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Research Article

Study on Different Peeling Techniques and Its Effect on Nutritional Components of Potato Peel

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ABSTRACT

Present study focused on the determination of nutrient content in potato peels by abrasive and steam peeling method. It was observed that type of peeling can significantly affect the nutrient content. In the present study steam peeling resulted in lower amount of starch content compared to abrasive peeling. Similarly, phytochemical components such as Total phenols, Tannins, Flavonoids and Alkaloid content were found to be higher in abrasive peeling, this can be attributed to the high temperature losses incurred in steam peeling leading to their thermal degradation. Hence it was concluded that abrasive peeling can be more suitable for using the peels flour as a food component in developing various food products.

Keywords: *Potato peel, Abrasive peeling, Steam peeling, Phytochemical and Thermal degradation*

INTRODUCTION

Potato (*Solanum tuberosum* L.) is one of the most cultivated food crops in the world after rice and wheat, where India accounts for a total production of about 437 million tonnes per year according to FAOSTAT, 2016. It belongs to the *Solanaceae* family which consists of about 90 genera and 2,800 species. It's cultivated in both temperate and tropical regions for around 150 countries and at elevations from sea level to around 4,000 m. The production has been steadily expanding globally since 1960, with 35% increase in total production. The increase in production is much higher in developing countries of Asia and Africa indicating its importance as a staple food diet (Warrier et al., 2016). Wide range of fried product such as French fries and chips can be produced from the potatoes. This industrial processing of potatoes generates huge amounts of peel as a byproduct and thereby causes disposal, sanitation, and environmental issues. These wastes are mainly categorized into three types, namely: (1) potato peels; (2) Potato fines (cut pieces during slicing and other unit operations); and (3) material from waste water recovery systems (belt solids, oxidation ditch, filter cake), among which the amount of potato peel generated is the highest.

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In a typical potato-processing plant, 6–10% of potato peel waste is generated during the peeling process. Approximately 0.16 tons of solid waste may be generated per ton of processed potato Shaobo & McDonald, 2014; Moreno-Piraján & Giraldo, 2012; Kazuhiro et al., 2006; Nelson, 2010; Katariina et al., 2016; Wu, 2016). Potato peel contains value added product like starch, dietary fiber, natural antioxidants, food additives and biopolymers (Chiellini et al., 2004; Di Mauro et al., 2002). However, the central dogma is development of suitable processing methods for the effective utilization of these by-products generated in a food processing industry (Bhushan et al., 2008; Chiu & Chan, 1992). The present study focuses on the analysis of nutritional components of the potato peel flours obtained from steam and abrasive peeling method.

Objectives:

1. To study the effect of peeling and drying on starch content in potato peel waste.
2. Physicochemical analysis of both steam peeled and abrasive peeled powder

MATERIALS AND METHODS

Potato was procured from the Thanjavur local market, Tamil Nadu, India. Chemicals used were procured from Sigma Aldrich (Germany) and Hi Media (India).

Sample preparation:

The methodology used includes different peeling method such Abrasive peeling and steam peeling followed by drying, milling, physicochemical analysis such as proximate, starch, total phenolic content, tannin, flavonoids and total alkaloids (Figure 1).

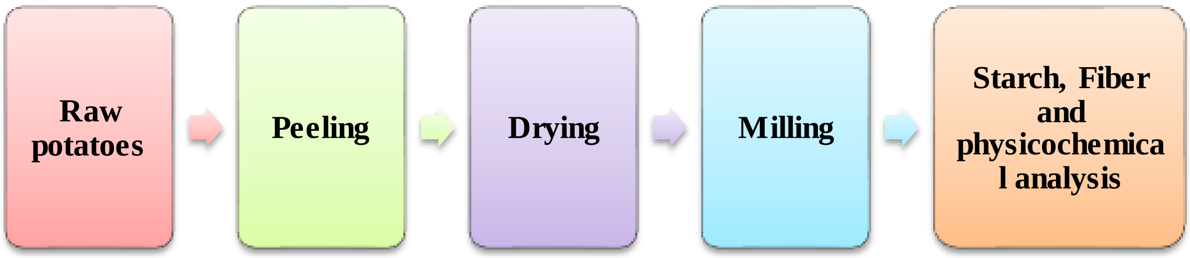

Fig. 1: Flowchart for Sample preparation

Extraction of Starch:

Starch was extracted by both the Abrasive peeled and steam peeled samples using aqueous extraction method through wet milling method peel (Babu et al., 2014) (Figure 2).

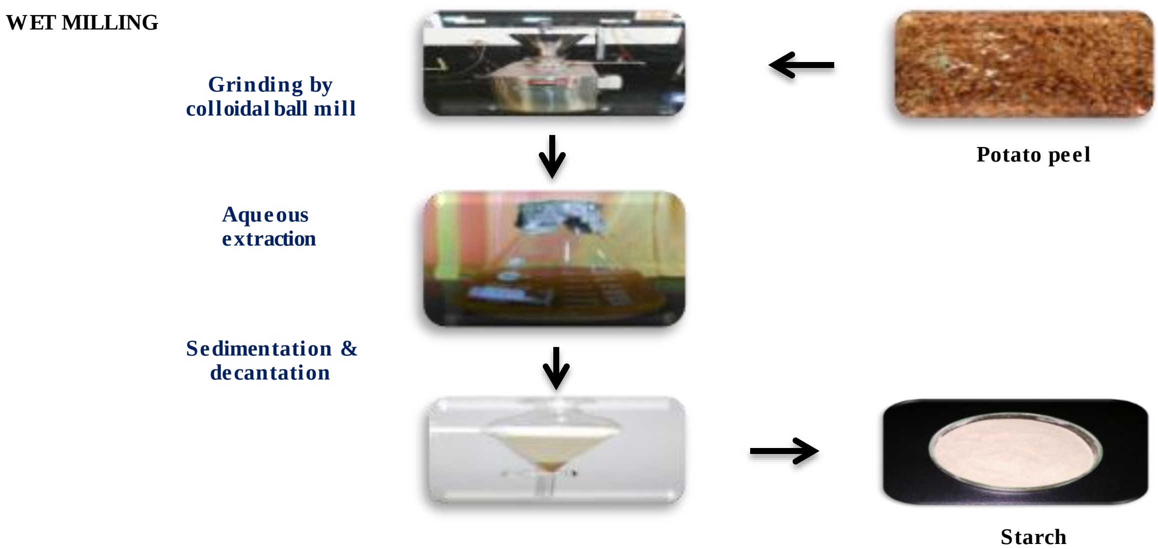

Fig. 2: Aqueous extraction of starch through Wet milling

Extraction of Fiber:

Dietary fiber was extracted from potato peel using aqueous extraction (Al-Farsi et al., 2008) (Figure 3).

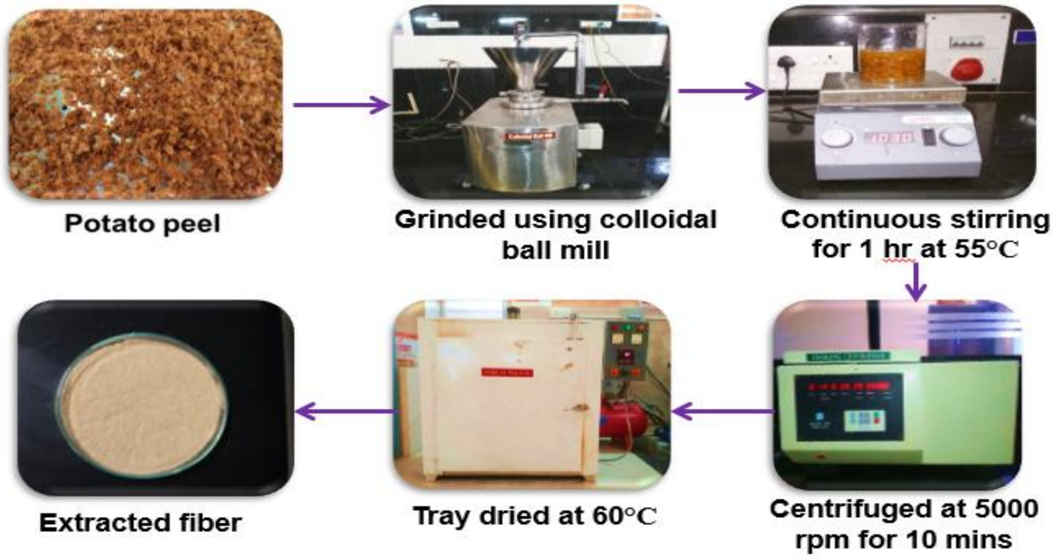

Fig. 3: Aqueous extraction of dietary fiber from potato peel

Proximate Analysis:

The proximate analysis of Abrasive peeled and steam peeled powder were determined according to the methodology described in the AOAC (Paez et al., 2016). Analyses of moisture were conducted by desiccation in an oven at 130±3^0 C for 3 hours; protein content was detremined by Kjeldhal method; fat by extraction with hexane using soxhlet apparatus; ash by incineration in a muffle furnace at 550˚C; crude fiber was determined by the acid and alkaline hydrolysis, respectively. Carbohydrate content was calculated by the difference between the total contents of all other ingredients. Each analysis was carried in replicates.

Total Phenolic and Flavonoid Content:

The total phenolic content was estimated by the method of Ganapaty et al. (2013) using Folin-Ciocalteu reagent. The total phenolic content was expressed inmgGAE/g. Total flavonoids content was estimated using colorimetric method according to the method of Ganapaty et al. (2013).

Total alkaloids:

Total alkaloids were determined by the method of Manjunath et al. (2012) using UV-spectrometry. Peel extract was mixed with 2 N HCl and filtered. The filtrate was then transferred to separating funnel and washed with 10 ml of chloroform. Add 5 ml of phosphate buffer and 5 ml of bromocresol in separating funnel. Then the mixture was shaken vigorously and collects the fraction from separating funnel. And the fraction was immediately diluted with chloroform. The absorbance was measured at 470 nm using UV- spectrometry.

Tannin Content:

Tannin content was estimated by Folin-Ciocalteu method. The extract was taken in 10 m volumetric flask which contains 0.5 ml of folin-ciocalteu phenol and 7.5 ml distilled water, 1 ml of 35 % Na_2CO_3 was added and then diluted with 10 ml distilled water. Thus the mixture was shaken and kept at ambient temperature for 30 mins. The absorbance was measured at 725 nm and the value was expressed in mg GAE/g of extract (Tambe et al., 2014).

Starch and Fiber analysis:

Starch and fiber were analyzed for both abrasive and steam peeled samples by the method of AOAC (Paez et al., 2016).

RESULTS AND DISCUSSION

Starch and Fiber Analysis:

Potato peel is a good source of dietary fibre having hemicellulose, cellulose, lignin, gums, pectin, etc. with average content of 40 g/100 g and it depends on the peeling method (Abd-El-Magied, 1991). Abrasive peeled sample resulted in high starch content and less fiber when compared to the steam peeling (table 1). From this, it was inferred that there is a loss of fiber content when the peel undergoes steaming at high temperature.

Table 1: Analysis of Starch and Fiber Content

Compound	Content (DW)%	
	Abrasive Peel	Steam Peel
Starch	64.63± 2.23	23.75±2.48
Fiber	29.56±2.20	40.56±2.27

Proximate Analysis:

Proximate analysis performed for abrasive peeled and Steam peeled samples (Table 2). Moisture was found to be less than 10 % in both Abrasive and Steam peeled samples. In case of ash, increase in mineral content results in increases ash content. When compared to steam peeling, the abrasive peeling resulted in high content of ash. From this, it was clearly showed that there is reduction in mineral content when the sample undergoes steaming at high temperature, which may be attributed to leaching affect. In case of fat, it was less in both abrasive and steam peeled sample. In case of protein, there was no significant difference between abrasive and steam peeling method. Carbohydrate content was high in steam peeled sample when compared to abrasive peeled sample. The result shows that there was a significant difference ($p<0.05$) observed in proximate values of abrasive peeling and steam peeling method.

Table 2: Proximate Analysis for Potato Peel

Compound	Content (DW)%	
	Abrasive Peel	Steam Peel
Moisture	6.0 ±0.2	6.9±0.36
Ash	10.33 ±2.08	8.5±0.5
Fat	0.62±0.13	0.67±0.21
Protein	15.96±0.25	16.18±0.18
Carbohydrate	64.63±3.13	67.73±0.81

Analysis of phytochemicals:

Potato peel contains flavonoids, tannin, glycoalkaloids and polyphenols which can be extracted and used as precursors for steroids and natural antioxidants in food (Schieber & Saldaña, 2009). Phenols and tannin content was found high in abrasive peeled sample ie. 2.5 mg GAE/g and 1.34 mg GAE/g, when compared to steam peeled sample which were 1.96 mg GAE/g and 1.05 mg GAE/g respectively. Total alkaloids were1.37 mg/g and 0.87 mg/g for abrasive and steam peels respectively expressed in mg/g and it was found high in abrasive peeled sample. In case of flavonoids, abrasive peeled sample showed high flavonoids content (0.92 mg QE/g) compared to steam peeled (0.77mg QE/g).

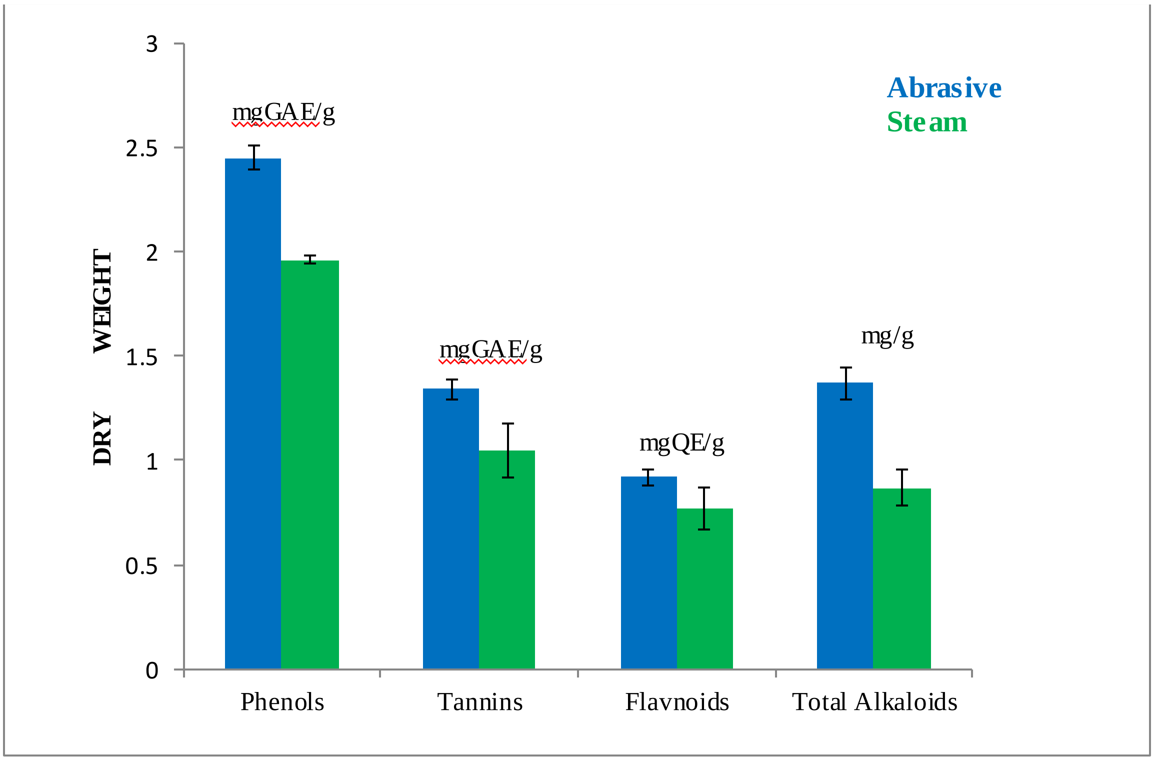

Fig. 4: Estimation of Total phenols, Tannins, Flavonoids and Alkaloids of potato peel

From the phytochemical analysis, it was inferred that steam peeled samples contains the low phytochemical due to steaming at high temperature which denatures the heat sensitive bioactive compounds as well as losses due to leaching affect.

CONCLUSION

The results showed significant changes in starch and fiber content following different peeling method. Steam peeling resulted in reduced starch content compared to abrasive peeling and this may be due to gelatinization process. From the physicochemical analysis, it was concluded that abrasive peeling suitable peeling method in industries which reduces the time consumption as well reduces loss of bioactive compounds. Different baked product can be developed from the potato peel flour which contain high fiber, starch and phytochemical.

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