{o}C). Thermofoam tray package was found least effective for storage of dried arils among all packaging materials.

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