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Cost analysis of mandarin fruit processed products

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Abstract
The present investigation entitled "cost analysis of mandarin fruit processed products" was carried out during 2015-16 at Post Harvest Technology Centre, Department of Horticulture, Mahatma Phule Krishi Vidyapeeth, Rahuri with an aim to study the cost economics of prepared products from mandarin. Fully ripened, mature, fresh and sound fruits were purchased from orange orchard located in Ahmednagar for preparation of juice, syrup, carbonated ready to serve (RTS) beverage and the materials such as citric acid, sodium benzoate, pet bottles, glass bottles were also purchased from local market. Fruit were washed in tap water and then were peeled and used as experimental materials. The cost economics of prepared products was observed Rs. 104.92 per liter for juice, Rs. 55.02 per liter for syrup and Rs. 4.08 per 200 mL for carbonated RTS.

Keywords: mandarin, RTS beverage, juice, syrup, cost of preparation

1. Introduction
Mandarin orange (*Citrus reticulata* Blanco) is one of the most popular citrus fruit having attractive bright colour, appealing taste and flavour, Citrus is grown in 114 countries around the world. Out of these, 53 countries grow citrus commercially with a total production of more than 115 million tonnes. On production basis, China tops the list with 22.9 million tonnes followed by Brazil with 22.7 million tonnes and USA with 10.4 million tones. India with 10.48 million tonnes is at 4th position (Anonymous, 2015) [2]. A single orange is said to have about 170 phytonutrients and over 60 flavonoids with anti-tumor, anti-inflammatory, blood clot inhibiting and antioxidant properties. All these properties help to promote overall health of citrus fruits (Etebu *et al.* 2014) [7]. Citrus fruit are recognized as important components in human healthy life. Vitamin C, Beta-carotene, flavonoid, limonoid, folic acid and dietary fiber are important bioactive components found in these species (Aslin, 2014) [3]. Mandarin oranges are rich source of vitamin C, A, B, phosphorus, these are either available in fresh or processed products. On the basis of nutrition target in case of fruit consumption per day per capita availability is 80 g and needed 137 g (Bante *et al.* 2015) [5]. Post-harvest handling losses of citrus fruits are 5-10 per cent in most developed countries and 25-30 per cent in developing countries. during glut season, fruits fetch very low price in markets and, therefore, utilization of fruits for preparation of processed product such as RTS beverage not only benefits the grower but also consumer by way of better nutritional and health improving properties (Byanna *et al.* 2012) [4]. Thus, in order to fully utilize the high production of mandarin, the only alternative is to make it feasible to process it into juice, syrup and other juice based products like carbonated RTS. Therefore, the present investigation was carried out with an aim to convert easily available large production of mandarin into more valued products by developing technology for preparation of juice, syrup and carbonated RTS.

2. Experimental Materials
2.1. Nagpur Mandarin Fruits
Fully ripened, mature, fresh and sound fruits were purchased from orange orchard located in Ahmednagar for preparation of juice, syrup, carbonated ready to serve (RTS) beverage and the materials such as citric acid, sodium benzoate, pet bottles, glass bottles were also purchased from local market. Fruit were washed in tap water and then were peeled and used as experimental materials in the following procedure:

2.2. Juice Preparation

The fruits were washed with tap cold water and then remove the peel manually. The juice of mandarin orange was extracted by using screw type pulper. The peeled fruits were fed into juice extractor. The juice and the pomace were separated and collected separately in two outlets. The juice was filtered through a clean muslin cloth. The extracted juice was pasteurized at 65 °C for 15min by adding sodium benzoate as a preservative. Then, at that temperature juice was filled in the pre-sterilized 200 mL glass bottles, 200 mL pet bottles, 200mL stand pouches and sealed with crown cork and pouch sealer. All packed juice samples were sterilized. The sterilized packed juice was stored. The flow chart for preparation and storage of juice was showed in Fig.1.

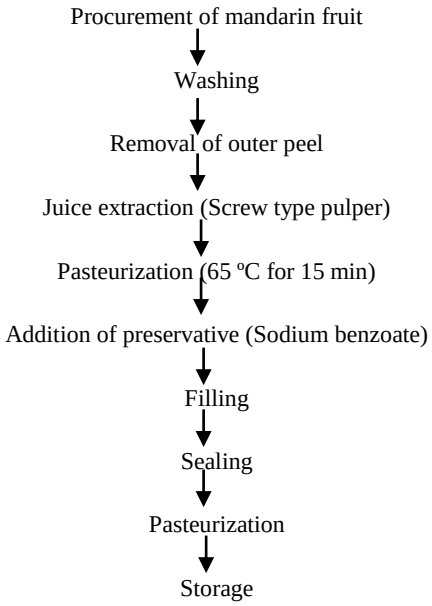

Fig 1: Preparation of Juice

2.3. Syrup Preparation

Sugar syrup was prepared by addition of water in sugar to boiling at a temperature of 90 ^{0}C, then the sugar syrup temperature decreased upto 60 ^{0}C and juice was mixed well to it. The syrup was bottled in the pre-sterilized 200 mL transparent glass bottles and pet bottles and sealed. After bottling, all syrup samples were sterilization for 20 min. Then syrup was stored. Fig. 2.

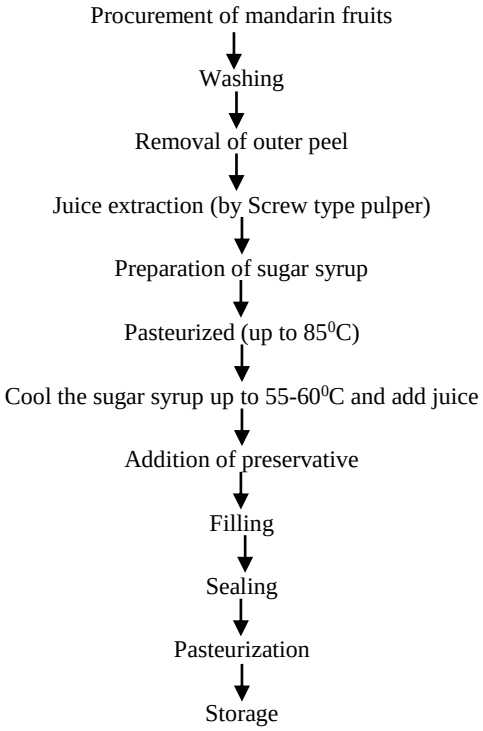

Fig 2: Preparation of Syrup

2.4. Carbonated RTS Preparation

RTS were prepared from syrup, 40 mL of syrup were added in 200 mL transparent glass bottles and bottles were filled with carbonated chilled water then bottle was sealed at the same time with carbonation machine and sealer. Fig. 3.

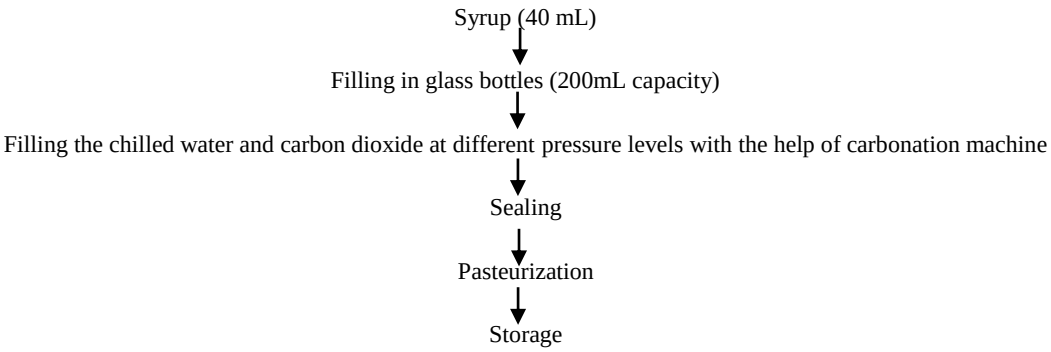

Fig 3: Preparation of carbonated RTS beverage

3. Results

3.1. Cost of Preparation of Mandarin Juice.

It could be observed from the table 1 that the cost (fixed cost and variable cost) of preparation of 1litre of juice from mandarin fruits was found to be Rs. 104.92 for best treatment combination S2P3B1 (cold storage+350 ppm preservative level+ glass bottle).

3.2. Cost of Preparation of Mandarin Syrup

It could be observed from the table 2 that the cost (fixed cost and variable cost) of preparation of 1-liter Syrup from mandarin fruits was found to be Rs. 55.02 for best treatment combination S2P3B1(cold storage+350 ppm preservative level+ glass bottle).

3.3. Cost of Preparation of Mandarin Carbonated RTS Beverage

It could be observed from the table 3 that the cost of preparation of 200ml of carbonated RTS beverage from mandarin orange fruits was found to be Rs. 4.08 for best treatment combination S2C3 (cold storage+90 psi CO_2 pressure).

4. Discussion

The processed products of Mandarin such as juice, syrup and RTS are highly acceptable because of excellent aroma, colour and high level of ascorbic acid of the fruit and refreshing acidic taste. The results of the present investigation entitled, "Studies on preparation of carbonated ready to serve beverage from mandarin orange" is discussed in this chapter.

The cost of preparation of juice, syrup and carbonated RTS prepared from Nagpur mandarin fruits were found to be Rs. 104.9 per litre, Rs. 55.02 per litre and Rs. 4. 08 per of 200 mL respectively. Similar results reported by Ahire (2007) [1] on pomegranate juice; Bhardwaj (2013) [6] on Kinnow juice; Lotha (1994) [11] kinnow mandarin juice; Ghume (2002) [8] on guava carbonated beverage; Phanase (2015) [12] on Jamun carbonated beverage; Byanna and Gowda (2012) [4] RTS beverage sweet orange; Khurdiya (1996) [9] carbonated guava beverage; Pandurnikar (2004) [13] carbonated RTS beverage from jamun; Korade (2014) [10] on kokum syrup.

5. Conclusion

The cost economics of prepared products was observed Rs. 104.92 per lit for juice, Rs. 55.02 per liter for syrup and Rs. 4.08 per 200 mL for carbonated RTS.

Table 1: Cost of preparation of Mandarin Juice.

Sr. No.	Particulars	Quantity	Rate (Rs.)	Cost (Rs.)
	I. Fixed cost			
1.	Interest @12 per cent on fixed assets of 350 kg/hour capacity screw type pulper is Rs 68000/- (Rs 8160 for 365 days i.e. Rs 22.36 per day). Working time 8 hours			0.015
2.	Depreciation @10 per cent on fixed assets of 350 kg/hour capacity screw type pulper is Rs 68000/- (Rs 6800 for 365 days i.e. Rs 18.63 per day). Working time 8 hours			0.013
	Total			**0.028**
	II. Variable cost			
1.	Nagpur mandarin fruit	1.900 kg	30.00 per kg	57.00
2.	Sodium benzoate	350mg	1000 per kg	0.35
3.	Glass bottle (200ml)	05	07.00	35.00
4.	Crown cork	05	0.60	3.00
5.	Overhead charges (@ 10 %) including Labor, Electricity charges, Pasteurization cost (Gas)			9.54
			Total	**104.89**
	Total Cost of 1 lit juice (Fixed Cost + Variable Cost)			**104.92**

Table 2: Cost of preparation of Mandarin Syrup.

Sr. No.	Particulars	Quantity	Rate (Rs.)	Cost (Rs.)
	I. Fixed cost			
1.	Interest @12 per cent on fixed assets of 350 kg/hour capacity screw type pulper is Rs 68000/- (Rs 8160 for 365 days i.e. Rs 22.36 per day). Working time 8 hours			0.060
2.	Depreciation @10 per cent on fixed assets of 350 kg/hour capacity screw type pulper is Rs 68000/-			0.050

	(Rs 6800 for 365 days i.e. Rs 18.63 per day). Working time 8 hours			
Total				**0.11**
II. Variable cost				
1.	Nagpur mandarin fruit (4000 mL juice)	7.600 kg	30.00 per kg	228.00
2.	Sugar	08.201	30.00/kg	246.03
3.	Citric acid	0.118 kg	120.00/kg	14.46
4.	Water charges	3.68 liter	1.00/ liter	3.68
5.	Preservative	5.6 g	1000/ kg	5.60
6.	Glass bottle (650ml)	24	12.00	288.00
7.	Crown cork	24	0.60	14.40
Total				800.17
8.	Overhead charges (@ 10 %)including Labor, Electricity charges, Pasteurization cost (Gas)			80.02
Total				**880.19**
Grand Total of 16 lit				**880.30**
	Total Cost of 1 lit Syrup (Fixed Cost + Variable Cost)			**55.02**

Table 3: Cost of preparation of Mandarin carbonated RTS Beverage

Sr. No.	Particulars	Quantity	Rate (Rs.)	Cost (Rs.)
I. Fixed cost				
1.	Interest @12 Interest on fixed assets of carbonation Unit is Rs 98000/- (Rs 11760 for 365 days i.e. Rs 32.22 per day). Working time 8 hours			1.65
2.	Depreciation @10 per cent on fixed assets of carbonation Unit is Rs 98000/- (Rs 9800 for 365 days i.e. Rs 26.84 per day). Working time 8 hours			1.40
Total				**3.05**
II. Variable cost				
1.	Nagpur mandarin syrup	1.00 liter	55.02	55.02
2.	Water charges	4.00 liter	1.00/ liter	4.00
3.	Preservative	5.6 g	1000/ kg	5.60
5.	CO_2 gas	-	-	4.00
6.	Crown cork	25	0.60	15.00
Total				83.62
8.	Overhead charges (@ 10 %)including Labor, Electricity charges, Pasteurization cost (Gas)			8.362
Total				**91.98**
Grand Total				**95.03**
200 mL RTS cost without bottle				**3.80**
200 mL RTS cost with bottle @ 7/bottle				**10.80**
200 mL RTS cost with bottle @ 7/bottle (Reused for 25 times)				**4.08**

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