

Original Research Article

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Bioactive Components (Polyphenols, Flavonoids, Total Carotenoids, Antioxidant Activity) and Proximate Chemical Composition of Selected Food Processing Industry By - Products

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ABSTRACT

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The study was conducted with the main objective of quantification of bioactive components and analysis of proximate composition of selected food processing industry by-products such as mango peel, mango seed kernel and groundnut seed coat. The food processing industry produces huge amount of wastes or by-products annually around the world in processing of different animal and plant sources. The by-products generated during food processing are excellent source of nutraceuticals and many bioactive food components that have significant health promoting effect. The food processing by-products are used as a chief source for the production of functional food ingredients. The economically valuable components such as proteins, fats, dietary fibers, flavour compounds, phytochemicals and bioactive compounds represent in food processing by-products. The waste management is one of the major challenging jobs around the world in food industries. The huge volume of the low cost by-product generated during food processing provides inexpensive source of many potentially valuable health promoting components.

Introduction

The Food processing industry by-products are produced in large amount in the food industries, annually around the world. About 38% of by-products are generated during food processing. The fruit and vegetable based processing by-products includes peels, stems, seeds, shells, bran, trimmings residues after extraction of oil, starch, juice and sugars. The disposal of these food industry wastes in the environment it is inconvenience to the ecosystem, because it's poor biological stability, significant nutritional value, high concentration of organic compounds, high

water activity, poor oxidative stability and optimum enzymatic activity. The large amount of food wastes and its microbial decomposition may cause adverse effect on the environment and human health and large cost for the waste treatment, it is additional charge on the food manufacturer (Helkar *et al.*, 2016). Attempts have been made broadly for the past few decades to develop methods and find different ways to utilize fruit and vegetable wastes therapeutically. Generally, agro-industrial wastes have been used extensively as animal feeds or fertilizers.

Recent reports shows development of high value products (such as cosmetics, foods and medicines) from agro-industrial by-products (Rudra *et al.*, 2015). Ameeravani *et al.*, (2013) indicates that in mango pulp processing, peel a major by-product, contributes about 15-20% of the fruit.

As peel is not currently utilized for any commercial purpose, it is discarded as a waste and becoming a source of pollution. Peel has been found to be a good source of phytochemicals, such as polyphenols, carotenoids, vitamin E, dietary fibre and vitamin C and it also exhibited good antioxidant properties (Ajila *et al.*, 2007; Kim *et al.*, 2010).

Mango kernel is a good source of starch and fat. A preliminary study showed that the seed represents from 20% to 60% of the whole fruit weight, depending on the mango variety and the kernel inside the seed, which represents from 45% to 75% of the whole seed (Maisuthisakul and Gordon, 2009).

Soong *et al.*, (2004) indicated that mango seed kernel has potent antioxidant activity with relatively high phenolic contents. They observed that mango seed kernel was also a good source of phytosterols, such as campesterol, sitosterol, stigmasterol and also contains tocopherols. An estimated 35– 45 g of generated per kg of shelled groundnut kernel.

Over 0.74 million metric tons of groundnut seed coat are produced annually worldwide as a by-product of the groundnut processing industry. Usually, only a little groundnut seed coats utilized to extract polyphenolic compounds or make the cattle feed, most of the skins are as the wastes of groundnut processing industry and discarded (Sobolev and Cole, 2003).

Materials and Methods

Collection of by-products

The by-products such as mango peel and seed kernel of Bangalore variety were collected from leading mango pulp producers namely Aditya agro products and Real agro products Pvt. Ltd located in Natham of Dindigul district, Tamil Nadu, India. Groundnut seed coat is one of the major by-product in groundnut chikkis industries in Tamil Nadu. It was collected from Laxmi villas chikkis processing unit located in Oomachikulam of Madurai district, Tamil Nadu, India.

Analysis of proximate composition

The moisture content of the sample was estimated by hot air oven method as per the procedure referred by AOAC (1997). The fat content of the sample was estimated by extracting with petroleum ether (60 - 80^oC) as described by Cohen (1917) using Soxhlet apparatus. The crude fibre content was determined by the method described by AOAC (1997). The protein content was estimated as per the method described by Ma and Zuazaga (1942) and Carbohydrate content by Anthrone method (Colorimetry) as reported by Sadasivam and Manickam (2008). The ash content was determined using dry ashing (Furnace method) as described by Hart and Fisher (1971).

Determination of total polyphenolics, flavonoids, carotenoids, tannins and DPPH antioxidant activity

The total polyphenolic content was determined using Folin - Ciocalteu method as reported by Sadasivam and Manickam (2008) with slight modification. The total phenolic contents were expressed as mg of Gallic Acid Equivalent (GAE) per 100 g. Total flavonoids content present in the selected by-products

were estimated by the aluminum chloride colorimetric assay as described by Marinova *et al.*, (2005). The total flavonoids contents were expressed in mg Quercetin equivalent (QE) per 100 g. Tannin content was measured using Folin-Denis method described by Sadasivam and Manickam (2008) and results were expressed as mg of Tannic Acid Equivalent (TAE) per 100 g. The total carotenoid content was spectrophotometrically determined as per the method described by (Lucia *et al.*, 2012). The DPPH assay was performed as described by Lim *et al.*, (2007) with slight modifications. The results were expressed as radical scavenging activity (% RSA) or percentage inhibitions of DPPH by the methanolic extract of the samples.

Results and Discussion

The proximate composition of selected food processing by-products such as mango peel, mango seed kernel and groundnut seed coat

are given in table 1. The moisture content is ranged from (61.00 %) in mango peel to (6.43%) in groundnut seed coat and it was found to be more in mango peels. Groundnut seed coat have high amount fat (9.80 g/100g), protein (7.15g/100g), carbohydrate (55.94 g/100g) followed by mango seed kernel (9.16 g/100g) and (6.78g/100g) of protein and (40.28g / 100 g) of carbohydrate. Groundnut seed coat have the highest quantity of crude fiber (17.16 g / 100 g) and ash content of (2.40 %) followed by mango peel (9.80 g / 100g) and ash content of 1.53 %.

In case of bioactive components mango peel has the highest amount of total polyphenols (210.76 mg GAE / 100 g), total flavonoids (37.15 mg QE/100g) and total carotenoids 20.10 mg/100 g. The groundnut seed coat has the high amount of tannins (16.42 mg TAE/100 g). Mango seed kernel has the maximum antioxidant activity (88.70 %) among the other by-products (Table 2).

Table.1 Proximate composition of selected food processing industry by-products

By-products	Moisture (%)	Fat (g/100 g)	Protein (g/100g)	Carbohydrate (g/100g)	Crude Fiber (g/100g)	Ash (%)
Mango peel	61.00±0.31	1.90±0.01	3.10±0.07	21.70±0.03	9.80±0.19	1.53±0.00
Mango seed kernel	39.25±0.77	9.16±0.12	6.78±0.25	40.28±1.08	2.16±0.08	1.28±0.08
Groundnut seed coat	6.43±0.17	9.80±0.06	7.15±0.28	55.94±0.45	17.16±0.15	2.40±0.15

* Values are expressed on FWB. All data are the mean ± SD of three replicates.

Table.2 Bioactive components in selected food processing industry by-products

By-products	Total Polyphenols mg GAE/ 100g	Total Flavonoids mg QE/100 g	Total Carotenoids mg/100 g	Tannins mg TAE/100 g	DPPH antioxidant activity (%)
Mango peel	210.76±2.46	37.15±0.84	20.10±0.09	8.93±0.15	83.54±1.95
Mango seed kernel	113.38±3.67	23.49±0.57	ND	13.10±0.53	88.70±0.31
Groundnut seed coat	132.50±4.180	19.55±0.68	1.78±0.00	16.42±0.39	73.59±2.98

* Values are expressed on FWB. All data are the mean ± SD of three replicates.

Fig.1 Collected by-products

Groundnut Seed coat



Mango peel



Mango Seed kernel



In conclusion, mango processing industry by-products could be a rich source of bioactive compounds such as polyphenols, flavonoids, carotenoids etc.

Mango peel if conveniently processed, could furnish useful products that may balance out waste treatment costs and also decrease the cost of main product (Fig. 1).

Therefore, there is a scope for the isolation of these active ingredients and also use of mango peel as an ingredient in processed food products such as bakery products, breakfast cereals, pasta products, bars and beverages (Ajila *et al.*, 2007).

Mango seed kernel is a potential source of functional food ingredients due to the high

quality of its fat, protein and the high content of antioxidants and compounds that have antimicrobial activity.

It is well known that the groundnut seed coat is rich in many antioxidants.

So, the more efficient utilization of groundnut seed coat benefit industry and the economy, and the exploitation of groundnut seed coat as a renewable raw material for antioxidant compounds will provide protection against several degenerative diseases (yu *et al.*, 2006).

It's concluded that the food processing industry by-products should be further used for product development and processing rather than just discarded as waste.

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