IJFANS
International Journal of Food And Nutritional Sciences

Volume 6, Issue 4, October 2017, www.ijfans.com e-ISSN: 2320-7876

INTERNATIONAL JOURNAL OF FOOD AND NUTRITIONAL SCIENCES

IMPACT FACTOR ~ 1.021

Official Journal of IIFANS

IJFANS

International Journal of Food and Nutritional Science

e-ISSN 2320 -7876 www.ijfans.com
Vol. 6, No. 4, October 2017

Research Paper *Open Access*

DEVELOPMENT AND STORAGE STUDY OF MANGO-PAPAYA FRUIT BAR

Bhalerao P P[1]*, Waghmare M D[1], Parate V R[1] and Talib M I[1]

*Corresponding Author: Bhalerao P P, ✉ prasannabhalerao007@gmail.com

Received on: 30th March, 2017 Accepted on: 31st July, 2017

A novel convenient fruit bar using Mango (*Mangifera indicia* L.) and Papaya (*Carica papaya*) was developed. The bars were prepared by using boiled mango-papaya pulp (3:1) with varying sugar proportion (60:40, 50:50, 40:60 and 30:70). The prepared homogenous mixture of 78° Brix consisted of pectin (2.5%), maltodextrin (1%) and citric acid (1%). The developed fruit bars were quantitatively evaluated for texture, physicochemical properties and storage stability for 2 months. The results showed a significant increase ($p \leq 0.05$) in acidity, moisture and Total soluble solids upon storage. Moreover, the texture profile of the developed fruit bars indicated an increase in hardness and stickiness upon storage. The sensory evaluation by hedonic scale revealed that 40:60 proportion of fruit and sugar possessed highest acceptance. The use of sugar with fruit pulp can result in suitable firmness and texture of the product.

Keywords: Mango pulp, Papaya pulp, Bars, Sensory evaluation

INTRODUCTION

Mango (*Mangifera indica* L) belongs to the family Anacardiaceae. It is known as 'King of Fruits', popular and economically important tropical fruit. India ranks first among world's mango producing countries accounting for about 50% of the world's mango production. Other major mango producing countries include China, Thailand, Mexico, Pakistan, Philippines, Indonesia, Brazil, Nigeria and Egypt. The post harvest losses in mangoes have been estimated in the range of 25-40% from harvesting to consumption stage (Jori *et al.*, 2015).

Mangoes are considered to have a good texture, flavor and high content of carotenoids, Vitamin C, Vitamin E, phenolic compounds, minerals and fiber. Mango consumption can provide antioxidants, and continuous intake in diet helps to prevent cardiovascular diseases and cancer (Danalache *et al.,* 2015). Mangoes cannot be kept for longer period of time due its perishable nature and consumed as fresh. Mango pulp is prepared from selected varieties of fresh mango fruit. Fully ripened mango fruits are washed, blanched, pulped, deseeded, centrifuged, homogenized, and concentrated when required, thermally processed and aseptically filled to maintain sterility. Mango pulp is perfectly suited for conversion to juices, nector, drinks, jams, fruit bars and various other kinds of products (Parekha *et al.*, 2014).

The Papaya (*Carica papaya* L.) is the most economically important fruit in the Caricaceae family. Brazil is amongst top most producer of papaya having 25% share in world market, while Mexico (14%), Nigeria (11%), India and Indonesia contributes 10% share to the papaya market. Venezuela, China, Peru are some of the other papaya growing countries which has market share less than 3%. The papaya fruit is rich in nutrition especially Vitamin C and carotene, carotene is converted into Vitamin A in the human body which prevents blindness in children (Sindhumati *et al.*, 2013). Papaya fruit contains 1.13% Sapotin which makes the fruit bitter (Sujatha and Sayantan, 2014).

[1] Department of Food Technology, University Institute of Chemical Technology, North Maharashtra University, Jalgaon, India 425001.

The post harvest losses of fruits in India are estimated at 5-30 percent of total production (Jori and Parate, 2015). Processing of fruit minimizes these losses to some extent and gives better returns to the farmers during glut seasons. Freshly harvested, ripe fruit naturally can remain in good condition only for few days. These fruits can be converted to commercial food commodities like pulp, juices, jam, nectors, etc. via mechanical crushing, sedimentation and filtration or enzyme assisted clarification (Ladole *et al.*, 2014)

Most of the market discarded fruits due to mechanical injury during harvesting transportation, washing, grading, packaging are practically not using for any processed product preparation, even though they are as good as other fruits except mechanical damage. These kind of fruits required immediate processing operation because they are not able to keep for long duration in the same condition. This kind of fruits shelf life can be increased by changing their form by preparation of value added products (Jori *et al.*, 2013).

Fruits serve as a source of energy, vitamins, minerals, and dietary fiber. One of the barriers in increasing fruit and vegetables consumption is time required to prepare them. They processed into different product (Parekha *et al*., 2014). Processing fruits is intended to preserve mango and papaya by slowing the natural process of decay caused by microorganisms, enzymes in the food, or other factors such as heat, moisture and sunlight and change them into value added product.

Most of the times in market Mango and Papayas are discarded in market due to several mechanical injuries occurred during harvesting, transportation, washing, grading, packaging such damaged fruits are not used for preparation of any processed products. These kinds of fruits require immediate processing because they cannot be kept in such condition for longer period of time. Shelf life of these kinds of fruits can be increased by converting them into value added products which is attractive and in demand by consumers, make products that consumer want to eat. The waste fruits generated during several processes can be used as a source for numerous biomolecules having potential market value and tremendous applications in food and nutraceutical industries. Recently, lycopene was successfully extracted and recovered from market waste tomato peels using enzyme assisted approach (Munde *et al.*, 2017). Bio-oil from waste orange peels was also extracted using response surface morphology approach in a solvent free system with microwave application (Meshram *et al.*, 2015). By doing this successfully, we can increase sales and earn profit.

Among the different processed products; fruit bar is one of the processed product which is thick, pleasant and dried product made from fruit pulp having greater nutritional value than the fresh fruits because of all nutrients are concentrated and, therefore, would be a convenience food assortment to get health benefits of fruits (Wahane *et al.*, 2015). Traditionally mango bars have been prepared from unmarketable but sound ripe fruits and have been blended with other fruits like papaya, banana, guava and jamun. This blending may impart enhanced physic-chemical properties and increase nutritive value of fruit bar (Orrego *et al.*, 2014).

The aim of the present work was focused on standardize the protocol for preparation of fruit bar from mango-papaya and to evaluate storage stability of the bar.

MATERIALS AND METHODS

Pectin was purchased from Krushna Pectin, Jalgaon, Mature mangoes (*Mangifera indica* L), papaya (*Carica papaya)*, Sugar and Citric acid were purchased from a local supermarket in Jalgaon, Maharashtra.

Preparation of Mango-Papaya Bar

The fruits were washed under running water, and manually peeled with a knife, cut into small pieces, and pulp was extracted from fruit by using pulper (Philips HL 1631 500 W). For preparation of fruit bar blend of mango and papaya pulp were taken in the ratio (3:1) and thermally processed. To the boiled pulp and sugar were added in the ratio (60:40, 50:50, 40:60 30:70) and were labeled as S1, S2, S3 and S4 respectively. Pectin (2.5%), Maltodextrin (1%) and Citric acid (1%) were added and it was thermally processed. Heated enough to form a homogeneous mixture till 78°Brix TSS the mixture was poured in plastic moulder smeared with butter (1–1.5 cm), takes out from moulder after setting fruit bar and dried at 55 °C ± 2 °C for 10-12 h in tray drier. Afterwards cooled fruit bar was wrapped in food grade polythene.

Chemical Analysis

Moisture Content (Ranganna, 1995)

A mass of 5 g of the mango-papaya bar was placed in the oven for 6 h at 105 °C (in triplicate). After drying, the dried sample was weighed, and the moisture content was calculated by subtracting the final weight from initial.

Evaluation of Total Soluble Solids

A digital refractometer PAL-1, USA, calibrated with distilled water was used to determine Total Soluble Solids (TSS). Analysis was repeated thrice.

Estimation of Titrable Acidity (Ranganna, 1986)

Sample (10 g) was taken in a conical flask (100 ml) Water (40 ml) was added to it and mixed thoroughly. If that mixture was opaque, then it was centrifuged for 5 min at 4000-6000 rpm. Then extract was titrated with 0.1 N sodium hydroxide using few drops of phenolphthalein solution as indicator. The titrate value was noted.

{Diluted sample with water was homogenized and centrifuged only if found opaque. The same was titrated against 0.1 N NaOH till got a CBR}.

$$\text{Acidity (\%)} = \frac{\text{N. of NaOH} \times \text{Volume made up} \times \text{B.R.} \times \text{Eq.wt. of acid} \times 100}{\text{Volume of sample taken} \times \text{wt. of sample} \times 1000}$$

Reducing Sugar (Ranganna, 1986)

Sample (50 g) was taken in 500 ml beaker and 400 ml of water was added. The solution was neutralized with 1 N NaOH using phenolphthalein indicator. Then it was boiled gently for 1 h with occasional stirring. Boiling water was added to maintain the original level. It was then cooled and transferred to a 500 ml volumetric flask. Volume was made up and filtered through whatsmanfilterpaper No. 4. 100 ml aliquot of neutral lead acetate solution was pipette out and mixed with 200 ml of water. Then it was allowed to stand for 10 min, and then precipitate the excess of lead with potassium oxalate solution. Make up to mark and filter.

$$\text{Reducing Sugar (\%)} = \frac{\text{Volume made up} \times \text{Glucose Equivaqlent} \times 100}{\text{Burette Reading} \times \text{Wt. of sample}}$$

Total Sugar (Ranganna, 1986)

Clarified sample solution (20 ml) was taken into a 250 ml conical flask. 10 ml of 10% HCl was added. This solution was boiled gently for 10 min. to complete the inversion of sucrose, and then cooled. It was then transferred to 250 ml volumetric flask and neutralized with 1 N NaOH using phenolphthalein as indicator. Volume was made up.

$$\text{Total invert Sugar (\%)} = \frac{\text{Volume made up} \times \text{Glucose Equivaqlent} \times 100}{\text{Titre} \times \text{Wt. of sample}}$$

$$\text{Sucrose (\%)} = (\text{\% Total invert sugar} - \text{\% Reducing Sugar}) \times 0.95$$

$$\text{Total Sugar (\%)} = \text{\% Reducing Sugar} + \text{\% Sucrose}$$

Texture Analysis

Instrumental texture analysis was performed as per described by (Ahmed *et al.*, 2005) using TAHD type texture analyzer (SMS, England) by texture expert software. Two types of forces namely compression and extension were used to carry out different tests to measure the textural properties like hardness and stickiness of bars.

Sensory Evaluation

Sensory attributes such as color, taste, flavor, appearance, texture, mouthfeel, aftertaste and overall acceptability of the product as a fruit bar was evaluated as recommended by Ranganna (1986) by hedonic rating scale. A semi trained panel consisting of 9 judges was selected to evaluate the sample as per experiment. Panelists were chosen from the staff and student of Department of Food technology, UICT, NMU, Jalgaon.

Statistical Analysis

Mean values, standard deviation, analysis of variance (ANOVA) were computed using a commercial statistical package SPSS 16.0 (USA). These data were then compared using Duncan's multiple range tests at 5% significance level. Pearson's correlations of selected functional properties were obtained.

RESULTS AND DISCUSSION

Moisture

The data presented in Table 1 revealed that overall moisture content of mango-papaya bar was found to be highest in combination S4 and lowest in combination S1 in a span of 60 days. Moisture content was observed in increasing order due to absorption of small quantities of moisture, by the stored products, from the atmosphere. Similar results were

Table 1: Moisture Content of Mango-Papaya Bar

Sample	0 Day	1 Months	2 Months
S1	19.23 ± 0.10^c	20.53 ± 0.19^b	21.17 ± 0.04^a
S2	20.14 ± 0.05^c	20.82 ± 0.04^b	21.29 ± 0.06^a
S3	20.51 ± 0.04^c	21.35 ± 0.06^b	21.5 ± 0.06^a
S4	20.76 ± 0.08^c	21.72 ± 0.04^b	21.98 ± 0.05^a

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

reported during storage of protein rich compresses bar and wild apricot bar (Sharma *et al.,* 2006).

Total Soluble Solid (°bx)

Overall (°Brix) of mango-papaya bar was found to be changing during storage period. Combination S4 exhibits higher TSS while combination S1 was lower amongst all samples during duration up to 2 months. Changes in oxidative metabolism with prolonged storage alleviated TSS. Porosity of the formulated product changes as per the moisture content. These results were also supported by Aruna *et al.* (1999) during storage of papaya bar; Vaghini (1998) in sun drying of sapota; Naik and Chundawat (1996) and Singh *et al.* (2006) in study of aonla dehydrated product.

Table 2: Total Soluble Solid for Mango-Papaya Bar

Sample	0 Day	1 Month	2 Months
S1	78.72 ±0.08^{c}	79.18 ± 0.06^{b}	79.58 ± 0.04^{a}
S2	79.22 ± 0.05^{c}	79.43 ± 0.02^{b}	79.67 ± 0.05^{a}
S3	79.25 ± 0.04^{c}	79.35 ± 0.02^{b}	79.57 ± 0.03^{a}
S4	79.27 ± 0.02^{b}	79.43 ± 0.03^{b}	79.67 ± 0.05^{a}

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

Acidity

It was observed from Table 3 that overall acidity (%) of bar was recorded maximum in combination S1 while the lowest acidity was found in combination S2 during storage. Increase in acidity in mango-papaya bar during storage might be due to hydrolysis of polysaccharides into sugar and increase in moisture level (Parekha *et al.,* 2014).

Table 3: Acidity Content for Mango-Papaya Bar

Sample	0 Day	1 Month	2 Months
S1	1.82 ± 0.02^{b}	1.88 ± 0.02^{a}	1.89 ± 0.02^{a}
S2	1.67 ± 0.01^{c}	1.73 ± 0.01^{b}	1.76 ± 0.01^{a}
S3	1.76 ± 0.01^{c}	1.8 ± 0.01^{b}	1.84 ± 0.03^{a}
S4	1.74 ± 0.02^{b}	1.76 ± 0.02^{b}	1.82 ± 0.01^{a}

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

Total Sugars

A gradual decrease in total sugar content of mango-papaya bar was observed over a period of 2 months (Table 4). Highest decrease (1.7%) was observed in combination S1 while combination S2 was found to be least affected by storage. Total sugar exhibited gradual decrease during storage which may be due to increase in reducing sugar by acid hydrolysis of total and non-reducing sugar and thereby inversion of total and non-reducing sugar to reducing sugar (Rao and Roy, 1980a).

Table 4: Total Sugar Content of Mango-Papaya Bar

Combination	0 Day	1 Month	2 Month
S1	67.95	67.15	66.78
S2	69.13	68.43	68.15
S3	72.89	72.16	71.84
S4	74.1	73.67	73

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

Reducing Sugars

Reducing sugar content of mango-papaya bar was found to be increased in all combinations (Table 5); this may be due the inversion of non-reducing sugars into reducing sugars and the conversion of polysaccharides to monosaccharides (Sharma *et al*., 2013). Similar types of observations were observed by Parekha *et al.* (2014) storage of mango bar with fortified desiccated coconut powder. The increase in reducing sugars has also been observed during storage of mango leather by Rao and Roy (1980b). Similar results have been recorded in sapota-

Table 5: Reducing Sugar Content of Mango-Papaya Bar

Combination	0 Day	1 Month	2 Month
S1	19.55	20.68	21.88
S2	21.86	23.21	24.28
S3	23.56	24.87	26.62
S4	24.65	26.24	27.65

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

papaya bar during 3 months of storage period (Sreemathi *et al*., 2008).

Non-Reducing Sugar

As shown in Table 6 Non-reducing sugar in bar decreased during storage up to 2 months which may be due to significant increase in reducing sugar by acid hydrolysis of total and non-reducing sugar and thereby inversion of total and non-reducing sugar to reducing sugar Parekha *et al*. (2014). Similar type of observation was also recorded by Aruna *et al*. (1999) during storage of papaya bar.

Table 6: Non-Reducing Sugar Content of Mango-Papaya

Combination	0 Day	1 Month	2 Month
S1	48.4	46.47	44.9
S2	47.27	45.22	43.87
S3	49.33	47.29	45.22
S4	49.45	47.43	45.35

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=3). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

Textural Properties of Fruit Bar

Results of texture analysis conducted by texture analyzer, has been presented in Table 7. Positive peak force described the compactness/hardness while the negative peak area described the gumminess/stickiness of fruit bar samples. The results are the average of the three replicates±SD. Samples S1 had the least hardness (492.96±1.94) while sampleS4 had the highest hardness (768. 54±0.80) indicating the compactness of the product. Highest stickiness was observed in sample S4 (142.62±0.87) whereas the lowest stickiness was observed in sample S1 (94.81±0.30).

Table 7: Texture Analysis of Mango-Papaya Bar

Textural Characteristics of Fruit Bar Sample		
Sample	**Hardness (g) Positive Force**	**Stickiness (g) Negative Force**
S1	492.96 ± 1.94	94.81 ± 0.30
S2	544.42 ± 1.63	106.75 ± 0.47
S3	565.43 ± 1.15	122.97 ± 0.49
S4	668. 54 ± 0.80	132.62 ± 0.87

Note: Values are means ± standard deviation (in parentheses) of three determinations (n=7). Values followed by different superscript letter in a column are significantly different ($p \leq 0.05$).

Sensory Evaluation

Table 8: Sensory Analysis for 0 Day Samples

0 Day Sensory				
Sample	**S1**	**S2**	**S3**	**S4**
Taste	6.88 ± 0.69	6.67 ± 0.71	7.5 ± 0.61	6.8 ± 0.56
Color	7.33 ± 0.79	7 ± 0.61	7.56 ± 0.53	7 ± 0.71
Flavor	7.13 ± 0.87	7 ± 0.61	7.67 ± 0.5	6.94 ± 0.58
Appearance	7 ± 0.61	7.6 ± 0.55	7.8 ± 0.44	7.1 ± 0.70
Texture	6.9 ± 0.49	7.17 ± 0.66	7.11 ± 0.33	7.06 ± 0.58
Mouthfeel	7.4 ± 0.42	7.1 ± 0.33	7.6 ± 0.55	7.4 ± 0.39
After taste	7.39 ± 0.42	7.1 ± 0.33	7.4 ± 0.39	7.3 ± 0.35
Overall acceptability	7 ± 0.5	7.11 ± 0.33	7.38 ± 0.41	7.33 ± 0.35

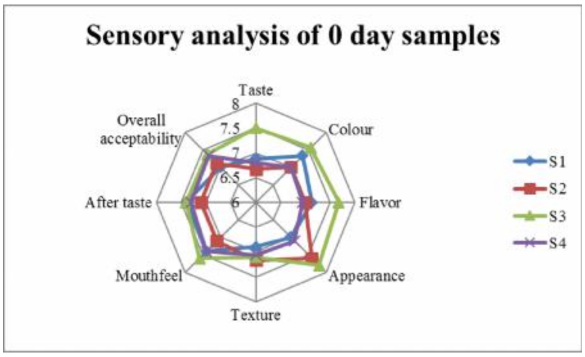


Table 9: Sensory Analysis of 1 Month Sample

1 Month Sensory				
Sample	**S1**	**S2**	**S3**	**S4**
Taste	6.67 ± 0.5	6.61 ± 0.55	7.33 ± 0.71	6.72 ± 0.51
Color	7.11 ± 0.65	6.67 ± 0.71	7.39 ± 0.42	6.78 ± 0.57
Flavor	7.02 ± 0.88	6.83 ± 0.43	7.5 ± 0.61	6.83 ± 0.66
Appearance	7.44 ± 0.46	6.83 ± 0.43	7.61 ± 0.41	6.94 ± 0.58
Texture	6.61 ± 0.42	6.94 ± 0.77	6.81 ± 0.88	6.94 ± 0.46
Mouthfeel	7.22 ± 0.44	6.89 ± 0.33	7.33 ± 0.43	7.22 ± 0.44
After taste	7.22 ± 0.44	6.89 ± 0.49	7.17 ± 0.56	7.06 ± 0.58
Overall acceptability	6.83 ± 0.56	6.89 ± 0.33	7.28 ± 0.36	7.11 ± 0.49

Table 9 (Cont.)

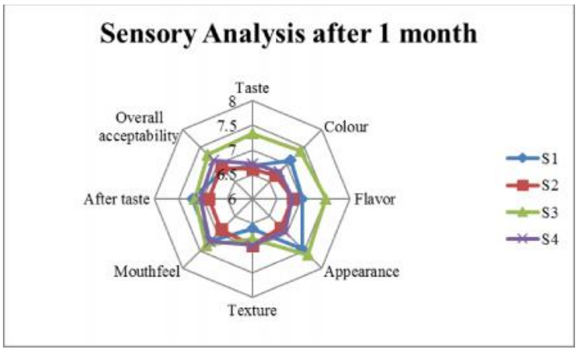
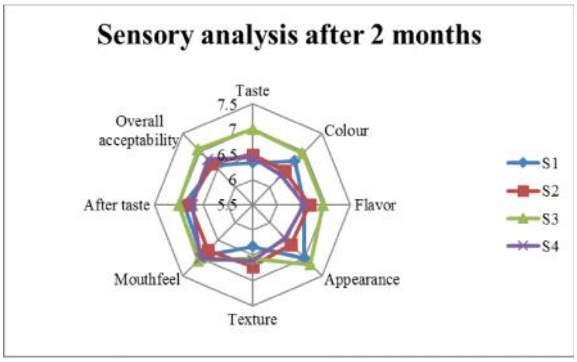


Table 10: Sensory Analysis of 2 Months Sample				
2 Months Sensory				
Sample	**S1**	**S2**	**S3**	**S4**
Taste	6.33 ± 0.43	6.5 ± 0.5	7 ± 0.79	6.44 ± 0.46
Color	6.72 ± 0.51	6.44 ± 0.68	6.94 ± 0.46	6.33 ± 0.43
Flavor	6.56 ± 0.81	6.67 ± 0.43	6.94 ± 0.77	6.56 ± 0.63
Appearance	7 ± 0.66	6.61 ± 0.42	7.17 ± 0.75	6.44 ± 0.46
Texture	6.33 ± 0.5	6.72 ± 0.71	6.56 ± 0.86	6.61 ± 0.49
Mouthfeel	6.94 ± 0.46	6.78 ± 0.57	7.06 ± 0.58	7 ± 0.5
After taste	6.89 ± 0.60	6.78 ± 0.57	7 ± 0.5	6.72 ± 0.62
Overall acceptability	6.61 ± 0.65	6.67 ± 0.5	7.06 ± 0.46	6.78 ±0.62



The mango-papaya bar was prepared by using different S1, S2, S3 and S4 combinations and was presented to panel members and analysed for different attributes such as taste, color, flavour, appearance, texture, mouthfeel, after taste and overall acceptability for the storage period up to 2 months as shown in Tables (8, 9 and 10). S1, S2 and S3 samples were least preferred as far as their texture and taste was considered. The formulation S3 was preferred by the panellist due to its consistency, color stability and taste in a storage period up to 2 months. Considering the preferred formulation S3 it can be concluded that sugar at proportion are enough to impart the suitable firmness and texture of the product. Results were in accordance with those reported by Dalanache *et al*. (2015).

CONCLUSION

It can be concluded from experimental observations and analysis that highly acceptable and shelf stable fruit bar can be prepared from mango-papaya fruit pulp. Significant changes in moisture, acidity and TSS were observed in two months storage span of mango-papaya bar samples. Sugar and liquid glucose made ameliorative effects on texture of fruit bar. As per the sensory evaluation study of mango-papaya bar, sample S3 was found to be most acceptable.

REFERENCES

- Agrahari P R, Khurdiya D S, Kaur C and Kapoor H C (2004), "Antioxidant Activity and Quality of Soy Enriched Apple Bar", *Journal of Food Processing Preservation*, Vol. 28, pp. 145-159.
- Ahmad S, Vashney A K and Srivasta P K (2005), "Quality Attributes of Fruit Bar Made from Papaya and Tomato by Incorporating Hydrocolloids", *International Journal of Food Properties*, Vol. 48, pp. 89-99.
- Aruna K, Vimala V, Dhanalakshmi K and Reddy V (1999), "Physico-Chemical Changes During Storage of Papaya Fruit (*Carica papaya* L.) Bar (Thandra)", *Journal of Food Science and Technology*, Vol. 36, No. 5, pp. 428-433.
- Danalache F, Paulina M and Martins M M (2015), "Texture, Microstructure and Consumer Preference of Mango Bars Jellified with Gellan Gum", *LWT - Food Science and Technology*, Vol. 62, pp. 584-591.
- Jori D B, Pawar A V, Kudake D C and Kotgirkar P G (2015), "Multienzymatic Clarification of Blended Pineapple and Mango Pulp Using Response Surface Methodology", *International Journal of Advanced Biotechnology and Research*, Vol. 6, No. 1, pp. 49-56.
- Jori D B and Parate V R (2015), "Optimization of Enzymatic Clarification of Pineapple Pulp with Multi Enzymes Using Response Surface Methodology", *Trends in Biosciences*, Vol. 8, No. 17, pp. 4585-4592.

- Jori D, Ladole M, Gore A and Bhand V (2013), "Study on Effect of Carbonation on Storage and Stability of Pineapple Fruit Juice", *International Journal of Engineering Research & Technology*, Vol. 2, No. 12, pp. 1841-1847.
- Ladole M R, Muley A B, Patil I D, Talib M I and Parate V R (2014), "Immobilization of Tropizyme-P on Amino-Functionalized Magnetic Nanoparticles for Fruit Juice Clarification", *Journal of Biochemical Technology*, Vol. 5, No. 4, pp. 838-845.
- Mehta G L and Tomar M C (1980), "Studies on Dehydration of Tropical Fruits in Uttar Pradesh II: Guava (*Psidium guajava* L.)", *Indian Food Packer*, Vol. 34, No. 3, pp. 8-11.
- Mehta G L and Tomar M C (1980), "Studies on Dehydration of Tropical Fruits in Uttar Pradesh III: Papaya (*Carica papaya* L.)", *Indian Food Packer*, Vol. 34, No. 4, pp. 12-15.
- Meshram P D, Gore A J and Usmani G A (2015), "Analysis and Optimization of Solvent Free Microwave Assisted Extraction of Bio-Oil from Orange Peels Using Response Surface Methodology", *International Journal on Recent and Innovation Trends in Computing and Communication*, Vol. 3, No. 2, pp. 015-020.
- Munde P J, Muley A B, Ladole M R, Pawar A V, Talib M I and Parate V R (2017), "Optimization of Pectinase-Assisted and Tri-Solvent-Mediated Extraction and Recovery of Lycopene from Waste Tomato Peels", *3 Biotech*, Vol. 7, No. 3, pp. 206 (1-10).
- Naik A G and Chundawat B S (1996), "Evaluation of Gujarat Aonla-1 (*Emblicaofficinalis Gaeetn.*) for Various Processed Products", *Journal of Applied Horticulture*, Vol. 2, Nos. 1-2, pp. 56-58.
- Orrego C E, Salgado N and Botero C A (2014), "Developments and Trends in Fruit Bar Production and Characterization", *Critical Reviews in Food Science and Nutrition*, Vol. 54, pp. 84-97.
- Parekha J H, Senapatia A K, Balb L M and Pandita P S (2014), "Quality Evaluation of Mango Bar with Fortified Desiccated Coconut Powder During Storage", *Journal of Bioresource Engineering and Technology*, Vol. 2, No. 3, pp. 34-41.
- Ranganna S (1986), "Handbook of Analysis and Quality Control for Fruit and Vegetable Products", Tata McGraw Hill Publishing Company Limited, New Delhi.
- Rao V S and Roy S K (1980b), "Studies on Dehydration of Mango Pulp, II: Storage Studies of the Mango Sheet/ Leather", *Indian Food Packer*, Vol. 34, No. 3, pp. 72-79.
- Sharma A and Mahajan H (2013), "Standardization of Technology for Preparation and Storage of Wild Apricot Fruit Bar", *Journal of Food Science and Technology*, Vol. 50, pp. 784-790.
- Sharma K D and Alkesh Kaushal B B L (2006), "Evaluation of Apple Cultivars for Dehydration", *Journal Food Science and Technology*, Vol. 43, pp. 177-181.
- Sindumathi G and Premalatha M R (2013), "Development and Storage Studies of Naturally Flavored Papaya-Pineapple Blended Ready—To Serve (RTS) Beverages", *International Journal Science and Research*, Vol. 4, No. 2, pp. 856-860.
- Singh R, Dashora L K and Upadhyay B (2006), "Effect of Pre-Drying Treatments and Drying Methods on Physico Nutritional Quality of Dehydrated Aonla Shreds", *Indian Food Packer*, Vol. 3, pp. 57-60.
- Sreemathi M, Sankaranarayanan R and Balasubramanyan S (2008), "Sapota – Papaya Bar", *Madras Agriculture Journal*, Vol. 95, Nos. 1/6, pp. 170-173.
- Sujatha Y and Sayantan Bera (2014), "Optimization of Ingredients in Papaya Fruit Bar", *Biolife*, Vol. 2, No. 1, pp. 377-380.
- Vaghani S N and Chundawat B S (1986), "Sun Drying of Sapota (*Achrassapota*) Fruits", *Indian Food Packer*, Vol. 40, No. 2, pp. 23-28.
- Wahane P R, Talib M I and Parate V R (2015), "Preparation of Honey Based, High Calorie Cum Fibre Passion Fruit-Dry Apricot-Flaxseed Bar", *International Journal of Engineering Research & Technology*, Vol. 4, No. 11, pp. 10-14.

IJFANS

International Journal of Food
And Nutritional Sciences