Effects of Conventional and Microwave Heating Pasteurization on Physiochemical Properties of Pomelo (Citrus maxima) Juice

Kumar S1*, Khadka M1, Mishra R2, Kohli D1 and Upadhaya S1
1Department of Food Technology, Uttaranchal University, Dehradun, India
2Department of Agricultural science and Engineering, IFTM University, Moradabad, India

Abstract
Effects of conventional and microwave heating pasteurization on physicochemical properties of pomelo (Citrus maxima) juice was evaluated. Microwave heating pasteurization shows less effect on pH, reducing sugar, ascorbic acid (Vitamin C) content, and total phenolic contents in compare to conventional pasteurization. Microwave heating pasteurization reduces tannin and naringin content more in compare to conventional pasteurization.

Keywords: Pomelo; Pasteurization; Microwave heating

Introduction
Fruit juices are consumed worldwide because they are a good source of vitamins, minerals and fibers [1]. Citrus juices are complex mixtures of aromatic volatiles and non-volatile components. Aromatic volatiles include esters, aldehydes, ketones and alcohols while non-volatile components include organic acids and sugars [2]. Citrus maxima (or Citrus grandis), commonly known as pomelo, pomello, pummelo, pamplemousse, jabong (Hawaii), shaddock is a citrus fruit, with the appearance of a big grapefruit, native to South and Southeast Asia. In India, it is also known as Chakotra. There are two varities of pomelo commonly classified as common which has white flesh or pigmented which has pink flesh [3]. They are generally used eaten as fruit. It tastes sweet, and is slightly acidic with a hint of bitterness. It also has appetizing, cardiac stimulant and anti-tumor properties [4]. Pummelo juice is a good source of ascorbic acid [5]. Citrus maxima have low commercial value due to the bitterness of its juice. Pomelo is a rich source of naringin, a bitter flavoured, flavanone glycoside with reported antioxidant [6].

Juice manufacturing industries aim to preserve the juices without losing organoleptic quality by the method of pasteurization. There are several methods for pasteurization. Thermal treatments are commonly applied in juice manufacturing industries for preservation of juices. However, heat-sensitive antioxidants and some of the essential compounds in the juice may deteriorate due to heat during thermal processing [7]. Microwave heating generate volumetric heating within the food material due to this microwave heating provide short heating and minimize the quality loses [9].

Material and Methods

Raw materials
Pomelo (Citrus maxima): The pomelo sample for present study was procured from the local market of Dehradun, Uttarakhand. The fruit used are of sound and good quality.

Preparation of pomelo juice
Mature, ripe pomelo fruit were washed and peeled by hand. The segments were separated and the segment membrane was separated carefully by hand and juice was prepared by squeezing.

Treatments
Conventional pasteurization (CP): Freshly prepared juice was filtered and poured into sterilized bottles and then heated at 90°C by using thermostatic water bath and maintain the temperature of juice 90°C for 15 seconds. Pasteurized juice was cooled to room temperature in a cooling water bath and was stored in a refrigerator at 4 ± 1°C.

Microwave heating pasteurization (MHP): Juice was heated at 90°C by using microwave and cooled to room temperature in a cooling water bath and was stored in a refrigerator at 4 ± 1°C.

Physicochemical analysis of Pomelo (Citrus maxima) juice before and after conventional and microwave heating pasteurization: Various physico-chemical properties like pH, Moisture Content, Ash content, TSS, titrable acidity, reducing sugar, Ascorbic acid content, tannin content, Naringine Content and Total phenolic contents were analyzed. pH was analyzed by handy pH meter, Moisture Content, Ash content and titrable acidity was measured by the standard method of Rangana [10]. TSS were measured in °Brix by handy refractometer (ERMA), Reducing sugars were determined by the method of Lane and Eynon [11]. Ascorbic acid in raw as well as RTS were measured by standard method of Sawhney and Singh [12]. Tannin content was determined by the protein precipitation method [13] naringin content in the fruit juice was estimated by the method of Davis [14] and total phenolics contents was measured by the method of Makkar et al. [15].

Results and Discussion
The physicochemical properties of Pomelo (Citrus maxima) Juice before and after conventional and microwave heating pasteurization are shown in Table 1.
Effect of conventional and microwave heating pasteurization on pH

The pH of fresh pomelo juice was observed 3.30 as shown in Table 1. pH of pomelo juice after pasteurization and microwave heating was observed 3.2. Figure 1 shows the effect of pasteurization and microwave heating on pH. The decrease in pH may be because of lactic acid production and due to the hydrolysis of sucrose. These results are in agreement with those of Mohamed et al. [16] who also reported decrease in pH of physalis juice.

Effect of conventional and microwave heating pasteurization on moisture content

The Moisture Content of fresh pomelo juice was observed 94% as shown in Table 1. Moisture content after pasteurization and microwave heating was 92.53% and 92.03% respectively. Figure 2 shows the effect of pasteurization and microwave heating on moisture content. The decrease in moisture content may be because of the evaporation of water which causes concentration of juice to some extent by heat processing. These results are in agreement with those of Dar et al. [17].

Effect of conventional and microwave heating pasteurization on ash content

The ash content of fresh pomelo juice was observed 1% as shown in Table 1. Ash content after pasteurization and microwave heating was 2.46% and 0.49% respectively. Figure 3 shows the effect of pasteurization and microwave heating on ash content. In our finding, we found that ash content increased in case of pasteurization but in case of microwave heating ash content was reduced.

Effect of conventional and microwave heating pasteurization on TSS

The TSS of fresh pomelo juice was observed 7.5°Brix and after treatment it was 9.1°Brix and 8.8°Brix in case of conventional and microwave heating pasteurization respectively as shown in Table 1. The increase in TSS may be because of the evaporation of water which causes concentration of juice to some extent by heat processing, or may be due to citric acid increases the TSS. These results are in agreement with those of Rivasa et al. [18]. Figure 4 shows the effect of conventional and microwave heating pasteurization on TSS.

Effect of conventional and microwave heating pasteurization on titrable acidity

The titrable acidity of fresh pomelo juice was observed 1.248% and after treatment it was 1.4% and 1.68% in case of conventional and microwave heating pasteurization respectively as shown in Table 1. The increase in titrable acidity may be because of Oxidation of reducing sugars can also contribute to increase in the acidity of fruits. These results are in agreement with those of Rivasa et al. [18]. Figure 5 shows
the effect of conventional and microwave heating pasteurization on titrable acidity.

Effect of conventional and microwave heating pasteurization on reducing sugar

The reducing sugar of fresh pomelo juice was observed 3.47% and after treatment it was 3.59% and 3.50% in case of conventional and microwave heating pasteurization respectively as shown in Table 1. Increase in reducing sugar may be due to the conversion of non-reducing sugars into reducing sugars. Figure 6 shows the effect of conventional and microwave heating pasteurization on reducing sugar. Our finding favors the findings of Zahid Mehmood et al. [19] who also reported the increase in reducing sugar in case of apple juice.

Effect of conventional and microwave heating pasteurization on ascorbic acid (Vitamin C)

The ascorbic acid (Vitamin C) of fresh pomelo juice was observed 67.71 mg/100 ml and after treatment it was 52.42 mg/100 ml and 54.29 mg/100 ml in case of conventional and microwave heating pasteurization respectively as shown in Table 1. The decrease in ascorbic acid (vitamin C) may be because of due to degradation of vitamin C because is heat labile nutrient. Our finding favors the findings of Cinquanta et al. [20] who also reported the decrease in ascorbic acid (Vitamin C) during microwave pasteurization of orange juice. Figure 7 shows the effect of conventional and microwave heating pasteurization on Ascorbic Acid (Vitamin C).

Effect of conventional and microwave heating pasteurization on tannin content

The tannin content of fresh pomelo juice was observed 0.42 mg/ml and after treatment it was 0.41 mg/ml and 0.39 mg/ml in case of conventional and microwave heating pasteurization respectively as shown in Table 1. Figure 8 shows the effect of conventional and microwave heating pasteurization on tannin content.

Effect of conventional and microwave heating pasteurization on naringin content

The naringin content of fresh pomelo juice was observed 600 µg/ml and after treatment it was 590 µg/ml and 594 µg/ml in case of conventional and microwave heating pasteurization respectively as shown in Table 1.
as shown in Table 1. Figure 9 shows the effect of conventional and microwave heating pasteurization on naringin content. These results are in agreement with those of Igal et al. [21] also reported the decrease in naringin content for grapefruit juices.

Effect of conventional and microwave heating pasteurization on total phenolic contents

The total phenolic content of fresh pomelo juice was observed 710 mg GAE/L and after treatment it was 690.5 mg GAE/L and 705.3 mg GAE/L in case of conventional and microwave heating pasteurization respectively as shown in Table 1. Figures 9 and 10 show the effect of conventional and microwave heating pasteurization on total phenolic contents. Our finding favors the findings of Pala and Toklucu [22] and Mohamed et al. [22] who also reported the decrease in total phenolic contents in thermally and UV treated pomegranate juice and physalis juice respectively.

Conclusion

Present investigation has been conducted to analyze the effect of conventional and microwave heating pasteurization on various physiochemical properties of pomelo juice. The results were analyzed for each physiochemical properties like pH, Moisture content, TSS, Titrable acidity, Reducing sugar, Ascorbic acid (Vitamin C), Tannin content, Naringin content and Total phenolic contents. On the basis of result analysis, we conclude that physiochemical properties of pomelo juice were less affected by microwave heating pasteurization in compare to conventional pasteurization.

Acknowledgement

This research was carried out in the department of food technology, Uttarakhand University, Dehradun we are sincerely thankful to HOD and Principal of UCALS for providing necessary requirements for smooth conducting of the research work.

References