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Studies on physical and bio-chemical analysis of value added products developed from tamarind pulp

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SUMMARY :

Tamarind is an evergreen crop grown in arid and semi-arid regions of India. It is also called as "Indian Date" from the date like appearance of dried pulp. The fruit is good source of calcium, phosphorus, iron and vitamins and also contains small amounts of vitamin A and C. Processing increases shelf-life of fruit and apart from increasing value. It also increases income to growers and processors. An attempt was made to use tamarind pulp for preparation of value added products from tamarind pulp like tamarind jam in the ratio of 1:2 (pulp: sugar), tamarind sauce in the ratio of 1:0.8:0.4 (Pulp: Sugar: Water) and tamarind squash in the ratio of 1: 0.06: 3.3: 1.6 (Pulp: Mint juice: Sugar: Water). In the present study, ripe tamarind fruit was analysed for various physical properties of tamarind fruit like length, width, thickness, geometric mean diameter, surface index and surface index and surface area were found to be 62.51 mm, 16.54 mm, 10.15 mm, 21.93 mm, 0.35 and 1510.11 mm^2, respectively. Value added products were analysed for bio-chemical characteristics like titratable acidity, pH, reducing sugar, fat, moisture, total soluble solids, carbohydrates, crude protein, crude fibre, ash content, etc Changes in the bio-chemical constituents of the value added products were studied. Tamarind possesses great potentials for making jam, sauce, squash and other products and is safe for human consumption. Further development of these value added products from tamarind pulp to an industrial status was recommended.

KEY WORDS : Tamarind, Value added products, Physical characteristics, Bio-chemical characteristics, Moisture content, Ash content

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Tamarind (*Tamarindus indica* L.) belongs to family *Leguminosae* or *Caesalpinicae* which is the third largest family of flowering plants. Tamarind is an evergreen crop grown in arid and semi-arid regions of India. The most outstanding characteristic of tamarind is its most acidic nature with total acidity range varying from 12.2 to 23.8 per cent as tartaric acid and which makes it unfit for fresh consumption (Siddig *et al.,* 2006). It is

also called as "Indian Date" from the date like appearance of dried pulp. In India, it is abundantly grown in Madhya Pradesh, Bihar, Andhra Pradesh, Tamil Nadu and Karnataka (Nath *et al.*, 2008). The fruit is a good source of calcium, phosphorus, iron and vitamins and also contains small amount of vitamin A and C. (Siddig *et al.*, 2006). India perhaps is the chief producer and consumer of tamarind. It is estimated that about 30,000 tonnes of tamarind and exports various intermediate and end products (Shankaracharya, 1998). Tamarind fruits can be processed into various value added products to make it a convenient product with advantage of ease of handling, transportation, storage and use. Processing increases shelf- life of fruit and apart from increasing value. It also increases income to growers and processors. To preserve tamarinds for future use, the shells, fibres and seeds are removed and the pulp stored baskets, jute bags or plastic bags for storage and marketing. Generally, under dry conditions, the pulp remains good for about one year, after which it becomes almost black. The colour of tamarind pulp becomes undesirable because of browning during the storage due to non-enzymatic browning such as Maillard reaction, resulting in quality loss of the pulp (Kotecha and Kadam, 2003 and Obulesu and Bhattacharya, 2011). Important products that can be prepared from tamarind are pulp, powder, juice concentrate, puree, paste, pickles, chutneys, jam, jelly, candy, fruit leather etc. Therefore, the present investigation was carried out to develop value added products from tamarind pulp has been taken up with the objective to study the physical properties of tamarind pod and bio-chemical properties of tamarind value added products.

EXPERIMENTAL METHODS

Raw materials :

For studies on processing of tamarind, about 5 kg mature tamarind pods were collected form the market of Madakasira. The outer shell of the fruit was broken and seeds, shreds etc. were removed manually and thus, the tamarind flesh was obtained.

Extraction of pulp :

The pulp portion of the fruit was separated from tamarind flesh. The pulp was extracted by soaking in the required amount of warm water 3.2:1 (ml of water: fruit pulp). The materials thus, obtained were used for further experimentation.

Preparation of tamarind jam :

In making tamarind jam, the extracted pulp is boiled for 10 minutes at 100ºC. For every 1part of pulp, parts of sugar are added. The mixture is then cooked and constantly stirred while boiling until it becomes thick in consistency. The resulting jam is cooled, packed in dry, sterilized jars and sealed (Jimoh and Onabanjo, 2012).

Preparation of tamarind squash:

For preparation of tamarind squash, mint was used as a flavouring material. Tamarind flesh was soaked in water for 3 h. The tamarind pulp was then extracted through filtration with muslin cloth or strainer. Fresh mint leaves were taken and subjected to washing, grinding and filtration. The obtained mint juice was blended with the tamarind pulp. The sugar syrup was prepared in a separate vessel and blended with pulp and mint juice in the ratio 1: 0.06: 3.3: 1.6 (Pulp: Mint juice: Sugar: Water). The obtained squash was filled in glass bottles and subjected to storage at room temperature (Archana and Laxman, 2015; Panjiar *et al.*, 2015; Pattar *et al.*, 2013a and b).

Preparation of tamarind sauce :

For preparation of sauce, pulp was extracted from cleaned flesh. The pulp was taken in a stainless steel vessel and sugar was added to the pulp in the ratio 1:0.8:0.4 (Pulp: Sugar: Water). Spices (garlic, black pepper, cloves, red chilies etc.) were placed into a muslin bag and bag was immersed in pulp. The pulp was heated until it reduced to about 1/3 of its volume. The muslin bag was squeezed to extract aroma and flavour of the spices and bag is removed from the pulp. The finished product was poured into medium sized glass bottles in hot condition and stored at room temperature.

Determination of physical properties of tamarind pod (fruit) :

Tamarinds were randomly chosen for measuring dimensions like length, width and thickness of each tamarind fruit were measured using Vernier calliper (least count 0.01 cm) (Taufiq *et al.*, 2015). Three observations were made to get average values of length, width and thickness of the tamarind fruits. Geometric mean diameter (Dg), Sphericity index (Φ) and surface area (S) were

calculated by using the following equations.

$D_g = (LWT)^{1/3}$

$C = Dg/L$

$S = \pi D^2 g$

where,

L = Length of the fruit, mm

W = Width of the fruit, mm

T = Thickness of the fruit, mm.

Bio-chemical analysis of tamarind processed products :

Proximate analysis of tamarind processed products:

The proximate composition of the value added products developed from tamarind pulp were analysed according to methods of AOAC. Moisture content of value added products was determined according to oven method - (AOAC, 2000). For protein estimation, Lowey's method – (AOAC, 2005) was carried out. In this method, extraction is usually carried out with buffers used for the enzyme assay. Weigh 500 mg of the sample and grind well with a pestle and mortar in 5-10 ml of the buffer. Centrifuge and use the supernatant for protein estimation. The crude fibre was analysed as per (AOAC, 2005) in which when the sample treated with the acid and subsequent alkali, oxidative hydrolytic degradation of native cellulose and considerable degradation of lignin occur. The residue obtained after final filtration is weighed, incinerated, cooled and weighed again. The loss in weight gives the crude fibre content. Estimation of crude fat was carried out by soxhlet method (AOAC, 2009). The ash content of the respective value added products were analysed according to (AOAC, 1965) in which the sample is ignited at 600°C to burn off all organic material which does not volatilize at that temperature and the resultant thus obtained is called ash. The total carbohydrate content was obtained by Anthrone method (AOAC, 2005). In this method, the carbohydrates were first hydrolyzed into simple sugars using dilute hydrochloric acid. In hot acidic medium glucose is dehydrated to hydroxyl methyl furfural. This compound forms with anthrone a green coloured product with an absorption maximum at 630 nm.

Determination of total soluble solids (TSS), total titrable acidity and pH :

Total soluble solids, total titrable acidity and pH were carried out for the value added products developed from tamarind pulp. The total soluble solids were determined using pocket refractometer by firstly rinsing the prism of refractometer with distilled water and calibrate with it. Now determine the refractometer reading by placing a drop of processed product on the prism and reading the corresponding percentage of dry substance or total soluble solids. The pH was determined as per (IS: 3025, 2002). For determining pH of fruits and vegetables and their products a buffer of pH 4 would be sufficient. Standardize the pH meter using this buffer and check the pH of the products. It is necessary to determine titrable acidity of a given food sample to ensure the presence of acid in terms of predominant acid present in it. It is done by titring the sample against standard NaOH (0.1 N) in presence of indicator. The predominant acid present in the tamarind and tamarind processed products is the tartaric acid and the acid content was determined as per (IS: 3025, 2002).

Determination of reducing sugars :

The reducing sugars present in the tamarind value added products were analysed by Fehling method, 1965. The reducing sugars when heated with alkaline copper tartrate reduce the copper from the cupric to cuprous state and the cuprous oxide is formed. When cuprous oxide is treated with arsenomolybic acid, the reduction of molybdic acid to molybdenum blue takes place. The blue color developed is compared with asset of standards in a colorimeter at 620 nm.

EXPERIMENTAL FINDINGS AND ANALYSIS

The results obtained from the present investigation as well as relevant discussion have been summarized under following heads :

Physical properties of tamarind pod (fruit):

Tamarind was analyzed for various physical properties like length, width, thickness, geometric mean diameter, surface area and sphericity index Table 1 (Ishola *et al.*, 1990 and Karpoora *et al*., 2013).

Bio-chemical analysis of tamarind processed products:

Proximate analysis of tamarind processed products:

Tamarind value addition products were analyzed for proximate composition like moisture content, ash content, crude fibre, protein, carbohydrate, crude fat Table 2 (Hedge and Hofreiter, 1962; Lowry *et al.*, 1951 and Mattoo, 1970).

Table 1 : Physical properties of tamarind pod

Properties	Mean values	Standard deviation
Length, mm	62.51	0.3252
Width, mm	16.54	0.2206
Thickness, mm	10.15	0.0650
Geometric mean diameter, mm	21.93	0.05
Sphericity index	0.35	0.0251
Surface area, mm^2	1510.11	6.8860

Table 2 : Proximate composition of tamarind processed products

Constituents	Tamarind pulp	Tamarind jam	Tamarind squash	Tamarind sauce
Moisture content (%)	38.8	48.7	50.5	44.5
Carbohydrates (%)	0.53	0.86	1.53	1.06
Protein (µg)	193.33	106.66	113.33	113.33
Crude fibre (%)	12.225	11.676	11.457	9.612
Crude Fa (%)	12.93	12.88	12.85	14.71
Ash content (%)	1.7317	0.3054	1.9133	1.07391

Table 3 : Total soluble solids (TSS), total titrable acidity and pH of tamarind processed products

Property	Tamarind pulp	Tamarind jam	Tamarind squash	Tamarind sauce
Total soluble solids (TSS) (°Brix)	33.5	33.8	36.1	34.5
Total titrable acidity (% of tartaric acid)	9.606	6.148	3.586	8.196
pH	3.60	3.81	3.84	3.63

Analysis of total soluble solids (TSS), *total titrable acidity and pH* :

Tamarind value addition products were analyzed for total soluble solids, total titrable acidity and pH Table 3.

Analysis of reducing sugars:

The reducing sugars in tamarind value added products- tamarind pulp, tamarind jam, tamarind squash and tamarind sauce were 18.7 per cent, 14.3 per cent, 15.1 per cent and 13.8 per cent, respectively. (Fig. 1).

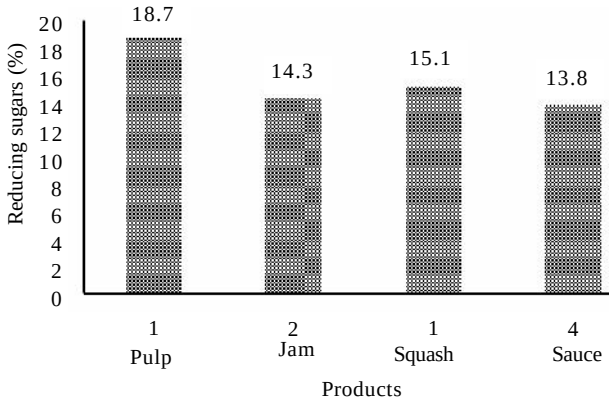

Fig. 1 : Effect of reducing sugars on different samples prepared from tamarind pulp

Conclusion:

Tamarind pulp has an attractive and immense commercial future for producing jams, squash, sauce on an industrial scale in India. The tamarind fruit pulp had a complex chemical composition. It is not eaten frequently in large amounts as fresh fruit and upon utilization in other ways it is greatly diluted with water or other food ingredients. There are appreciable levels of vitamin C in tamarind pulp which in the nutrition of humans could prevent the manifestation of diseases. Beside this tamarind price is very low in the Indian market. All these factors motivated the researcher to use tamarind in production of a valuable product such as vinegar and hence improve its economical value. Tamarind fruit pulp has great potentialities (its high sugar concentration, low pH) to be

used industrially in many products such as concentrates, pickles, confections, powders, etc.

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