International Journal of Agriculture, Environment and Biotechnology
Citation: IJAEB: 10(6): 739-747, December 2017
DOI: 10.5958/2230-732X.2017.00091.2

AGRICULTURE ENGINEERING

Physico-chemical Analysis of Fruit Juices by Using Self-Made Low Cost Portable Ohmic Heater

Anjum Ayoub[1], S.A. Sofi*[1] and Ashish mohite[2]

[1]Division of Food Science and Technology, SKUAST-Jammu, India
[2]Department of Food Technology, Gautam Buddha University Greater Nodia UP. India

*Corresponding author: sajadtec@gmail.com (ORCID ID: 0000-0003-4214-1138)

Paper No.: 636 **Received:** 09-09-2017 **Accepted:** 18-11-2017

ABSTRACT

The conventional methods of preservation like refrigeration, adding preservatives etc. are some of the methods but they might have side effects on environment like refrigeration on ozone layer, and on consumers like preservatives affects the health. In this experiment firstly ohmic heater was constructed having 3 ltrs and then 2 ltrs of capacity and finally they were discarded because they need large surface area and require large quantity of juice. Finally we prepared heater of 1.5 ltrs capacity which gave good electrical conductivity and it was economical also. The juices were stored in PET bottles at refrigeration temperature and physico+chemical analysis was done at weekly intervals over a period of 21 days. In parallel study, another spicemen of juices was stored at ambient temperature and checked at regular intervals. TSS, pH, Titrable acidity and Vitamin C content were checked after heating. The juices were heated for the 5 minutes, 10 minutes and 15 minutes respectively and then their TSS, pH, Titrable acidity, Vitamin C , sensory analysis were checked at weekly interval stored in both refrigerated and ambient conditions. Significant difference in pH,of sweet orange and pomegranate juice refrigerated and ambient condition were observed. It was noticed that TSS, and Titrable acidity Pomegranate and sweet orange juice under ambient and refrigerated increased significantly, whereas vitamin C showed the decreasing pattern in both the conditions.

Highlights

- Self-made low cost portable ohmic heater was designed .
- Sweet orange and pomegranate juices were analysed for various parameters tested on portable ohmic heater.

Keywords: Ohmic heating, refrigration, titratable acidity, sensory

The main goals of conventional thermal processing of foods are to ensure microbiological safety, enhance shelf life of food through destruction of enzymes, toxins etc. Despite the effectiveness of traditional technologies from a microbial safety stand point, they cause sensorial and nutritional food deterioration. Although food fortification can overcome certain nutritional degradation, sensorial attributes such as flavour, aroma, texture and appearance are difficult to retain in conventional thermal processing. Ohmic heating is an alternative and fast heating method that has large number of actual application exists in food industry, water distillation, waste treatment, chemical, processing etc. Ohmic heating is one of the excellent alternative methods of heating, and it shows much promise especially in food industry over the last few decades because there is an increasing shift from batch thermal operation towards continuous high temperature and short time processing of foods. It is also called as joule heating direct electrical resistance heating, electrical resistance heating or electro conductive heating and is defined the process in which alternating electric currents are passed through a food or any other material with the main purpose of heating them. In Ohmic heating, the principal mechanism of microbial in activation is thermal in nature. But recent study shows that mild electroporation occurs during Ohmic heating. Ohmic heating involves the passing of electric current (AC) through a material such as liquid–particulate food system and it acts as an electrical resistance in which heat is generated. (Salengke *et al.* 2009).

There are endless possibilities for design of Ohmic heating system, but there are several key elements that will be present in all types. A power supply is needed to produce the electricity and the electrodes connected to the power supply must be in physical contact with the material in order to pass the electric current. The electrode gap(distance between the electrodes in the system)can vary depend upon the size of the system, but by changing this distance, the electric field strength, expressed in volts per centimetre (v/cm) can also be varied. Two possible geometrics can be considered transverse field collinear field models (Strirling 1987) with the transverse model the applied electric field and current flux are at right angles to the mass flow, and with the collinear model they are parallel Salengk *et al.* (2011).

Ohmic heating provides rapid and uniform heating resulting in less thermal damage to the food product. Beyond heating of fruits and vegetables, the applied electric field under Ohmic heating causes various changes in quality and nutritional parameters which include inactivation of enzymes and microorganisms, degradation of heat sensitive compounds, changes in cell membrane, viscosity, pH, colour, and rheology. Ohmic heating rate depends upon the electric field strength and electrical conductivity of the product. Long *et al.* (2004) studied the effect of different heating methods on the production of protein- lipid film. Salangke *et al.* (2011) studied the experimental investigation of Ohmic heating of solid- liquid mixtures under worst-case heating scenarios. Marybethlima *et al.* (2009) studied the effects of Ohmic heating frequency on hot air drying rate and juice yield.

Presently studies going on design of process. Another study is going on blanching of mushrooms has indicated that substantial water saving could occur as a result of this technology. It has proven advantages over conventional thermal processing and novel thermal alternative technologies like microwave heating, radio frequency heating and induction heating better product quality, less cooking time, low capital cost, better energy efficiency and an environment friendly process. Research is going also in future in Ohmic heating which is defined as follows: Ohmic Thawing, Inactivation of food enzymes, Pasteurization and sterilisation, Aseptic process under Ohmic heating. It results in minimal mechanical damage and better nutrient's and vitamins retention, high energy efficiency because 90% of the electrical energy is converted into heat, reducing risks of fouling on heat transfer surface and burning of the food products. The present study was aim to develop portable Ohmic heater for instant thermal preservation process for selected juices (Etebu & Nwauzoma 2014). It can also be used for ready to serve juices. The instrument is designed very compactly and is easy to handle .Efforts were made to develop a low initial cost instrument which can be easily shifted to desired place and it takes less processing time with environmental friendly advantage with following objectives (1) To design a portable Ohmic heater for selected fruit juices and (2) To study the physico-chemical properties of Ohmic heated juices.

MATERIALS AND METHODS

Fabrication of Ohmic heating

The details of completely fabricated model of Ohmic heating system are as follows:

Product body fabrication

The product body of Ohmic heating system was made by using food grade PVC material of diameter of 12 cm and height of 16 cm with a capacity of filling 1.5 L of pomegranate juice.

Stainless steel electrode

The top and bottom electrodes for ohmic heating system was designed and made by Stainless Steel Grade (SS) – 316.

Thickness of electrode

Stainless steel electrode was made with a thickness of 0.5 cm.

Extraction of pomegranate and sweet orange juice

Raw pomegranates and sweet oranges were selected and were sorted for selecting proper juice extraction and also to prevent any sort of contamination after that washing was done by clean water proper hygienic conditions were maintained during washing. After completing of washing process, peeling was done by specialised knife (Aslam & Varani 2006).

Sweet orange and pomagarnate
↓
Sorting and washing
↓
Juice extraction (Juicer, Mixer)
↓
Filtration (Sieves)
↓
Bottle Filling (Filling into bottles)
↓
Storage (Refrigerated)

Fig. 1: Flow diagram of pomegranate Juice extraction

Physico-chemical analysis of ohmic heated juices

Titrable acidity, TSS (Total Soluble Solids) pH, total sugar and vitamin C by AOAC 2000 and Ranganaa (2005). Sensory analysis by 9- hedonic scale (Sofi *et al*. 2014).

RESULTS AND DISCUSSION

The investigation was carried out to observe the effect of various physico-chemical properties of sweet orange and pomegranate juice after Ohmic heating at different storage condition.

TSS of fruit juices in refrigerated and condition after Ohmic heating for 5 minutes

The TSS of pomegranate juice and sweet orange juice with the increasing storage period increasing linearly as also revealed by Ayadi (2004). Table 1 showed that TSS was found highest in sweet orange juice in comparison with the pomegranate juice at refrigeration storage condition after Ohmic heating for 5 min. At first day of storage the TSS was same for both the juices. but after one week there was rise in TSS of sweet orange juice over pomegranate which was 8 °Brix in comparison to pomegranate which was 6 °Brix. After 14 days (i.e. at 2 weeks.) the TSS of sweet orange juice increased which was 10 °Brix and also there was increase in TSS of pomegranate juice which is 8, but rate of increase in TSS of pomegranate was less in comparison with sweet orange juice. Then after 21 days (i.e. at 3 weeks) the rate of increase in TSS of sweet orange juice continued as 11 °Brix. Also TSS of pomegranate juice increased which was 10 °Brix. Increase in TSS of pomegranate was low than TSS of sweet orange juice.

Finally, the TSS of juices increased 10 °Brix for sweet orange juice and 14 °Brix for pomegranate at 21 days of storage at refrigeration condition. At first day of storage the pH of pomegranate juice as showed in Table 1 was 3.6 and for sweet orange juice it was 3.7. After 7 days (i.e.1 week) the pH of pomegranate juice decreases and became 3.45, for sweet orange juice the pH also decreased and became 3.3. Then after 14 days (i.e. 2 weeks) the pH of pomegranate

Table 1: Ohmic heated fruit juices in refrigerated and ambient condition for 5 minutes

Juice	TSS (° Brix)				pH				Titrable Acidity (%)				Vitamin C (mg/100gm)			
Days	1	7	14	21	1	7	14	21	1	7	14	21	1	7	14	21
Pomagarnate (A)	5	8	9	11	3.60	3.50	3.40	3.20	0.64	0.71	0.78	0.80	10	9	8	6
Pomagarnate (R)	5	6	8	10	3.60	3.45	3.15	3.05	0.64	0.68	0.71	0.76	10	9	7	6
Sweet orange (A)	5	6	8	9	3.70	3.50	3.40	3.20	0.75	0.85	0.90	0.96	53	50	47	43
Sweet orange (R)	5	8	10	11	3.70	3.30	3.0	2.8	0.75	0.81	0.85	0.89	52	47	44	40

juice decreased and became 3.15, for sweet orange the pH decreased and became 3. After 21 days (i.e. 3 weeks) the pH of pomegranate juice decreased and becames 3.05, for sweet orange pH also decreased and became 2.8.

Finally the decrease of pH occurred for sweet orange juice in comparison to pomegranate juice after Ohmic heating at 21 days of storage at refrigeration condition. The pH decreases for sweet orange juice from 3.7 to 2.8, while for pomegranate juice the pH decreased from 3.6 to 3.05 within 21 days of storage at refrigeration condition respectively. The effect on titrable acidity as shown in above tables of pomegranate juice and sweet orange juice within the storage condition of 30 days. At day one the titrable acidity of pomegranate juice was 0.64% and for sweet orange juice it was 0.752%. After 7 days (i.e. 1 week) the titrable acidity was 0.68% which increased for pomegranate juice and for sweet orange juice it was 0.81% which also increased. After 14 days (i.e. 2 weeks) the titrable acidity increased for pomegranate juice which is 0.71%, also increased for sweet orange juice which was 0.85%. After 21 days (i.e. 3 weeks) the titrable acidity increased for pomegranate juice which was 0.76%, also for sweet orange juice it also increased which was 0.891%. Finally, it showed that titrable acidity increased for both the juices but for sweet orange the titrable acidity increased maximum in comparison to pomegranate after Ohmic heating and storage at refrigeration conditions for 21 days similar findings was reported by Quarini (1995).

Effect on vitamin C content mg/100g of pomegranate juice and sweet orange juice after Ohmic heating and storage at refrigerated conditions for 21 days.

At day first the value of vitamin C content for both the juices of pomegranate and sweet orange were 10 mg/100g and 52 mg/100g, respectively. After 7 days (i.e. 1 week) the vitamin C content of pomegranate decreased and became 9 mg/100g and for sweet orange juice the vitamin c decreased and becomes 47 mg/100g. After 14 days (i.e. 2 weeks) the vitamin C decreased for pomegranate juice decreased and becomes 7 mg/100g and for sweet orange juice it continued to decrease and became 44 mg/100g. Then after 21 days (i.e. 3 weeks) the vitamin C content for pomegranate juice continued to decrease and became 6 mg/100g, for sweet orange juice it continued to decrease and became 40 mg/100g.so there was gradual decrease of vitamin C for both the juices. But from the graph the maximum decrease occurred in pomegranate in comparison to sweet orange during 21 days of storage at refrigeration conditions

Fruit juices after Ohmic heating for 5 minutes and stored at ambient condition

Effect of ohmic heating at ambient condition on juices

The TSS increases in sweet orange juice and also in pomegranate juice but maximum rise was in pomegranate juice in comparison with the sweet orange juice (Table 1). Initially the TSS was 5 °Brix for both the juices and it increased up to 11 °Brix and 11 °Brix for pomegranate juice and sweet orange juice respectively. The pH of both the juices decreased but the maximum decrease observed in sweet orange with the increase in number of days of storage. The pH decrease occurs in both the juices, for pomegranate the pH decreased from 3.6 to 3.2 and for sweet orange juice it decreased from 3.7 to 3 with in the 21 days of storage. The titrable acidity of both the juices increased but the maximum rise was observed in sweet orange juice with the increase in number of days of storage. It increased from 0.64% to 0.8% for pomegranate juice and 0.752% to 0.96% for sweet orange respectively with in the storage of 21 days. The vitamin C (mg/100g) of both the juices decreased but the maximum decrease was observed in pomegranate juice with the increase in number of days of storage. Vitamin C decreases for pomegranate juice changed from 10mg/100g to 6mg/100g and for sweet orange it decreased from 53mg/100g to 43 mg/100g Earlier Walton *et al.* (1945) also observed similar finding.

Fruit juices after Ohmic heating for 10 minutes stored at refrigerated condition

Table 2 Shows TSS of pomegranate juice and sweet orange juice with the passage of time (days) the TSS became maximum in sweet orange juice in comparison with the pomegranate juice under refrigeration storage condition after ohmic heating. At first day of storage the TSS was same for both the juices but after one week there was rise in TSS of sweet orange juice and pomegranate which was

Table 2: Ohmic heated fruit juices in refrigerated and ambient condition for 10 minutes

Juice	TSS (° Brix)				pH				Titrable Acidity (%)				Vitamin C (mg/100gm)			
Days	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**
Pomagarnate (A)	5	8	10	13	3.60	3.35	3.25	3.10	0.64	0.78	0.80	0.90	10	9	7	6
Pomagarnate (R)	5	6	9	11	3.60	3.25	3.10	3.02	0.64	0.70	0.72	0.76	10	9	8	7
Sweet orange (A)	5	7	9	11	3.70	3.40	3.20	3.0	0.75	0.90	0.96	1.12	53	50	45	40
Sweet orange (R)	5	7	8	11	3.70	3.25	2.9	2.6	0.75	0.86	0.89	0.91	52	48	47	45

Table 3: Ohmic heated fruit juices in refrigerated and ambient condition for 15 minutes

Juice	TSS (° brix)				pH				Titrable Acidity (%)				Vitamin C (mg/100gm)			
Days	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**	**1**	**7**	**14**	**21**
Pomagarnate (A)	5	8	10	14	3.60	3.25	3.10	3.0	0.64	0.80	0.90	0.95	10	7	5	3
Pomagarnate (R)	5	9	11	13	3.60	3.28	3.10	3.0	0.64	0.70	0.74	0.78	10	9	8	6
Sweet orange (A)	5	9	10	11	3.70	3.20	3.0	2.80	0.75	0.96	1.3	1.4	53	48	43	40
Sweet orange (R)	5	7	10	11	3.70	3.20	2.8	2.6	0.75	0.89	0.92	0.96	53	50	47	43

7 °Brix and for pomegranate which was 6 °Brix. After passing of 14 days (i.e. 2 weeks) the TSS of sweet orange juice increased which was 8 °Brix and also there was increase in TSS of pomegranate juice which was 9 °Brix, but increase in TSS of pomegranate was very low in comparison with sweet orange juice. Then after passing of 21 days (i.e. 3 weeks) the increase in TSS of sweet orange juice continued which was 11 °Brix and for pomegranate it was 11°Brix. Finally the TSS of juices increased but for sweet orange juice TSS became maximum than pomegranate juice after Ohmic heating for 10 minutes and 21 days of storage at refrigeration condition.

Effect on pH of sweet orange juice and pomegranate juice

At first day of storage the pH of pomegranate juice was 3.6 and for sweet orange juice it was 3.7. After 7 days (i.e. 1 week) the pH of pomegranate juice decreased and became 3.35, for sweet orange juice the pH also decreased and became 3.25. Then after 14 days (i.e. 2 weeks the pH of pomegranate juice decreased and became 3.1, for sweet orange the pH decreased and became 2.9. After 21 days (i.e. 3 weeks) the pH of pomegranate juice decreased and became 3.02, for sweet orange pH also decreased and became 2.6. Finally the major decrease of pH occurred for sweet orange juice in comparison to pomegranate juice after Ohmic heating for 10 minutes and 21 days of storage at refrigeration condition. The pH decreased for sweet orange juice from 3.7 to 2.6, for pomegranate juice the pH decreased from 3.6 to 3.02 within 30 days of storage at refrigeration condition respectively.

Effect on titrable acidity of pomegranate juice and sweet orange juice within the storage condition of 21 days

At day one the titrable acidity of pomegranate juice was 0.64% and for sweet orange juice it was 0.752%. After 7 days (i.e. 1 week) the titrable acidity was 0.7% which increased for pomegranate juice and for sweet orange juice it was 0.86% which also increased. After 14 days (i.e. 2 weeks) the titrable acidity increased for pomegranate juice which was 0.72%, also increased for sweet orange juice which was 0.89%. After 21 days (i.e. 3 weeks) the titrable acidity increased for pomegranate juice which was 0.76%, also for sweet orange juice it also increased which was 0.91%. Finally, it showed that titrable acidity increased for both the juices but for sweet orange the titrable acidity increased maximum in comparison to pomegranate after Ohmic heating for 10 minutes and storage at refrigeration conditions for 21 days.

The effect on vitamin C content mg/100g of pomegranate juice and sweet orange juice after Ohmic heating for 10 minutes and storage at refrigerated conditions for 21 days.

At day first the value of vitamin C content for both the juices of pomegranate and sweet orange were 10 and 52 respectively. After 7 days (i.e. 1 week) the vitamin C content of pomegranate decreased and becomes 9 mg/100g and for sweet orange juice the vitamin C decreases and becomes 48mg/100g. After 14 days (i.e. 2 weeks) the vitamin C decrease for pomegranate juice decreases and became 9mg/100gm and for sweet orange juice it continued to decrease and becames 47 mg/100g. Then after 21 days (i.e. 3 weeks) the vitamin C content for pomegranate juice continued to decrease and becames 7mg/100g, for sweet orange juice it continued to decrease and becames 45 mg/100g.so there was gradual decrease of vitamin C for both the juices. But from the above table the maximum decrease occurred in pomegranate in comparison to sweet orange during 21 days of storage at refrigeration conditions.

Fruit juices after Ohmic heating for 10 minutes stored at ambient condition

Table 2 showed that the TSS increased in sweet orange juice and also in pomegranate juice but maximum rise was in pomegranate juice in comparison with the sweet orange juice. The TSS increases from 5 °Brix to 13 °Brix for pomegranate juice and for sweet orange the TSS increased from 5 °Brix to 11 °Brix respectively with in the storage period of 21 days. The pH of both the juices decreased but the maximum decrease observed in sweet orange with the increase in number of days of storage. The decrease in pH occurs in pomegranate juice from 3.6 to 3.1, and for sweet orange juice the pH decreased from 3.7 to 3 with in the storage of 21 days. Titrable acidity of both the juices increased but the maximum rise was observed in sweet orange juice with the increase in number of days of storage. The rise in the titrable acidity of pomegranate juice was from 0.64% to 0.9%and for sweet orange juice it was from 0.752% to 1.12% respectively. The vitamin C (mg/100g) of both the juices decreased but the maximum decrease was observed in pomegranate juice with the increase in number of days of storage. The maximum decrease occurred in pomegranate juice than sweet orange juice. It decreases from 10mg/100g to 60mg/100gm for pomegranate juice, and for sweet orange juice it decreased from 50mg/100gm to 40mg/100g with in storage of 21 days.

Fruit juices after Ohmic heating for 15 minutes stored at refrigerated condition

The TSS was same for both the juices but after one week there was rise in TSS of sweet orange juice than pomegranate which is 9 °Brix in comparison to pomegranate which is 7 °Brix. After (2 weeks) the TSS of sweet orange juice increased which was 11 °Brix and also there was increase in TSS of pomegranate juice which is 10 °Brix, but increase in TSS of pomegranate is little in comparison with sweet orange juice. Then after 21 days (i.e. 3 weeks) the increase in TSS of sweet orange juice continued which is 13 °Brix. Also TSS of pomegranate juice increases which was 11 °Brix. At first day of storage the pH of pomegranate juice was 3.6 and for sweet orange juice it was 3.7. After 7 days (i.e. 1 week) the pH of pomegranate juice decreased and becames 3.28, for sweet orange juice the pH also decreased and becames 3.2. Then after 14 days (i.e. 2 weeks the pH of pomegranate juice decreased and became 3.1, for sweet orange the pH decreased and became 2.8. After 21 days (i.e. 3 weeks) the pH of pomegranate juice decreased and became 3, for sweet orange pH also decreased and became 2.6.

Finally the major decrease of pH occurred for sweet orange juice in comparison to pomegranate juice after Ohmic heating for 15 minutes and 21 days of storage at refrigeration condition. The pH decreased for sweet orange juice from 3.7 to 2.6, for pomegranate juice the pH decreased from 3.6 to 3 within 21 days of storage at refrigeration condition respectively.

The effect on titrable acidity of pomegranate juice and sweet orange juice within the storage condition of 30 days.

At day one the titrable acidity of pomegranate juice was 0.64% and for sweet orange juice it was 0.752%. After 7 days (i.e. 1 week) the titrable acidity was 0.7% which increased for pomegranate juice and for sweet orange juice it was 0.89% which also increased. After 14 days (i.e. 2 weeks) the titrable acidity increased for pomegranate juice which was 0.74%, also increases for sweet orange juice which was 0.92%. After 21 days (i.e. 3 weeks) the titrable acidity increased for pomegranate juice which was 0.78%, also for sweet orange juice it also increased which was 0.96%.

Finally it shows that titrable acidity increases for both the juices but for sweet orange the titrable acidity increases maximum in comparison to pomegranate after Ohmic heating for 15 minutes and storage at refrigeration conditions for 21 days.

Effect on vitamin C content mg/100g of pomegranate juice and sweet orange juice after Ohmic heating for 15 minutes and storage at refrigerated conditions for 21 days.

At day first the value of vitamin C content for both the juices of pomegranate and sweet orange were 10 mg/100g and 53 mg/100g respectively. After 7 days (i.e. 1 week) the vitamin C content of pomegranate decreased and became 9 mg/100g and for sweet orange juice the vitamin C decreased and became 50 mg/100g. After 14 days (i.e. 2 weeks) the vitamin C decreased for pomegranate juice decreased and became 18mg/100g and for sweet orange juice it continued to decrease and became 47 mg/100g. Then after 21 days (i.e. 3 weeks) the vitamin C content for pomegranate juice continued to decrease and became 6mg/100g, for sweet orange juice it continued to decrease and became 43 mg/100g. so there is gradual decrease of vitamin C for both the juices. But from the above table the maximum decrease occurred in pomegranate in comparison to sweet orange during 21 days of storage at refrigeration conditions.

Fruit juices after Ohmic heating for 15 minutes stored at ambient condition

The TSS increased in sweet orange juice and also in pomegranate juice but maximum rise was in pomegranate juice in comparison with the sweet orange juice. The TSS increased from 5 °Brix to14 °Brix for pomegranate juice and for sweet orange juice it increased from 5 °Brix to 14 °Brix with in the storage of 21 days. The pH of both the juices decreased but the maximum decrease observed in sweet orange with the increase in number of days of storage. The pH decreased from 3.6 to 3 for pomegranate juice and for sweet orange juice it decreased from 3.7 to 2.8 with in the storage period of 21 days. The titrable acidity of both the juices increased but the maximum rise was observed in sweet orange juice with the increase in number of days of storage. The Titrable acidity of pomegranate juice increased from 0.64% to 0.95% and for sweet orange juice it increased from 0.752% to 1.4%, respectively with in the storage of 21 days. Similar observation was reported by Tripoli, (2007). The vitamin C (mg/100g) of both the juices decreased but the maximum decrease was observed in pomegranate juice with the increase in number of days of storage. The vitamin C decreases from 10mg/100gm-3mg/100gm for pomegranate, and for sweet orange juice it decreases from 50mg/100gm-40mg/100gm.

Table 4: Comparison of Sensory analysis of Pomegranate juice and sweet orange juice stored at refrigerated condition after Ohmic heating

Sensory property of Pomegranate juice after Ohmic heating and stored at refrigerated condition					
Sl. No.	**Days**	**Colour**	**Aroma**	**Taste**	**Over all acceptance**
1	1	9	8	9	9
2	7	8	8	8	8
3	14	8	7	8	7
4	21	8	7	6	7
Sensory property of sweet orange juice after Ohmic heating and stored at refrigeration condition					
Sl. No.	**Days**	**Colour**	**Aroma**	**Taste**	**Over all acceptance**
1	1	8	7	8	8
2	7	7	7	7	7
3	14	7	7	7	7
4	21	7	6	5	6

As per the sensory analysis colour, aroma, and taste remain in strong condition as well as the overall acceptance was appreciable for pomegranate juice stored at refrigerated condition after ohmic heating and on the other side the sweet orange juice stored at similar condition after ohmic heating colour, taste, aroma and overall acceptance remained moderate.

Table 5: Comparison of Sensory analysis of Pomegranate juice and sweet orange juice stored at ambient condition after Ohmic heating

Sl. No.	Days	Colour	Aroma	Taste	Over all acceptance
Sensory property of Pomegranate juice after Ohmic heating and stored at ambient condition					
1	1	9	8	9	9
2	7	8	8	8	8
3	14	7	7	6	7
4	21	6	6	5	6
Sensory property of sweet orange juice after Ohmic heating and stored at ambient condition					
Sl. No.	**Days**	**Colour**	**Aroma**	**Taste**	**Over all acceptance**
1	1	9	7	8	8
2	7	8	7	7	7
3	14	7	6	6	6
4	21	6	5	5	5

As per the sensory analysis of pomegranate juice stored at ambient condition after ohmic heating the colour was moderate in comparison to the aroma and taste and hence over all acceptance was moderate. Also, on the other side the sweet orange juice stored at similar condition after ohmic heating the colour remained in strong condition in comparison to the aroma and taste, hence overall acceptance was moderate.

CONCLUSION

The pH of sweet orange juice stored at refrigeration temp in PET bottles was studied for 1-21 days after Ohmic heating for 5,10,15 minutes respectively. The pH values varied with increasing number of days (21) from 3.70-2.8, 3.70-2.6, and 3.70-2.26 respectively. The pH of sweet orange juice also varied with the increase in number of days of storage at ambient condition in PET bottles after Ohmic heating for 5,10,15 minutes. The variation in the pH was from 3.70-3, 3.70-3, 3.70-2.80 respectively. Similar condition was found in pomegranate juice within (21) days of storage at refrigerated condition as the pH varied from 3.60-3.05, 3.60-3, 02, 3.60-3, and in PET bottles within 21 days after Ohmic heating for similar time, the pH varied from 3.62-3.2,3.60-3.10, 3.60-3.0 respectively. The TSS of both samples increased when stored in refrigerated condition also in ambient condition after Ohmic heating. This might be due to the evaporation of water which causes the concentration of juice to some extent by heat, also due to the hydrolysis of polysaccharide (starch) into monosaccharide (sugars).increase in concentration of juice due to dehydration of juice and degradation of pectin. The titrable acidity of samples stored in refrigerated conditions increased also in the samples stored in ambient condition. This may be due to the high temperature processing might be due to the inactivation of enzymes and other reactions responsible for acidity.

The vitamin C estimation of 1 day sample was 50 mg/100gm. After 21 days it decreased in all the samples stored in refrigerated and ambient storage conditions. Vitamin C is liable to degrade by heat. Hence vitamin C degraded with the increase in duration of storage days. Sensory evaluation of samples stored in refrigeration was also done. The conditions in PET bottles was appreciable for, colour, taste, aroma and overall acceptability was appreciable. The overall acceptance of the juices stored in ambient conditions was good up to the 2 weeks but after two weeks its quality deteriorated.

REFERENCES

Aslam, M.N., Lansky, E.P. and Varani, J. 2006. Pomegranate as a cosmeceutical source: Pomegranate fractions promote proliferation and procollagen synthesis and inhibit matrixmetalloproteinase-1 production in human skin cells. *J. Ethnopharm.*, **103**(3): 311-317.

Ayadi, M.A. 2004. Studied the Experimental study of hydrodynamics in a flat ohmic cell—impact on fouling by dairy products. *J. Dairy Sci.*, **12**(2): 12-18

Long, K.D., Shunhe, P.G. and Tewri, D.J. 2004. Studied the Effects of different heating methods on the production of protein–lipid film. *J. Chem. Eeng.*, **46**(7): 43-54.

Morton, J. 2005. Pomegranate. In: Fruits of warm climates. Julia F. Morton, Miami, Mousavinejad, G., Emam-Djomeh, Z., Rezaei, K., Khodaparast, M.H.H. Phandis, N.A. *Pomegranate for Dessert and Juice Indhort.*, **19**(3): 9-17.

Quarini, G.L. 1995. Studied the Thermal hydraulic Aspects of the Ohmic Heating Process. *J. Therm. Sci.*, **14**(37): 56-62.

Ranganna, S. 2005. Hand book *Analysis and quality control for fruit and vegetable* products second edition.

Salengke, S. 2011. Models for Ohmic heating of solid–liquid mixtures under worst-case heating scenarios. *Plant Physiol.*, **21**(2): 5–12.

Salengke, S. and Sastry, S.K. 2009. Experimental investigation of Ohmic heating of solid–liquid mixtures under worst-case heating scenarios orange juice. *Plant Physiol.*, **20**(1): 3–18.

Sofi, S.A., Dar, B.N., Jabeen, A. And Majeed, D. 2014. A Study of Biscuits available in local market in Kashmir. *Adv. Food Sci.*, **15**(2): 151-158.

Tripoli, E., La Guardia, M., Giammanco, S., Di Majo, D. and Giammanco, M. 2007. Citrus flavonoids: Molecular structure, biological activity and nutritional properties: A review, *Food Chem.*, **104**: 466–479.

Walton, B.S., Bartholomew, E.T. and Ramsey, R.C. 1945. Analysis of the organic acids of Wealth of India: A dictionary of Indian Raw materials and industrial products raw material series, Vol VIII324 1969, publication and information directorate, Council of Scientific and industrial Research, New Delhi.