SUMMARY AND CONCLUSIONS

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The main purpose of this investigation was to utilise the soybean in the development of cheese type spreads, with flavour profile acceptable to Indian palate, by employing two approaches, i.e., maska and slurry, with and without cheese and milk solids, to optimise the processing conditions, to investigate the scope of incorporating spices, and to characterise the products during processing (curing and storage) in terms of physico-chemical, and microbiological parameters. This chapter summarises the important findings of the study, and conclusions derived from it.

* The standardization of soy maska was based on the bean to water ratio of soymilks, titratable acidity development, curd strength, yield of soy maska, and the partitioning of soy solids from beans to milk, curd, maska, whey and soy residue (okara).

- The increase in the level of soybean to water ratio (from 100 to 200 g/L water) resulted in a corresponding increase in the yields of soymilk, soy residue, and soy maska. However, along with an increasing of concentration of bean in water there was also a corresponding reduction in the recovery of major constituent fractions, particularly, protein, and fat, with the exception of carbohydrates, and ash.

- The various methods for fermenting soymilk included, using lactose, sucrose, glucose at 1% level, and reconstiuted skim milk (RSM) at 5% level, with lactic culture (5%), and incubated for 12 hrs. at 30oC. The steady development of acidity

was experienced with soy milks fortified with 5% RSM, and 1% lactose, which gave a titratabile acidity of 1.08% lactic at the end of 12 hrs. of incubation period at 30oC.

- The total, and net developed acidity increased with an increase in bean concentration, the highest being in case of 200 g beans/L water, and the pH reduction was inversely related to the acid production and the total solids levels of the soymilks.

- Soy curd strength was found to be positively, and significantly related to the total solids, protein, and mineral content of soymilks.

- The firmnness of the curd, and the amount of whey expelled depended on the moisture holding properties of the curd gel.

Based on the above observations a bean concentration of 200 g/L water was selected for extraction of milk, and subsequent curd setting, and maska preparation.

* Initial trials were conducted utilising both maska, and slurry approaches with and without milk solids and cheese solids. While maska without cheese did not give satisfactory spread, the acceptable cheese spreads could be made with following methods.

- cheese solids (72%) in maska, with 1.8% sodium chloride, incubating for 8 to 10 days at 8 to 10oC with occasional agitation.

- A soy slurry with 30% milk solids in the form of SMP, and cream, 2% sodium chloride, incubating for 8 to 10 days at 25 to 30oC with added 0.01% papain, 100 ppm GSH, and daily agitation coupled with pH adjustment ot 5.3.

- In a similar slurry approach, replacing the milk solids by 23.5% cheese solids, incubating at 8 to 10oC for 8 to 10 days resulted in an acceptable product.

- Although each of the three soy cheese spreads had a pleasant, mild acceptable flavour, body and texture, their sensory attributes were distinctly different from each other.

- The sensory scores i.e., flavour, body and texture, spreadability, and over all acceptability, were positively and significantly related to the cheese/milk solids, cheese/milk fat and cheese/milk protein contents in the soy based spreads.

- Reducing the cheese solids level below 72% in maska blend resulted in a poor body and texture. While reducing the cheese solids from 23.5 to 13.3%, and milk solids from 30.0 to 7.5% resulted in acceptable slurry cheese spreads.

- A desirable flavour development of soy slurry spreads were dependent upon agitation, use of culture, addition of GSH, papain, and pH control to 5.3 during curing. However, these factors did not influence the flavour development in maska based samples.

- Slurry with 13.3% cheese solids developed a desirable flavour profile when cured at an alternative temperature of 3 days refrigerated (8 to 10oC), 3 days room temperature (25 to 30oC), and 2 days refrigerated temperature for 8 days.

- Termination of curing by 8 to 10 days was critical for slurry based cheese samples. Beyond that an objectionable putrid flavour developed which coincided with an increase in pH above 6.

* At the end of curing, the processed cheese spread making trials were concerned with establishing heat processing conditions and the role of additives eg. emulisfying salts, stabilisers, natural spices, and fat, on the sensory attributes of the spreads.

- The slurry based samples were heat processed at 72oC, and maska samples at 65oC for 15 mts.

- Addition of 2% emulsifying salts either as tri-sodium phosphate or citrate along with 0.1% pectin improved the textural qualities significantly in maska based samples. Tri-sodium citrate with 0.1% agar agar was found more suitable for slurry based ones.

- Among the various combinations of 25 different spices and condiments screened, only 1% coarse ground pepper , and a paste of 1% garlic with green chillies were considered most acceptable.

- Incorporation of 10% fat either as butter, or hydrogenated fat at the time of heat processing significantly improved the body and texture, and melt down quality of the products. When added during the curing period, the spread was criticized for a strong, bitter, and unpleasant flavour.

* The characterization during curing, and heat processing was concerned with the physico-chemical, and microbiological changes in the soy cheese spreads.

- The change in pH during curing revealed an initial decrease due to formation of lactic acid. The increase in pH subsequently was due to proteolysis, resulting in free amino acids. The maximum increase in lactic counts in all the samples coincided with the period of decrease in pH values.

- A steady increase in titratable acidity during curing was apparent reaching final value of 0.8 to 1.4% lactic acid.

- Protein breakdown was associated with increases in SN, NPN, and AN levels in soy samples. The proteolytic count exhibited a positive and significant correlation with ripening index (SN/TN), NPN/TN, and AN/TN.

- In general, a steady rise in TFFA, TVFA, and lipolytic counts up to 4 days of curing was followed by a drop in these values between 4 to 8 days curing period.

- The lipolytic count registered a positive, and significant correlation with TFFA, and TVFA concentrations.

- The gross composition of processed soy cheese spreads indicated a moistre level of 64 to 65%; fat, 40-41%; protein, 24 to 35% and ash, 8 to 10% on dry matter basis.

- Soy cheese spreads packed in polystreyene cups tightly packed with sterile aluminimum foil could be stored under refrigeration (8 to 10oC) for 3 months.