

Chemical And Colour Characteristics Of Peanut Chikki Incorporated With Soy Protein Concentrate

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Abstract:

Soy Protein Concentrate powder was acquire from soy meal from which the oil was detach and it is dominant source of protein with the potential to use in food application. The intention of this experimentation was to analyse chemical composition, SEM of soy protein concentrate powder and to utilize it in Peanut Chikki to know the effect of addition of peanut protein concentrate by chemical composition, colour and techno economic feasibility. Chemical composition of soy protein concentrate (SPC) and Peanut Chikki analysed by the A.O.A.C. where Surface characteristics was examined using Scanning Electron Microscopy (SEM), for Chikki Colour analyse by the Hunter colour lab. In soy protein concentrate highest value found for the protein i.e. 79.52%, for carbohydrates 9.32% followed by moisture 6.27% ash 3.96 % and fat 0.93%. The concentration of soy protein concentrate was 5% for ST₁ sample and gradually increased by 5% for every treatment till ST₄ that contains 20% of Soy protein concentrate. The sensory analysis performed for Peanut Chikki showed treatment ST₂ with 10% incorporation of Soy protein concentrate (SPC) was the best treatment. In case of chemical composition of Peanut Chikki Protein content, moisture and ash was found increased from sample ST₁ to sample ST₄, whereas carbohydrates decreased from sample ST₁ to ST₄ and slight variations in fat content was found. In case of colour 'a' and 'b' values are found in increasing order where 'L' value found in decreasing order.

Keywords: Colour measurement, Defatted soy meal (DSM), Food application, Scanning Electron Microscopy (SEM), Soy Protein Concentrate (SPC)

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INTRODUCTION

Soybean contains 36 - 40% protein, 18-20% oil, 13-17% carbohydrates like sucrose, 13-17% insoluble carbohydrates Dietary fibres, 8 to 10% moisture, ash and others. Soybeans are abundant provider of minerals like iron, zinc, calcium, phosphate, magnesium and vitamin B. Soybean has high nutritive value and great source of protein. It can provide massive protein to humans in the view of the fact that it accommodate surpassing forty percentage protein of excellent grade also hold each and every essential amino acid distinctly Lysine, tryptophan, glycine alike protein of animal origin. Soy oil is rich in polyunsaturated fatty acids (PUFA) and do not contain cholesterol¹.

Soy is a major vendor of superior protein and fat and soybean seed grade is evaluated by wholesomeness and dietary inhibitors. Reason of this study was to explore the physical characteristics and nutritional composition of various soybean genotypes². Separated proteins were principal cause of affordable proteins for the most part need for players, body-builders, sport-persons and vegetarians, and has retained high use in various food

sectors. It was made by utilizing defatted meal and the process of maintaining pH followed by centrifugation to obtain isolate that can dried to get abundant source of protein Concentrate from soy have enrich nutritional value and healthy profile of amino acid also many research works have been conducted to made the efforts for utilizing it in different sectors of food⁴.

Chikki a favourite Desi desserts formed from peanut and many sources that may influence the protein content and vitamin content to comply requirement for health foods⁵. India with various eating habits is having a number of regional dishes, inclusive of sweet products. Primarily formed utilizing jaggery as sweetener and roasted peanuts (*Arachis hypogaea*). Confections with jaggery are attaining popularity due to the consciousness of its health aid⁶.

In the present study the obtained Soy protein concentrate exposed for the chemical composition and scanning electron microscopy for study of microstructure and suitability for application in food products then Chikki was incorporated in its formulation with soy protein concentrate and exposed for the sensory analysis followed by the

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physicochemical parameters including chemical composition, colour were studied.

MATERIALS AND METHODS

The study entitled “Effect of utilization of Soy Protein Concentrate (SPC) in Peanut Chikki.” was conducted in Department of Institute of Biosciences and Technology (IBT), MGM College of Food Technology, Chhatrapati Sambhajanagar. Stuffs used and procedures adopted for the existing study are showcased under suitable headings and subheadings. Materials required for conducting this research procured from local market of Chhatrapati Sambhajanagar. Utensils, chemicals and machineries was utilized from department of food technology, MGM institute of Biosciences and technology, MGM University.

Determination of chemical composition of derived soy protein concentrate.

Chemical investigation of the SPC viz. moisture, ash, fat, protein, carbohydrate had performed according to the methods given in AOAC 2005⁷.

Analysis of Soy protein concentrate for scanning electron microscopy

Soy protein concentrate was analyzed employing scanning electron microscopy (Nano nova SEM 450, United State). Soy protein concentrate were spreader on double sided tape mounted on field emission electron microscopy stub and at various magnifications the micrograph was taken at an accelerating voltage of 15 KV to see the microstructural changes of the samples.

Formulation of Peanut Chikki with incorporation of Soy protein concentrate

Extensive trial was made to standardize the formulation of Peanut Chikki with incorporation of soy protein concentrate at various levels. Initially SPC (Soy protein concentrate) was added at the level of 2, 4, 6 and 8 percent that did not show much variation in sensory characteristics of formulated Chikki. Further standardized formulation used for preparation of Chikki adding Soy protein concentrate in various proportions viz. 5, 10, 15 and 20 % levels replacing peanuts was finalized and presented in table No. 01

Table No. 01: Formulation of Chikki prepared with incorporation of obtained Soy protein concentrate.

Ingredient	ST ₀	ST ₁	ST ₂	ST ₃	ST ₄
Peanut	100	95	90	85	80
SPC	-	5	10	15	20
Jaggery	58	58	58	58	58
Ghee	5	5	5	5	5

Details of treatment

T₀- Control sample with no SPC

T₁- Peanut Chikki sample with 5% SPC

T₂- Peanut Chikki sample with 10% SPC

T₃- Peanut Chikki sample with 15% SPC

T₄- Peanut Chikki sample with 20% SPC

Method of formulation of Peanut Chikki by incorporating Soy protein concentrate.

Procedure used for formulation of Peanut Chikki incorporated with soy protein concentrate presented in flowsheet No. 01

Flowsheet No. 01: Flowsheet for formulation of Peanut Chikki with incorporation of soy protein concentrate.

Peanuts roasted till golden brown, removed the peel and coarsely crushed.



Jaggery heated with little water, filtered and boiled till hard crack stage



Crushed peanuts and Soy protein concentrates powder added to jiggery syrup and mixed thoroughly



Hot and homogenous mass was then transferred to pre-greased stainless steel tray



Mass was then spread and rolled with roller and cut into uniform pieces



Chikki was then cooled and packed

This method followed by as given in the citation⁸ with slight modifications.

Sensory analysis of the soy protein concentrate incorporated Peanut Chikki

The Chikki was formulated by incorporating soy protein concentrate at the 5,10,15,20 percent. Sensory analysis of Chikki was done on the basis of colour, texture, flavour, taste, appearance and overall acceptability. The consequence of soy protein concentrate in Peanut Chikki was analysed. A semi trained panel of 30 judges evaluated the sample with the help of nine point headonic scale. Panellist rated each product using 9 point headonic scale, where 9 indicates “liked extremely” and 1 corresponded to “dislike extremely”.

Chemical composition of soy protein concentrate incorporated Chikki

Chemical analysis of the SPC incorporated Chikki viz. moisture, ash, fat, protein, carbohydrate and energy, sodium, potassium had performed according to the methods given in AOAC 2005⁷.

Analysis of the soy protein concentrate incorporated Peanut Chikki for colour by hunter colour lab.

The colour measurement of peanut chikki incorporated with soy protein concentrate was accomplished using colour Flex EZ (XE-Lab scan, Hunter Lab USA).

Sample placed on the glass and covered with black plate, beneath glass there was light source and the values were recorded in terms of 'L', 'a' and 'b'.

Statistical analysis

All the data was analysed using appropriate statistical method to evaluate the significance of the finding.

ANOVA variance was used to compare the differences between the experimental groups. Post-hoc tests (Tukey's test) were conducted to determine group differences. The outcomes were given as SD i.e. standard deviation and significance was set $P < 0.05$.

RESULTS AND DISCUSSION

Chemical composition of the soy protein concentrate

Chemical analysis for Soy Protein Concentrate (SPC) obtained from the defatted meals performed and results predicted in the table no 02.

Table 02:- Chemical analysis of Soy protein concentrate

Sr. No	Parameters	Soy protein Concentrate (%)
1	Protein	79.52±0.8 ^a
2	Carbohydrate	9.32±0.5 ^b
3	Moisture	6.27±0.2 ^a
4	Fat	0.93±0.1 ^b
5	Ash	3.96±0.1 ^b

*Results represents mean ±SD, different exponent within the each column shows major disparities.

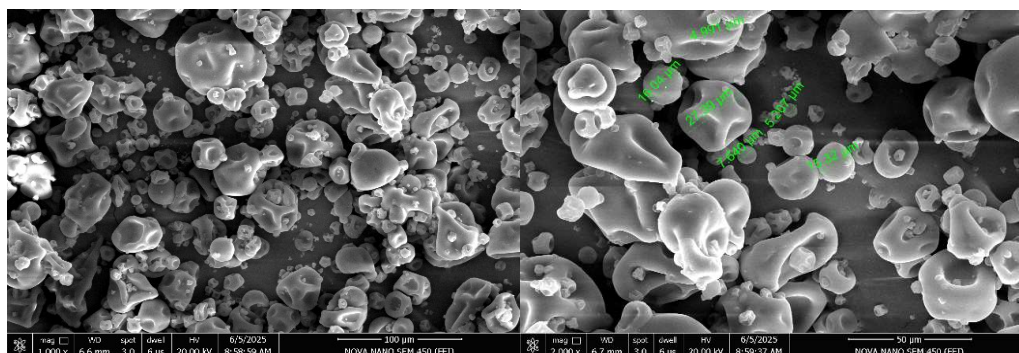
The chemical composition of soy protein concentrate (SPC), highest value found for the protein i.e. 79.52%, for carbohydrates 9.32% followed by moisture 6.27%, ash 3.96 % and fat 0.93%. These values were identical⁹ that states, protein 72.2, Moisture 6.8. These values were in similar range to citation¹⁰. As the Soy protein concentrate obtained from defatted soy meal, Moisture, ash and protein content had higher values (depends on the method utilized) in soy protein concentrate in comparison with the defatted soy meal¹¹.

Scanning electron microscopy of Soy protein concentrate.

Field emission scanning electron microscopy was performed on the Soy protein concentrate at various magnifications viz. 1000x, 2000x, 4000x and 8000x and the scanning micrographs obtained from this analysis was used for structural analysis and presented

here Fig 1 (a, b, c, d). It was revealed from the figures at lower magnifications 1000x and 2000x small particles adhering to larger ones that is called agglomeration and they form a cluster or bunch, this degree of agglomeration related to the protein solubility and dispersibility that often appears dense and irregular. This results shows that, the soy protein concentrate reflects good protein solubility and dispersibility indicates can be effectively utilized for food application. At higher magnifications i.e. 4000x and 8000x result reflects large globular aggregates with minor rough surface with deep cavities indicates presence of good enzyme active site which facilitate easy metabolism of proteins. Micrographs also shows the smooth surface that indicates good solubility and dispersion smooth pore walls related with better water holding capacity¹².

Scanning electron microscopy images shown in Fig 1 at magnifications 1000x, 2000x, 4000x and 8000x



a) 1000 X

b) 2000 X

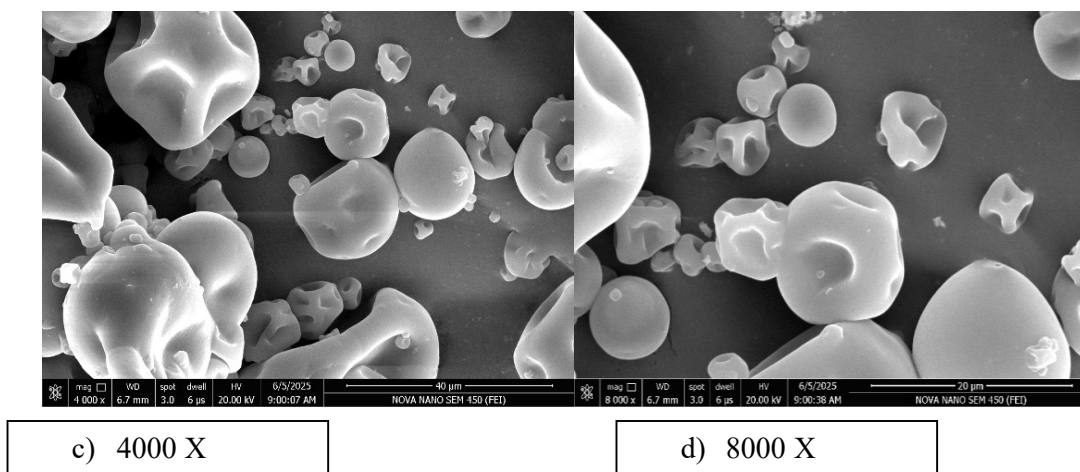


Fig 1: Scanning electron microscopy of SPC. Fig a, b, c, d indicating the magnifications

Sensory analysis of the Soy protein concentrate (SPC) incorporated Chikki

As the ST₁ contains 5% of SPC and it increases by 5% in each treatment till ST₄. Samples were analysed on hedonic scale by the semi trained panel of 30 members in the sensory analysis of SPC incorporated Chikki. Treatment ST₁ and ST₂ were liked by the panel members still ST₂ with (10% SPC) was more appreciated as compare to other treatments. As the protein percentage increased there was

difficulty in setting the Chikki treatments in Sample ST₃ and ST₄ and treatments becomes harder therefore had lower acceptance. All the values of Colour, flavour, taste, texture appearance and overall acceptability found significantly higher for treatment ST₂ and ST₁ where overall acceptance was very low for treatment ST₃ and ST₄. With increasing protein concentration treatment ST₃ and ST₄ becomes more prevalent for darkness and hardness resulting lower overall acceptability.

Table 3: Sensory evaluation of Peanut Chikki incorporated with SPC (soy protein concentrate)

Sr. No	Treat Ments	Color	Flavor	Taste	Texture	Appearance	Overall acceptability
1	Control	7.9 ^{ab}	7.8 ^{ab}	8.1 ^a	8.2 ^a	8.1 ^a	8.2 ^a
2	ST ₁	7.8 ^{ab}	8.0 ^a	8.1 ^a	8.1 ^a	7.9 ^{ab}	8.0 ^a
3	ST ₂	8.0 ^a	7.9 ^a	8.1 ^a	8.2 ^a	7.9 ^{ab}	8.2 ^a
4	ST ₃	7.6 ^b	7.5 ^b	7.3 ^b	7.6 ^b	7.7 ^b	7.0 ^b
5	ST ₄	6.1 ^c	5.9 ^c	5.5 ^c	6.0 ^c	5.8 ^c	5.2 ^c

* Different exponent within the each column shows major disparities.

Chemical composition of SPC incorporated Peanut Chikki

The chemical properties of SPC incorporated Chikki was determined and it was found that, the protein content of the sample increased from treatment ST₁ (10.05%) to ST₄ (13.52%). Ash content also found increased from ST₁ (1.46%) to ST₄ (2.35%) and moisture also found increased from ST₁ (1.95%) to ST₄ (2.84%). Carbohydrates found in decreased order from ST₁ (73.34%) to ST₄ (67.69%)⁵. The Moisture content that defines the stability of product and the fat content shows minute differences on increasing the soy protein concentrate as similar to the reported for groundnut Chikki¹³. The protein content and sodium was significantly increased and decrease in carbohydrate values due to addition of Soy protein concentrate.

Table 04: Chemical composition of SPC incorporated Chikki

Particulars	Moisture (%)	Ash (%)	Carbohydrates (%)	Protein (%)	Fat (%)	Energy (Kcal/100g)	Sodium (mg/100g)	Potassium (mg/100g)
Control	2.10 ± 0.07 ^b	1.32 ± 0.05 ^b	74.57 ± 0.4 ^d	9.45 ± 0.2 ^e	12.55 ± 0.3 ^a	480 ± 4.0 ^b	201 ± 6.0 ^c	812 ± 9.8 ^a
ST ₁	1.95 ± 0.07 ^d	1.46 ± 0.06 ^a	73.34 ± 0.4 ^c	10.05 ± 0.2 ^d	13.2 ± 0.4 ^b	473.5 ± 4.5 ^c	165 ± 7.0 ^d	771 ± 9.6 ^b
ST ₂	2.07 ± 0.07 ^a	1.89 ± 0.06 ^a	71.50 ± 0.5 ^a	11.04 ± 0.3 ^c	13.5 ± 0.4 ^d	441 ± 6.0 ^e	136 ± 6.0 ^e	817 ± 8.7 ^a
ST ₃	2.13 ±	2.10±0.07 ^c	70.36 ± 0.5 ^b	12.11 ±	13.6 ±	466 ± 6.0 ^d	212 ± 7.0 ^b	654 ± 8.1 ^d

	0.08 ^c			0.3 ^b	0.4 ^c			
ST ₄	2.84 ± 0.09 ^e	2.35 ± 0.09 ^d	67.69 ± 0.5 ^e	13.52 ± 0.4 ^a	13.9 ± 0.4 ^a	485 ± 7.0 ^a	327 ± 9.0 ^a	735 ± 9.5 ^c

*Results represents mean ±SD, different exponent within the each column shows major disparities.

Colour measurement of SPC incorporated Chikki by hunter colour lab

The colour of SPC enriched Chikki measured by hunter colour lab. Predicting values in ‘L’, ‘a’ and ‘b’ format, where ‘L’ value shows “Lightness”, ‘a’ value shows “Redness” and ‘b’ value shows “yellowness”. In case of SPC Chikki ‘L’ value decreased, ‘a’ and ‘b’ value found in increasing order.

The colour of Chikki was much affected with treatment ST₃ and ST₄ as the concentration of soy protein concentrate increased colour become darker. The lightness decreased as a result of incorporation of soy protein concentrate and the Chikki becomes darker in the subsequent treatments on other side redness and yellowness increased in the subsequent treatments¹⁴.

Table 05: Determination of colour of SPC incorporated Chikki.

Treatments	Colour values			
	L*	a*	b*	ΔE
ST ₁	48.02±1.1 ^a	10.89±0.4 ^a	17.57±0.6 ^a	--
ST ₂	41.17±1.2 ^b	11.61±0.5 ^{ab}	17.90±0.6 ^{ab}	6.89
ST ₃	39.13±1.1 ^b	12.14±0.5 ^{bc}	18.91±0.7 ^b	2.33
ST ₄	33.95±1.2 ^c	12.82±0.6 ^{cd}	25.31±1.0 ^c	8.26

*Results represents mean ±SD, different exponent within the each column shows major disparities.

CONCLUSION

The present investigation ‘study on utilization of soy protein concentrate in peanut Chikki.’ disclose findings for the chemical composition and SEM analysis of the soy protein concentrate. In the chemical composition high value found for the protein (79.52%) whereas scanning electron micrographs suggest good functional properties and the utilization of soy protein concentrate in Chikki, after utilization of soy protein concentrate in Peanut Chikki noticeable increase in the percentage of protein percent (from 10.05% to 13.52%) along with minerals observed in the subsequent treatments. In case of colour analysis darkness found to be increased with increasing concentration of soy protein concentrate.

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