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Shelf life study of table spread incorporated with soya protein isolate (ISP)

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Abstract
The present investigation was made with an attempt to develop a soya spread with incorporation of soya protein isolate and study the shelf life characterstics of the developed spread. Sunfiber was added as a source for dietary fiber and lecithin was incorporated which act as emulsifier in soya spread. Soya spread was prepared and shelf life evaluation for different treatments were conducted for pH, Titrable acidity, free fatty acid, TBA value, emulsion stability. And also microbial paramaters such was yeast and mould and Total Viable Count It was found that soya spread was shelf stable having a shelf life of 45 days under refrigerated temperature.

Keywords: shelf life, TBA value, titratble acidity, lecithin, Yeast and mold, Total Viable Count

Introduction
Soy protein isolates have been known and produced for industrial purposes, mainly as adhesives for paper coating industry, well before World War II. ISP's for food use, however, have been developed only in the early fifties.
The basic principles of ISP production are simple. Using defatted soy flour or flakes as the starting material, the protein is first solubilized in water. The solution is separated from the solid residue. Finally, the protein is precipitated from the solution, separated and dried. In the production of ISP for food use, in contrast to ISP for industrial use, care is taken to minimize chemical modification of the proteins during processing. Obviously, the sanitary requirements are also much more demanding.
Being almost pure protein, ISP can be made to be practically free of objectionable odour, flavour, colour, anti-nutritional factors and flatulence. Furthermore, the high protein concentration provides maximum formulation flexibility when ISP's are incorporated into food products. These and other advantages have been the source of highly optimistic forecasts regarding the widespread use of ISP. Although the volume of production increased and although several production facilities have been erected in the U.S.A., Europe, Japan, India and Brazil, the tonnage figures are far from those predicted when food grade ISP was first marketed.
The principal reasons for this situation are: the relatively high production cost (see below), nutritional and regulatory limitations, the inability of ISP-based texturized products to compete with texturized soy flour and texturized Soya Protein Concentrate, and finally, the competition of other abundant "isolated proteins", particularly casein and caseinates. Nevertheless, it should be noted that many novel isolated proteins, such as those obtained from cottonseed, peanuts, fish, squid etc. have been much less successful than ISP. Many of these did not reach the stage of commercial production.
Although actual trade figures are not disclosed, the growth in sales of concentrates and isolates is said to be, at present, stronger than that of flours.
ISP can be further modified and processed into more sophisticated products. These include: spun fibres from ISP as an ingredient for muscle food analogs, proteinates and enzyme modified ISP.
Storage stability of the spread depends on the type of treatment applied to the product. At ambient temperature spreadable products do not have any appreciable shelf stability. Basically table spreads undergo chemical and microbiological spoilage.

Changes during Storage
1. Chemical Changes: Titrable acidity greatly influences the flavour score of the dairy

spreads. The change in titrable acidity is the result of various biochemical changes caused due to the microbial action. An increase in the pH value of low calorie butter spreads during storage was reported by (Patange, 2005) [6]. It was reported by; (Ibrahim *et al*., 1994; Reddy, 2001) [3, 8] that the titrable acidity remained unchanged for 12 weeks and then afterwards it showed a progressive increase.

2. Physical and rheological changes: A significant increase in wheying off and no change or little change in oiling off was noticed in low-fat butter spread during storage by Verma *et al*., 1998c and Patange, 2005 [6].
3. Microbiological changes: The increase was gradual from 2.1 to 3.4 log cycle between 0-14 days of storage. Thereafter it increased sharply from 3.4 to 6.7 log cycles (Deshpande, 1998) [1].

Material and Methods

The experimental work was carried out in the research laboratory of department of Dairy, Technology, and Warner college of Dairy Technology, Sam Higginbottom University of Agriculture, Technology and Sciences, Allahabad. Soya flour, refined soyabean oil and salt was procured from local market. Spread was prepared by soya flour in prescribed level of protein Sunfiber as dietary fibre at different levels was mixed with aqueous phase. A fat blend consisting of milk fat and vegetable oil blend was prepared separately. Calculated amount of fat blend was mixed with aqueous phase for emulsification. Different type and levels of emulsifiers were used to provide a stable emulsion. The pH of prepared emulsion was adjusted to 5.2 using lactic acid as acidifying agent. The emulsion was then pasteurized, cooled and packed in suitable containers. Type and level of additives were selected through sensory characterstics. The table spread prepared using selected level of ingredients was used further for selection of level of salt and flavouring material. The level of salt and flavouring material was selected based on sensory evaluation of the product. The final product was subjected to shelf life evaluation.

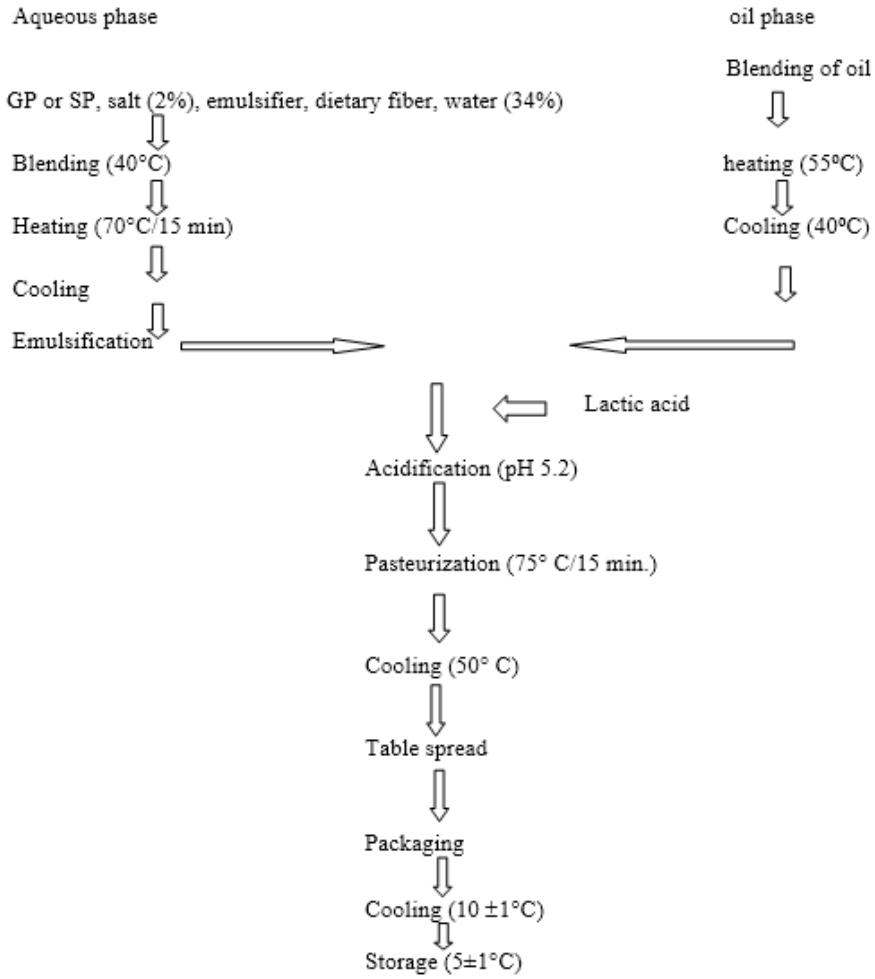

Fig 3.1: Schematic diagram of preparation of table spread

Chemical parameters for evaluation of shelf life in spread

Determination of PH: The pH of the spread was measured by a microprocess or controlled pH meter (Lab India Instruments Pvt. Ltd., Mumbai) fitted with an Orion gel- filled combined electrode.5)

Determination of Titrable acidity: Titratable acidity of the spread were determined as per IS: SP: 18, Part XI (1981).

Determination of Emulsion stability: The method delineated by Pearce and Kinsella (1978) [7] was followed for estimating the emulsion stability

Determination of Free Fatty Acid content: The fat breakdown in spread samples was determined by estimating free fatty acids (FFA) (% oleic acid) adopting the procedure of Thomas, Harper & Gould (1954) [9].

Determination of TBA value: The thiobarbuitric acid (TBA) reaction was used to monitor oxidative deterioration in the spread during storage. The method developed by King (1962) [4] was used to determine TBA value of spread.

Samples were stored for a period of 90 days to access their storage life under refrigerated conditions. The data obtained was further statistically analyzed.

Microbial Characterstics

Determination of Yeast and Mold: Microbiological analysis of the spread was ascertained for yeast and mould counts as per the method suggested by Marshall (1993) [5] using Potato Dextrose Agar (pH 3.5). The prepared plates were incubated at 30°C for 3-5 days and counts were expressed as yeast and mould log cfu/ml of sample.

Determination of Total Viable Count: The total number of viable bacteria in the spread was enumerated by the method described by Houghtby *et al*. (1992) [2] using Plate Count Agar as nutrient medium. The prepared plates were incubated at 37°C for 48 h.

Result and Discussion

The present study was based to evolve "Shelf life study of soya spread incorporated with soya protein isolate". The data collected on different aspects were tabulated & analyzed statistically using the methods of analysis of variance & critical difference. The significant & non-significant differences observed have been analyzed critically within & between the treatment combinations. The results obtained from the analysis are presented in this chapter under the following headings:

- Chemical characteristics of soya spread.
- Microbial characterstics of soya spread

Table 1: Chemical Parameters for Soya Spread

Days	PH	Titrable Acidity	Free Fatty Acid	TBA	Emulsion Stability
0	5.1	0.52	0.11	0.16	98.86
15	5.11	0.54	0.11	0.04	98.84
30	5.04	0.57	0.15	0.17	95.9
45	5.03	0.62	0.2	0.13	88.97
60	4.83	0.7	0.31	0.2	78.23
75	4.77	0.76	0.33	0.27	74.73
90	4.73	0.82	0.37	0.32	72.68

It can be observed from table 1 and Fig no 1 to 5 that highest pH was found to be 5.10 on 0th day and the lowest pH was found to be 4.73 on 90th day. In most of the days pH differed significantly it is also evident that highest titrable acidity was found to be 0.82 on 90th day and the lowest titrable acidity was found to be 0.52 on 0th day. In most of the days titrable acidity differed significantly. Highest free fatty acid was found to be 0.37 on 90th day and the lowest free fatty acid was found to be 0.11 on 0th day. In most of the days free fatty acid differed significantly. Highest TBA value was found to be 0.32 on 90th day and the lowest TBA value was found to be 0.04 on 15th day. In most of the days TBA value differed significantly. Highest Emulsion stability was found to be 98.86 on 0th day and the lowest Emulsion stability was found to be 72.68 on 90th day in most of the days Emulsion stability differed significantly

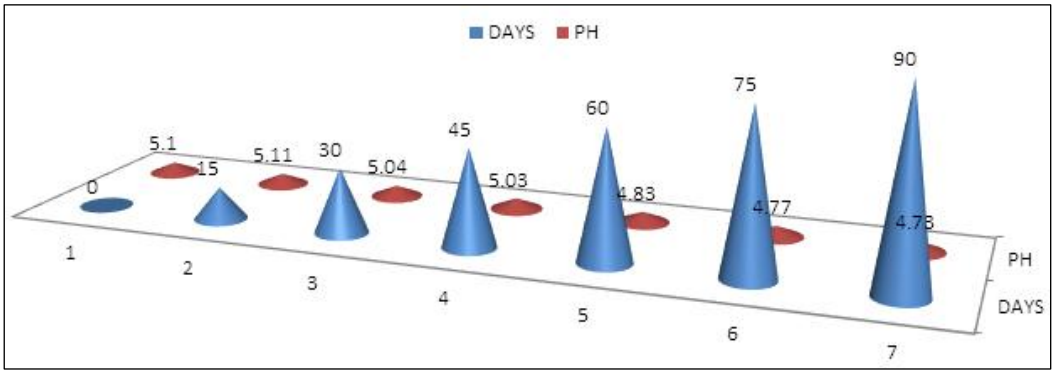

Fig 1: Ph. of soya spread

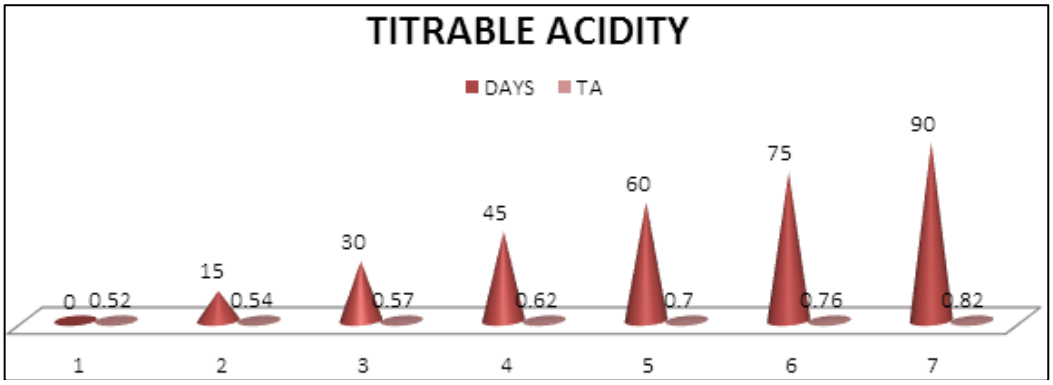

Fig 2: Titrable acidity of soya spread

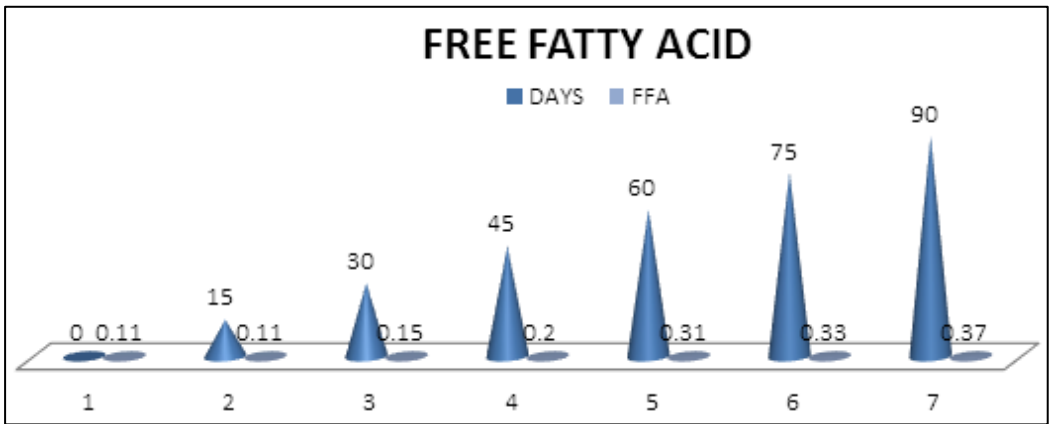

Fig 3: Free Fatty Acid of soya spread

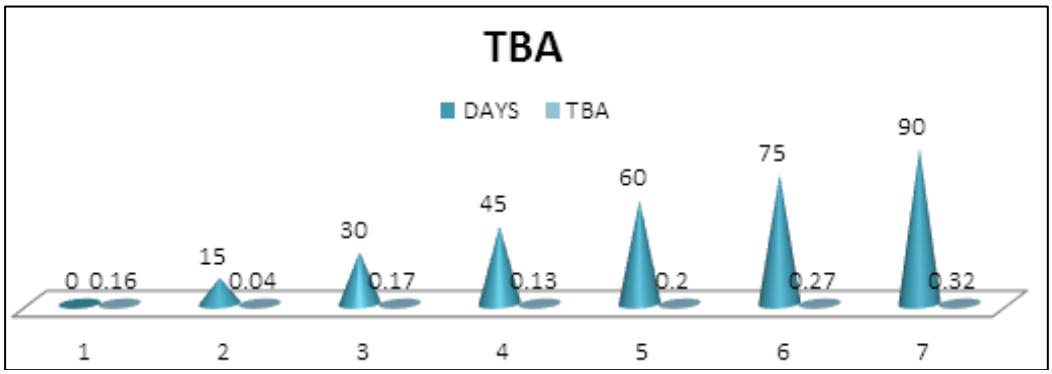

Fig 4: TBA value of soya spread

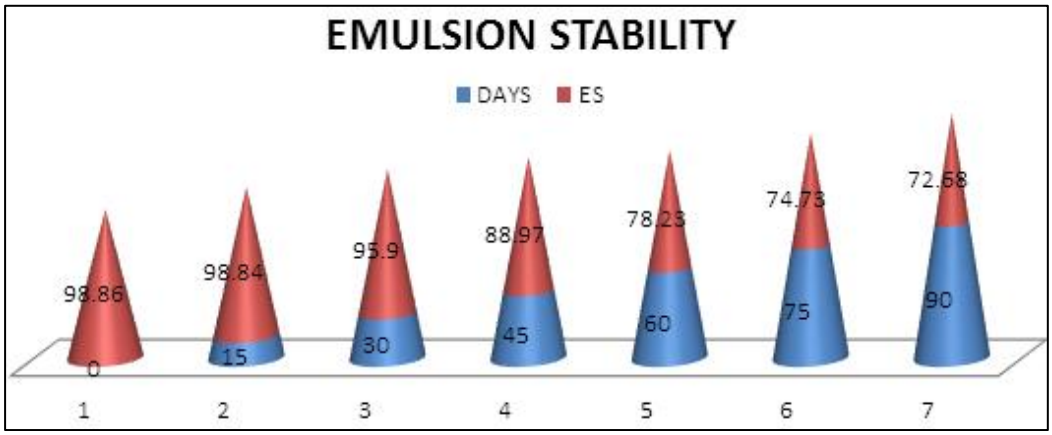

Fig 5: Emulsion Stability of soya spread

Table 2: Microbial Parameters of Soya Spread

Days	Yeast and Mold Count	Total Viable Count
0	1.12	1.38
15	2.23	3.31
30	2.38	5
45	2.74	23.92
60	2.76	26.84
75	3.09	42.94
90	3.23	49.31

It is also observed from table 2 and Fig no 6 and Fig no. 7 which gives the microbial paramaters that yeast and mold ranges from 1.12 to 3.23 in soya spread. The highest data was analysed on 90th day i.e 3.23. Lowest data was analysed on 1st day i.e 1.12. The table also shows the incidence of total viable count (cfu/g) between 0-90 days. The incidence of yeast and mold ranges from 1.38 to 49, 31 in soya spread. The highest data was analysed on 90th day i.e 49.31. Lowest data was analysed on 1st day i.e 1.38.

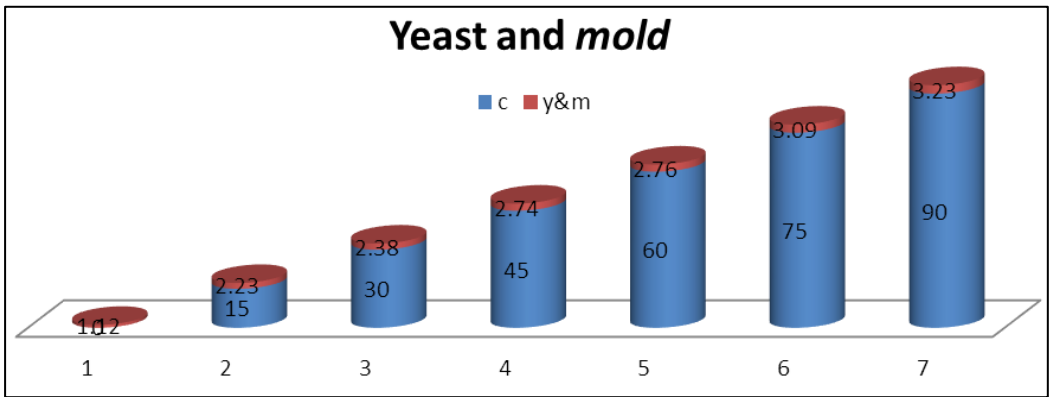

Fig 6: Yeast and Mold count (cfu/g) of soya spread

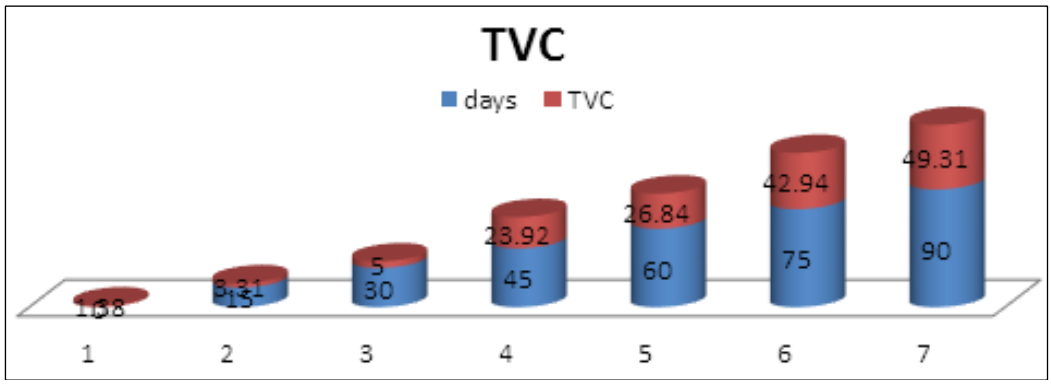

Fig 7: Total Variable Count (cfu/g) of soya spread

Conclusion

It can be concluded that soya spread which was incorporated with soya protein isolate can be marketed for commercial purpose. It showed the shelf stability of 45 days on both chemical and microbial parameters therefore if kept in refrigeration the developed spread can be consumed till 45 days under refrigerated conditions.

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