
Inventive Utilization Of Soybean Whey As Beverage

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ABSTRACT:

The processing of soybean for producing milk, soy-paneer (tofu) and other products was studied. The practical on processing of soybean was done at the processing unit M/s B K Soya Products Sangrur, Punjab. Large quantity of whey is produced during preparation of soy-paneer and it goes waste. The properties of whey were evaluated for its utilization for whey-based beverage. Titrable acidity, protein and total reducing sugar were observed to be 0.192, 0.3 and 0.4 % respectively. pH of the freshly prepared soybean whey was observed to be 5.11. Average specific gravity and viscosity were observed to be 1.01 and 20.5 cP. Colour of the whey was yellowish red. The L, a* and b* values of the whey were in the range of 32.02 - 40.35, 3.03 - 4.56 and 19.58 - 22.27 respectively. The turbidity of why was 82.37 Nephelometric Turbidity Units. Ready to serve beverage was prepared by adding sugar, synthetic colour and flavour, eight combinations were tried. The sensory quality of beverage was carried out on 9 point Hedonic scale. The panelists tasted the samples and gave the scores. The combination with 443.75g whey, 112.5g sugar and 443.75g water was observed to be the best.*

Key-words: *Soybean, Soya processing, Soy milk, Whey, Characterization, Beverage.*

INTRODUCTION

Soybean is being used as food for over 5,000 years in China, Japan and Thailand. It has now become a major source of protein, oil and health promoting phytochemicals for human nutrition around the globe. It is the leading source of edible oils constituting about 30% of the world supply. Soy products are nutritious, economical and healthful. Use of 30-50 g of processed soybean in daily diet protects human health and enhances the longevity (Kale, 1985).

Soybean production has been steadily increasing world over and reached to 251.5 Million MT in 2011. The India's production of soybean was 9.9 Million Tonnes during 2008-09 with

total area under soybean cultivation of 9.51 Million hector and productivity 1041 kg/ha (Agricultural Statistics at a Glance, 2010). The major soybean producing states in India during 2008-09 with percent share in production were Madhya Pradesh (59.06%), Maharashtra (27.83%) and Rajasthan (8.13%).

Soybean on an average contains about 40% protein, 23% carbohydrates, 20% oil and reasonable amounts of minerals, vitamins and dietary fiber. Supplementation (5-25%) of soybean in various traditional foods/recipes is recommended. Soybean can be utilized in the form of whole bean or after partially or fully defatting. Soyfoods made out of whole bean are wholesome, nutritious and extend all the nutritional and health benefits to consumer (<http://www.usda.gov>).

Though, soybean is a widely cultivated crop, most of it is used as the raw material for oil milling, and the residue (soy meal) is mainly used as feedstuff for domestic animals (Liu, 1997). Dry soybean contain 36% protein, 19% oil, 35% carbohydrate (17% of which dietary fiber), 5% minerals and several other components including vitamins (Liu, 1997). Soybean based foods in the diet. Soybean represents an excellent source of high quality protein with a low content in saturated fat, with no cholesterol, and a great amount of dietary fiber. Therefore, the possible use of soybean in functional food design is very promising, since the consumption of soybean protein and dietary fibre seems to reduce the risk of cardiovascular diseases and to improve glycemic control.

Unlike other legumes, soybeans contain a variety of nutritional components that provides health promoting benefits (Schryver, 2002). Typically, whole soybeans or bean cotyledons separated from the germ are utilized for commercial soy and soy-products. Soybean composition includes varying amounts of protein content (38-40%), and fat (18%) of which 85% is unsaturated and high in linoleic and linolenic acids (a precursor to omega-3 fatty acids), 23% oleic acid and 16% palmitic acid. Most fatty acids in soybean and its derivatives are unsaturated, and, therefore, susceptible to oxidation (Penalvo *et al.*, 2004). In addition, the bean contains 30% carbohydrates, of which 15% is insoluble and the other 15% soluble carbohydrates. Other components include varying concentration of isoflavone, high levels of minerals, including iron, calcium, zinc; vitamins including α -tocopherol, niacin, pyridoxine, and folacin (United Soybean Board, 2001).

Amongst the many soy products, soymilk is one of the popular traditional products in China and other Asian countries (Shun-Tang *et al.*, 1997) consumed as a nutritious and

economical protein food. Consumers in western countries consume soymilk mainly as an important replacer of cow milk due to lactose intolerance or allergic reaction to cow's milk, and as a low cost source of good quality protein and energy (Rosenthal *et al.*, 2003; Lui, 1997). In the United States, adoption of soymilk as a cow milk substitute has now received widespread attention because soybeans and soybean products have gone mainstream.

Soymilk is the aqueous extract of whole soybeans (dehulled or non-dehulled) (King and Bignell, 2000), closely resembling dairy milk in physical appearance and composition (Penalvo *et al.*, 2004). The traditional soymilk is a simple water extract of soybeans made from soaking the beans in water overnight, wet grind the beans, steam the wet mash to improve flavor and nutritional value, and filter (Howell and Caldwell, 1978). More recently, modified modern flavored versions have hit the mainstream market as meal replacement beverages and cow milk replacer. Apart from its beverage form, soymilk is used as a base in a wide variety of products, including tofu, soy yogurts and soy-based cheeses (Golbitz, 1995). Proximate composition of whole soymilk contains 2.86-3.12% protein, 90-93.81% moisture, 1.53-2% fat, 0.27-0.48% ash, 1.53-3.90 % carbohydrate (Rosenthal *et al.*, 2003; Yadav *et al.*, 2003). Typically, soymilk contains higher moisture than bovine milk, and their proximate constituents differs significantly between the two (Yadav *et al.*, 2003).

Intensive work has been carried out on production of soy milk world over. Since past decade, scientific investigation is being carried out to produce different dairy analogues from soy milk such as ice-cream, paneer, cheese, etc. Amongst these soy milk based dairy analogues, paneer is fetching more attraction. In preparation of paneer, the whey obtained usually is of no importance and was not further utilized. However, the studies revealed that the whey contained some essential compounds and valuable proteins. Consequently, the whey obtained during preparation of such products as paneer and cheese can be utilized for food purposes through its value addition. Thus, the present research work was undertaken with the objective to utilize the whey obtained from soy milk for preparation of high value beverage and to evaluate its physic-chemical and sensorial characteristics.

MATERIALS AND METHODS

Materials

Soyabean (SL-295 variety) was procured from local market of Ludhiana. Chemicals and Equipments were made available from Central Institute of Post Harvest Engineering and

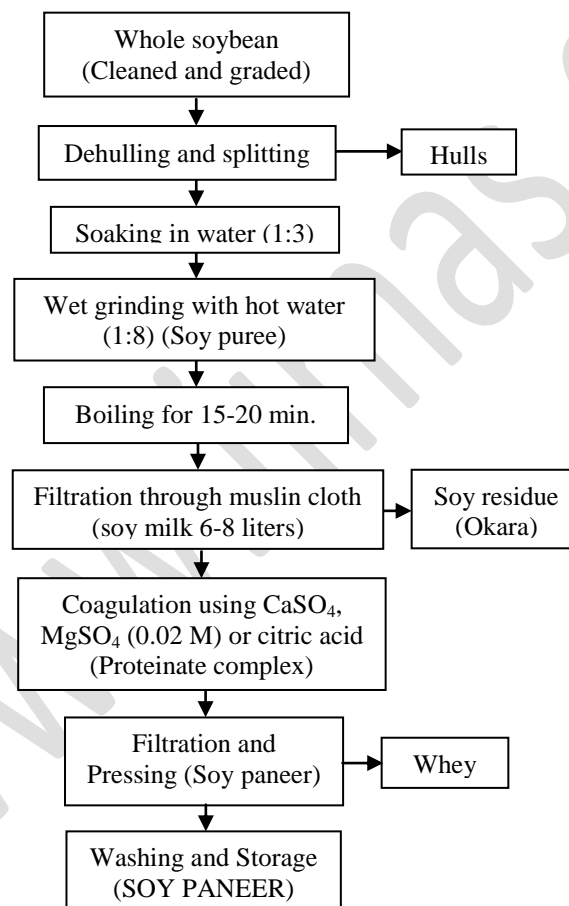
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Methods

Preparation of soy milk, Paneer and whey

Different compositions and properties of soymilk whey was determined using standard methods such as total soluble solids (Srivastava and Kumar, 2003); Titrable acidity (Ranganna, 1986), protein content (Ranganna, 1986); total reducing sugar (Ranganna, 1986); pH (AOAC, 2005); β -carotene (Srivastava and Kumar, 2003); specific gravity (Ranganna, 1986); Viscosity (Sriburi and Hill, 2000) and turbidity (Mori *et al.*, 2001)

The soy milk and paneer was prepared from the soy beans as given in the following flow sheet.



Characterization of soy milk whey

The soy milk based whey was assessed for different physico-chemical properties by using standard procedure.

Preparation of beverage

The beverage was formulated by mixing different levels of whey, sugar and water. The required quantity of sugar was dissolved in sterile distilled water and was then mixed with appropriate amount of whey. The prepared beverage was packed in glass bottles and kept in refrigeration temperature. The various combinations of whey, sugar and water levels are given Table 2.

Organoleptic Evaluation

The soy milk based whey beverage prepared was chill served to semi-trained panel members and was asked to evaluate on 9-point hedonic scale for various organoleptic properties (color, flavor, taste and odour).

RESULTS AND DISCUSSION

Whole investigations are completed in three part of likewise Preparation of soybean milk and soy-paneer (Kulkarni, S D, 2005), Characteristics of soybean milk whey and Preparation of Beverages.

(i) Preparation of soybean milk and soy-paneer

Soybean milk and soy-paneer are making with good quality and highly proteins from raw soyabean.

(ii) Characterization of soybean milk whey

The characteristics of liquid soybean milk whey were measured using standard methods and are given in Table 1.

Table 1: Characteristics of soybean milk whey

S. No.	Properties of Whey	Results
1	Total Soluble Solid (TSS)	1.766%
2	Titration Acidity	0.192%
3	Protein	3%
4	Total Reducing Sugar	4%
5	pH	5.11%
6	Beta Carotene	13.53 ppm; 18.64 ppm
7	Specific gravity	1.01
8	Viscosity at 100 rpm, 30°C	24 Cp
9	Colour	
	L*	32.02-40.35
	a*	3.03-4.56
	b*	19.58-22.27
	Lovibond	
	R	2.2-3.1

	Y	3.9-5.9
	B	0.0
	N	0.0
10	Turbidity	82.35 NTU

(iii) Preparation of Beverages

The liquid whey was used to prepare beverages. Sugar, artificial colour and flavour were used to prepare beverage from whey. The eight combinations of beverages are given in Table 2 .

Table 2: Different combinations of whey, sugar and water

Combinations	Whey (g)	Sugar (g)	Water(g)
1	300	150	550
2	625	75	300
3	300	75	625
4	550	150	300
5	300	112.5	587.5
6	462.5	75	462.5
7	587.5	112.5	300
8	443.75	112.5	443.75

The beverage samples were prepared and evaluated for sensory qualities according to 9-point hedonic scale. The average score obtained by the beverages are listed in Table 3-

Table 3: Sensory Evaluation Results

Sample No.	Attributes				
	Color	Flavour	Taste	Odour	Overall Acceptability
1	7.14	7	7.28	7.21	7.28
2	7	7.57	7	7.14	7.07
3	7.28	7	6.14	6.57	6.78
4	7	7.42	7.28	7.42	7.28
5	7.28	7.07	6.57	6.85	6.85
6	7	7.57	6.14	6.85	6.85
7	7.28	7.14	6.85	7	6.92
8	7.42	7.7	7.4	7.57	7.5

CONCLUSIONS

Physical properties of soybean whey is color, turbidity, viscosity, total soluble solid and specific gravity was observed to be (L*18.79, a*3.221,b*13.52 and Lovibond RYBN is 3.3,

5.5, 0 and 0), 82.37 NTU, 20.5 cP, 1.79% and 1.01 respectively. Titrable acidity, protein and total reducing sugar were observed to be 0.192 %, 3 gram per liter and 4 gram per liter respectively. pH of the freshly prepared soybean whey is observed to be 5.11. Ready to serve beverages is prepared by adding sugar, synthetic colour and flavour. The sensory evaluation of the beverage was calculated using 9 point Hedonic rating scales. The combination whey 443.75g, 112.5g sugar and 443.75g water in out of 1000g is the best.

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