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Hemanth M
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Deshpande HW
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Katke SD
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Machewad GM
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Gangakhedkar PS
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Corresponding Author:
Hemanth M
Department of Food Microbiology and Safety College of Food Technology, VNMKV, Parbhani, Maharashtra, India

Studies on process standardization of milkshake by using acid modified Psyllium husk

Hemanth M, Deshpande HW, Katke SD, Machewad GM and Gangakhedkar PS

Abstract
In the present study efforts were made for preparing milkshake using acid modified psyllium husk. The prepared milkshake was analyzed for physiochemical, proximate, sensorial and microbial parameters. Milkshake was prepared with 630 ml of milk, 270 gm apple pulp and 100 gm sugar. Acid modification of psyllium husk was done using HCL in ethanol as solvent. Acid modified psyllium husk of 0.75% HCL of ratio 1:6 in ethanol solvent had better functional properties, hence it was used in milkshake samples at different percentages of 0.4, 0.6 and 0.8. Ageing of mix was done at 6-10°C for 2-3 hours followed by deep Freezing of Mix -2 to -6 °C and after the addition of modified psyllium husk, milkshake was stored at -18˚C for 24 hours. Organoleptic evaluation of the milkshake with acid modified psyllium husk was performed and the results showed that 0.6% psyllium husk of 0.75% HCL in 1:6 ethanol solvent had maximum score among all the samples as per the hedonic scale.

Keywords: Standardization, milkshake, modified, Psyllium, husk

Introduction
Psyllium husk is the seed's outermost skin, which is removed mechanically. From the seed, about 25 to 26 percent of the husk is recovered. In normal and traditional storage circumstances, the shelf life of psyllium husk is only 6 months. On a dry weight basis, the husk makes up about 10% to 25% of the seed. *P.ovata* is a 119- to 130-day crop that thrives in chilly, dry conditions. In India, P. ovata is mostly grown as a "Rabi," or post– rainy season crop, in North Gujarat (October to March). Average temperatures are in the range of 15–30 °C (59–86 °F) during this season, which follows the monsoons, and moisture is scarce (Anjali *et al.*, 2013) [3].

The amazing feature of mucilage from seed husk as a thickening, the seed husk finds a variety of applications in the food industry; it might be utilized as such in food businesses. It's used as a base stabilizer in ice creams, as well as a component in chocolates and other foods. Psyllium can be used as a fiber substitute, thickener, and binder in the food and beverage industry, such as in health drinks, beverages, ice cream, bread, biscuits, and other bakery products, rice, cakes, jams, instant noodles, and breakfast cereals, to achieve better fiber content of food products and to increase the bulkiness of the food products with various health benefits.

Psyllium Husk can also be added to fresh fruit drinks or flavored drinks to increase the mouth feel, richness, and consistency of the beverage. Psyllium is used in the food and beverage industries to improve softness and body texture, as well as to give strength as a binder and stabilizer (Chan *et al.*, 1988). Psyllium is a laxative that forms a bulk. It works by enlarging the feces and relieving constipation. It begins by attaching to partially digested food as it passes from the stomach and into the small intestine. It then aids in the absorption of water, resulting in larger and moist stools. The ultimate result is larger, easier-to-pass stools that aid in the relief of constipation. It can thicken stools and make them take longer to move through the colon. Psyllium can assist to regular bowel motions by preventing constipation and reducing diarrhea (Washington *et al.*, 1998) [12].

Prebiotics are non-digestible substances that nourish and aid the growth of intestinal flora. Intestinal bacteria can ferment a tiny amount of psyllium fibers, despite the fact that psyllium is fairly resistant to fermentation. Short-chain fatty acids (SCFA), such as butyrate, can be produced via this fermentation. Psyllium does not induce gas or stomach pain because it ferments more slowly than other fibers (Jonna *et al.*, 2019) [6]. Fiber of any kind is beneficial to the heart.

Dietary fiber lowers the risk of heart disease, stroke, type 2 diabetes, and obesity by improving cholesterol levels. Psyllium and other water-soluble fibers may help lower blood lipids, blood pressure, and the risk of heart disease.

The various sorts of links between milk products and the dairy processing industry characterize the dairy sector. The dairy processing business is dominated by a few large cooperatives/companies that cater mostly to urban consumers, with unorganized small processors still capturing a large share of the market. According to India’s dairy report 46% of milk was sold in India in 2007. The structured sector processes about 13% of total milk produced in the country, whereas the unorganized sector processes 22% of total milk.

Currently, the dairy business is involved in product development both actively and articulately. This includes new formulations and imitated products that are designed to compete with or replace existing products based on their superiority in terms of convenience, cost and quality, indicating product development progress. Fruit milk shakes and Kulfi are two milk products with added value.

Milk shake is a western product made by combining milk, skim milk powder, stabilizer, and sugar in a mixer and speed mixing it to make it pourable and foamy. It is lower in sugar and fat than ice cream. Milk shakes are regularly served in the subcontinent regions of India and are made up of sweetened cold milk with added flavoring and coloring additives by shaking vigorously while freezing. Rose, coffee, and chocolate are the most popular flavor combinations (Kadav 2001) [7]. In India, mango fruit milk shakes are the most popular. Apple, banana, orange, sapota, and other fruits can be substituted for mango. A drink made from a mixture of different fruit pulps such as mango, sapota, orange, apple, and other fruits will be delicious and popular. Fruit milk shakes are in high demand, especially in the months of summer. When fresh fruits aren't readily available, milk fruit blend will be prepared by the pulp that is preserved (Taware 2000) [11].

Materials and Methods

Proximate Composition

Proximate composition such as moisture, fat, crude protein, ash and crude fibre were determined as per AACC 2000 and carbohydrate by difference method.

Viscosity

The viscosity of the almond milkshake samples was determined using a Brookfield viscometer (spindle-type). The viscometer was fixed with UL adaptor and spindle no. 63 Before viscosity measurement of the samples, the viscometer was subjected for auto zeroing in air. After this, the type of spindle and speed of rotation (rpm) were mentioned in the viscometer as per instructions.63 spindle was selected for viscosity measurement of almond milkshake samples at 30 rpm. Viscosity measurement of almond milkshake samples was carried out at 20°C.

Acid Modification

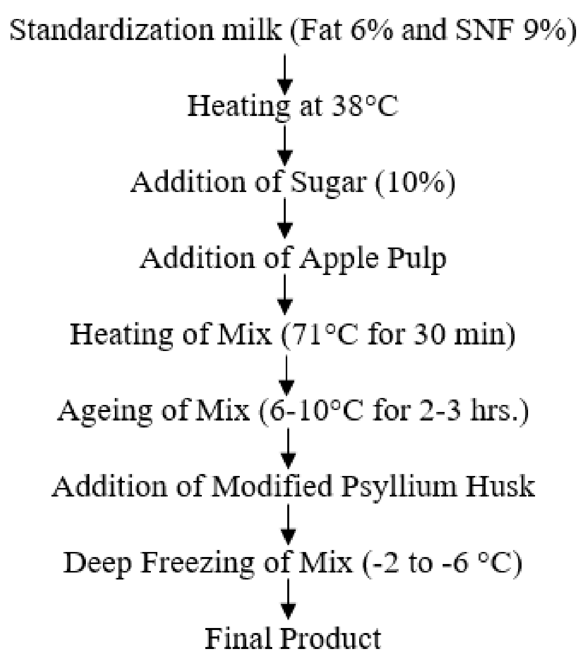
The acid modification of psyllium husk was carried out according to the process developed by Xiaoyin Pei (2008) [13], with minor changes in the concentration of HCl in ethanol solvent based on the findings of a research study conducted by Syed *et al.*, (2018) on the standardization of acid concentration and solvent ratio for psyllium husk modification. Acid modified psyllium husk of 0.75% HCL in ethanol as solvent of psyllium husk- solvent ratio had better functional properties 1:6 (w/v) and used. The solvent ratio was changed to improve the functional properties of psyllium husk, which is required for further research into the value addition of processed foods. The solvent used to treat psyllium husks was vacuum filtered, rinsed twice with 95 percent ethanol and 100 percent ethanol, then dried and stored. For the control during the process of vacuum filtration 95% and 100% ethanol was used once and followed the same steps as in the table 3.

Preparation of Milkshake with modified psyllium husk

Milk with fat 6 percent and SNF 9% percent was taken. And pan heating was done up to 38°c by addition of sugar 10 percent and was allowed to dissolve. The apple fruits that were sorted and washed were made crushed into pulp. The crushed fruit pulp was added and further heating of mix done at 71°C for 30 min. And the whole mix of ingredients were stirred at the time of boiling. Ageing of mix was done at 6-10°C for 2-3 hours followed by deep Freezing of Mix -2 to -6 °C. And the above steps lead to the final product. Psyllium husk of 0.75% HCL treated with 1:6 PSH: solvent ratio was used. The final product of milkshake was divided into three samples and 0.4%, 0.6% and 0.8% acid modified psyllium husk was added respectively to the milkshake samples aseptically. Then the milkshake was refrigerated to 18 °C for 24 hours. The standard recipe for the preparation of milkshake is mentioned below.

Ingredients	Standardization
Milk (ml)	630
Apple pulp(gm)	270
Sugar(gm)	100

Flow chart for the preparation of Milkshake



Results and Discussion

Table 1: Effect of acid modification on proximate composition of psyllium husk

Chemical parameters	Native psyllium husk	Modified psyllium husk
Moisture (%)	6.91	7.11
Ash (%)	2.64	2.24
Total fat (%)	1.81	0.65
Total protein (%)	2.31	1.11
Total carbohydrate (%)	86.82	89.01
Crude fiber (%)	3.2	2.75
Dietary fiber (%)	76.59	78.65
Energy value (Kcal/100g)	375	369

The proximate composition of milkshake was depicted in table 1 and it revealed that moisture content in psyllium husk was 6.91 percent and was increased to 7.11 percent in modified psyllium husk. Carbohydrate and dietary fiber content were found to be increased from 86.82 to 89.01 percent and 76.59 to 78.65 respectively. Crude fiber and Ash content decreased from 3.2 to 2.75 percent and 2.64 to 2.24 percent respectively. Total fat content decreased from 1.81 to 0.65 percent.

Total protein in native PSH was found to be 2.31 percent and decreased to 1.11 percent in modified PSH. Present results are also in corroborated with the finding of Guo *et al.*, (2008), they were found to be similar. There was decrease in fat, protein, ash and crude fiber content due to gel hardness of psyllium formed by partial degradation after acid modification. The carbohydrate content was increased due to acid hydrolysis of psyllium husk caused by HCL and the results are similar with results shown by Syed *et al.*, (2018).

Table 2: Mineral composition of native psyllium husk

Parameters	Results (mg/100 g)
Iron (Fe)	7.88±0.04
Copper (Cu)	0.713±0.002
Manganese (Mn)	0.650±0.003
Zinc (Zn)	0.356±0.001

The results from the table 2 indicate that the iron content was the highest with 7.88±0.04 mg followed by copper, Manganese and zinc with the values of 0.713±0.002 mg, 0.650±0.003 mg, and 0.356±0.001 mg respectively.

Table 3: Acid treatment levels for psyllium husk

Concentration of HCL in ethanol solvent	Psyllium husk: Solvent ratio
0.75%	1:6 (w/v)
0.00% for control	1:6 (w/v)

Table 4: Effect of acid modification on functional properties of psyllium husk

Concentration of HCl in Ethanol	Psyllium Husk: Solvent Ratio	Hydration capacity (ml/g)	Oil absorption capacity (ml/g)	Water up- taking rate (mg/(g×min)
Control	1:6	2.6	0.9	1.80
0.75%	1:6	0.8	0.3	1.54
Native Psyllium Husk	---	3.1	1.0	2.20

The results from the table 4 show that hydration capacity was highest for native psyllium husk with 3.1 ml/g followed by control sample with 2.6 ml/g. After modification hydration capacity was decreased to 0.8 ml/g. The water holding capacity of the husk is decreased due to the charge imbalance caused by the PH of hydrochloric acid (Robyn 2017) [10]. The oil absorption capacity was Parameters Results (mg/100 g) Iron (Fe) 7.88±0.04 Copper (Cu) 0.713±0.002 Manganese (Mn) 0.650±0.003 Zinc (Zn) 0.356±0.001 Concentration of HCL in ethanol solvent Psyllium husk: Solvent ratio 0.75% 1:6 (w/v) 0% for control 1:6 (w/v)found to be 1.0 ml/g for native psyllium husk and there showed a slight reduction for the control sample with 0.9 ml/g. Modified psyllium husk had showed better oil absorption capacity among all with 0.3 ml/g due to the major chemical component affecting OAC is protein, which is composed of both hydrophilic and hydrophobic parts. Lower OAC might be due to the non-partial denaturation of proteins with exposition of high hydrophobic proteins which show lesser binding to hydrocarbon chains of lipids (Oladele and Aina 2007) [9].

Water up-taking rate from the table show that native psyllium husk and control sample had higher water up-taking rate with 2.20 (mg/(g×min) and 1.54 (mg/(g×min) respectively. After modification with 0.75% HCL in ethanol solvent had decreased rate with 1.54 (mg/(g×min) and the results for the water up-taking rate are in good agreement with the results found by the Xiaoyin Pei and Liangli Yu (2008) [13] and Zhihong *et al.*, (2009) [14] for water up-taking rate for acid treated PSH.

Table 5: Organoleptic evaluation of prepared milkshake

Sample	Appearance	Color	Taste	Flavour	Texture	Overall acceptability
M0	8.1	6.9	6.5	6.1	7.5	7.1
M1	7.2	7.3	8.5	6.5	7.6	7.8
M2	7.4	7.4	8.3	6.9	8.2	8.1
M3	7.2	7.5	8.3	6.8	8.1	8.0
SE ±	0.036	0.029	0.065	0.047	0.089	0.081
CD@5%	0.065	0.049	0.092	0.145	0.197	0.247

M0: Control with native psyllium husk psyllium husk
M1: Milkshake with 0.4% modified psyllium husk of 0.75% HCL in ethanol
M2: Milkshake with 0.6% modified psyllium husk of 0.75% HCL in ethanol
M3: Milkshake with 0.8% modified psyllium husk of 0.75% HCL in ethanol

The results from the table show sample M2 had the best hedonic score of Appearance, Color, taste, flavor and texture with 7.4, 7.4, 8.3, 6.9 and 8.2 respectively when compared with the milkshake with native psyllium husk.

Table 6: Proximate Composition of milkshake

Chemical parameters	Mean value
Moisture (%)	81.91
Ash (%)	0.92
Total fat (%)	3.89
Total protein (%)	2.73
Total carbohydrate (%)	8.21
Crude fiber (%)	2.25
Energy value (Kcal/100g)	79

The proximate composition of milkshake was depicted in table 6 and it revealed that moisture content in psyllium husk was 81.91 percent and total carbohydrate content found to be 8.21 percent. It is clear from the table that Ash, Total fat, Total protein and Crude fiber content were found to be 0.92 percent, 3.89 percent, 2.73 percent, 2.25 percent respectively. Calculated energy value was found 79 Kcal/100ml. The following results are good confirmatory with (Dantas *et al.*, 2017) [3].

Table 7: Mineral composition of milkshake

Parameters	Results (mg/100 g)
Iron (Fe)	0.453
Copper (Cu)	0.279
Manganese (Mn)	0.153
Zinc (Zn)	0.595

The results from the table 7 show that the zinc content was the highest with 0.595 mg followed by iron, copper and manganese with the values of 0.453 mg, 0.279 mg, and 0.153 mg respectively.

Table 8: Textural properties of milkshake

Sample	Viscosity (Pa-s)
Control	0.72
A	0.53
B	0.56
C	0.62

From the above table 8 results showed that viscosity of control sample with native psyllium husk had more viscosity 0.72 Pa-s when compared to milkshakes with modified psyllium husk. Viscosity of the samples A, B and C were 0.53, 0.56 and 0.62 Pa-S respectively. There was a decrease in viscosity due to reduced swelling of the psyllium particles caused by the acid for the modified psyllium husk. The results for the viscosity of milkshake were supported by the findings of (Deepak *et al.*, 2021 and Madhuvanti *et al.*, 2016) [4, 8] in literature.

Table 9: Microbial quality of milkshake

Time in weeks	Total Plate Count (cfu/g)x10^4	Yeast and Mold (cfu/g)x10^4	Coliform count (cfu/g) x10^3
1	1.6	ND	ND
2	3.5	2.1	ND
3	4.2	2.9	ND

The results from the table 9 show that TPC growth was found to be 1.6 x105, 3.5 x105 and 4.2 x105 (cfu/g) for the first, second and third weeks respectively. There was no yeast and mold growth in the first week but in the second and third week growth of 2.1 x 105 and 2.9 x105 (cfu/g) can be seen. Coliform count was not found in the first two weeks under good hygienic and refrigeration of milkshake. And the above results for TPC, yeast and mold were similar to the results reported by (Divya *et al.*, 2014) [5].

Conclusion

Modified psyllium husk had better functional properties than the native psyllium without affecting the nutritional and sensory parameters, hence it was used in the preparation of sample. Milkshake prepared with 0.6% modified psyllium husk of 0.75% HCL of ratio 1:6 ethanol solvent was the best among all the other samples with the hedonic score of overall acceptability 8.1. Further the microbial quality results show that that it was stored under hygienic conditions and found to be safe for consumption.

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