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Research Article

BIOCHEMICAL CHARACTERIZATION OF INDUSTRIAL PROCESSED FRUIT WASTES

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Abstract-The industrial processed fruit wastes *viz.*, mango peel, mango seed stone and tomato pomace samples were collected from Mother Dairy processing plant, near Whitefield, Bengaluru. The samples were subjected for biochemical analysis for parameters *viz.*, pH, TSS, acidity and proximate contents of waste samples. The results of biochemical analysis revealed that the pH and TSS varied from 3.42–5.06 and 1.0 – 7.35 respectively between the fruit waste samples. The proximate composition of different fruit wastes revealed that the total protein and fat content were ranged from 4.75 to 18.18 per cent and 1.77 to 6.26 per cent respectively. The moisture content ranged from 5.38 to 8.09 per cent between the wastes. The crude fibre and ash content ranged from 2.65 to 38.10 per cent and 2.45 to 3.61 per cent respectively. The carbohydrate content ranged from 25.76 to 72.99 per cent while tomato pomace showed a very low carbohydrate content compared to mango peel and seed meal. The mineral and pigments contents of industrial processed fruit wastes revealed that the mango peel contains more of iron (230ppm) with carotenoids (4028µg/100g) and Ca (0.42%). Mango seed meal contains more of polyphenols (23.4mg/100g) and potassium (1.49%). Tomato pomace contains more of lycopene (4.4mg/100g) and Ca (4.05%). The results of chemical analysis revealed that the processing of fruit wastes contain more of valuable nutrients which are essential for the development of different value added products.

Keywords- Mango peel, Mango seed kernel, Tomato pomace, Industrial fruit waste, Proximate contents.

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Introduction

The production of fruits and vegetables in world is about 416.78 and 608.80 million tons, respectively [1,2] and in India is about 74.88 and 146.55 million tons, respectively) [4]. Fruits and vegetables are processed for the production of various types of value added products such as fruit juices, jam, jelly, alcoholic beverages, pickles, canned products etc. A huge quantity of fruit and vegetable wastes is generated from processing industry as well as during post harvest chain (harvesting, grading, packaging, transportation, marketing etc) as un-marketable, damaged and inferior quality of fruit and vegetable wastes. These wastes contains various sugars, starch, pectin, minerals, vitamins and are either composted or dumped in landfills, roadsides or rivers causing environmental hazards. Joshi and Bhutani [5] reported about 9 million tons of solid residue and 8 million gallons of waste water are produced annually by the processing industry. This large scale processing facilities provide large quantities of factory wastes in terms of solids and liquids. There are many options for the utilization of these wastes from the processing industries [6].

Shui and Leong [12] reported on byproducts such as fruit wastes (bagasse, peel, and seeds) could be a potential ingredients in food formulations or raw material for the extraction of bioactive compounds such as phenolics, carotenoids, essential oils, and vitamins. Further, there are also reports of use of fruit wastes as minerals and antimicrobial agents (4–6). Studies carried out by Gupta et al.[3] on fruit residues for the presence of saturated and unsaturated free fatty acids and minerals such as Calcium, potassium, magnesium, sodium, and phosphorous that could be an important as food supplements.

Fruit and vegetable wastes have attracted the attention of scientists and data has been generated on various fruits and vegetables defining their valuable constituents, mode of extraction of some of the byproducts and their end uses. Processing of fruits and vegetables produce two types of wastes namely, a solid waste derived from peel/skin, seeds, stones etc. and a liquid waste is the waste portion obtained from juice and wash waters. In some fruits the discarded portion is very high (e.g. mango 30-50%, banana 20%, orange 30-50%). Pomace constitutes a major part of the wastes obtained during fresh fruit processing, juice, fermented beverage and soft beverage production and accounts for 25 per cent of the volume of the raw material processed [7]. Therefore, there is a serious waste disposal problem, which leads to flies and rats problem around the processing area or processing plant if the wastes are not utilized suitably or disposed properly. If there are no plans to use the waste it should be buried or fed to animals well away from the processing site. Quantity and quality of wastes is important on the decision of evaluation of wastes.

Currently, lot of interest is being focused on possibilities of exploiting these fruit and vegetable wastes as animal feed by animal scientist, but lack of data on their chemical composition has limited the prospects of this waste utilization. This study provides data on the nutrient composition of industrial processed mango peel, mango seed kernel and tomato pomace.

MaterialsandMethods

The industrial processed fruit waste such as mango peel (variety: Totapuri), mango seed stone (variety: Totapuri), and tomato pomace (variety: local) samples [Fig-1] were collected from Mother Dairy processing plant (National Dairy Development Board), near Whitefield, Bengaluru for experiment. The samples were tray dried (make: CM Enviro systems, India) at 55° C for 48 hours and grounded in a mixie to get the powder. The grounded dried powder samples were stored under cold room at 3 – 4◦C until used.

pH of the different fruit waste samples were measured using digital pH meter of analog model (make: Micropro Labmate, India). Standard buffer solutions of pH 4.0, 7.0 and 10.0 were used to calibrate the instrument [10].

Total soluble solids of fruit waste samples were determined using digital Refractometer (make: ATAGO, Japan) having a range of 0 to 32º Brix.The Titrable acidity was determined by as per the procedure followed bySrivastava and Kumar[11].

Mother Dairy fruit processing plant, Whitefield, Bengaluru

Fig-1 Industrial processed Tomato pomace and Mango peel,Mango kernel seeds

The proximate analysis for parameters moisture, protein, fat, ash and crude fibre content in the fresh waste samples were determined by AOAC methods [1]. Crude protein was calculated by multiplying with a conversion factor of 6.25 [1]. Similarly, crude fat, crude fibre and ash content of samples were estimated using the procedure described in AOAC[1]. The available carbohydrate was detemined by the difference of protein, fat, fibre, ash and moisture as per the procedure of AOAC [1].

The phosphorus and magnesium content of the fruit waste samples were estimated using Flame Photometer (make: ATS 200S, Switzerland). Ash obtained from the ignition of fruit waste was digested in 6 N HCl, evaporated over a water bath and dissolved using a little quantity of 6 N HCl and the volume was made up to 100 ml. This ash solution was used for estimating above minerals content with help of Flame Photometer.

The iron, calcium and zinc content of the fruit waste samples were estimated using Atomic Absorption Spectrometer (AAS). Ash obtained from the ignition of fruit waste sample was digested in 6 N HCl evaporated over water bath and dissolved using little quantity of 6 N HCl and the volume was made up to 100 ml. This ash solution was used for estimating ions of above three elements content with help of AAS.

The aim of this study was to determine the bio-chemical composition of industrially processed tomato pomace, mango peel and seed kernel collected during processing at SAFAL, National Dairy Development Board, near Whitefield, Bengaluru in order to assess the quality of these by-products. Samples were analyzed for biochemical, proximate contents, mineral contents and anti nutritional factors.

Industrially processed mango peel, mango seed meal and tomato pomace samples were analyzed for biochemical, proximate contents, mineral contents and anti-nutritional factors. The chemical composition of mango processing by-products was found to be varying between the varieties with different proportion of seeds, hulls, pulp, peels and sugar content. Further, mango by-products contain variable amounts of fruit components; hence, it was found difficult to provide accurate nutrient composition of mango by-products.

Results& Discussion:

[Table-1] shows the results of biochemical contents of different fruit wastes. The results revealed that the pH varied from 3.42–5.06 between the processed fruit waste samples. However, mango peel showed highly acidic pH (3.42) as compared to mango seed meal (5.06). The TSS (7.35°brix) content was observed more in the mango peel when compared to tomato pomace and seed meal. This could be due to the presence of pulp remains in the peel after processing and this could have resulted in higher TSS value. The titratable acidity varied from 0.84 – 1.62 per cent between the processed fruit wastes, however, more acidity was in the mango peel and tomato pomace, than in mango seed meal.

Table-1 *Physicochemical and proximate parameters of Industrially processed fruit wastes*

Physicochemical properties	Mango peel	Mango seed /kernel	Tomato pomace
pH	3.42	5.06	4.08
TSS (brix)	7.35	1.10	1.00
Acidity (%)	1.62	0.84	1.56
Moisture (%)	5.38	6.66	8.09
Protein (%)	4.75	7.50	18.18
Fat (%)	1.77	7.75	6.26
Crude fibre (%)	10.10	2.65	38.10
Ash (%)	3.07	2.45	3.61
Total carbohydrate (%)	71.93	72.99	25.76
Energy (K.cal/100g)	322.65	391.71	232.10

The proximate composition of different fruit wastes are shown in [Table-1]. The total protein content in selected fruit wastes ranged from 4.75 to 18.18 per cent. The highest protein content was observed in tomato pomace (18.18%), where as mango peel and seed meal contained 4.75 and 7.5 per cent, respectively. Moisture content ranged from 5.38 to 8.09 per cent between the wastes, while, tomato pomace showed a higher moisture content. The fat content ranged from 1.77 to 6.26 per cent and it was found to be more in mango seed meal (7.5%) followed by tomato pomace (6.26%). The crude fibre content ranged from 2.65 to 38.10 per cent and was found to be higher in tomato pomace followed by mango peel. The ash content ranged from 2.45 to 3.61 per cent. The carbohydrate content ranged from 25.76 to 72.99 per cent where tomato pomace showed a very low carbohydrate content compared to mango peel and seed meal. The analysis results of different fruit wastes namely mango peel and seed meal were found to be in concurrent with readings reported by Ojokoh [Table-1] [9].

The mineral and pigments contents of industrial processed fruit wastes is shown in [Table-2]. The results revealed that the industrial processed mango peel contains more of iron (230ppm) with carotenoids (4028µg/100g) and Ca (0.42%), Mg (0.30%) and potassium (0.73%). Mango seed meal contains more of polyphenols (23.4) and potassium (1.49%). Tomato pomace contains more of lycopene (4.4mg/100g) with-

Ca (4.05%) and Mg (2.60%). The results of chemical analysis revealed that the processing fruit wastes contain more of valuable nutrients which are essential for the development of different value added products [Table-2].

Table-2 *Mineral and pigments contents of Industrial processed fruit wastes*

Fruit Wastes	Ca (%)	Mg (%)	K (%)	Fe (ppm)	Mn (ppm)	Lycopene (mg/100g)	polyphenols	Carotenoids
Mango peel	0.42	0.30	0.73	230.0	32.6	*	2.7	4028.0
Mango seed meal	0.18	0.56	1.49	25.0	75.0	*	23.4	*
Tomato pomace	4.05	2.60	*	120.0	*	4.40	*	*

* Not Determined

Conclusion

The chemical composition of different fruit processing wastes was found to be varying with the type of waste. The mango processing by-products was found to be varying between the varieties with different proportion of seeds, hulls, pulp, peels and sugar content. More over by-products of fruit wastes contain variable amounts of fruit components; hence, it is difficult to provide accurate nutrient composition of fruit by-products.

Conflict of Interest: None declared

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