

A PROCESS FOR THE PREPARATION OF SOY FLAKES

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(Received February 1, 1989; revised October 21, 1989)

Soy-flakes have been prepared from whole soybean and soybean meal in different combinations with rice, maize, and wheat. The mixture is thermally treated to inactivate the enzymes and made into flakes using drum drier. The product prepared from whole soybean contains 25-31% protein 11-24% oil and 5-6% moisture. Whereas the product prepared from soymeal contains 26-33% protein, 3-6% oil and 4-6% moisture. The biological value evaluated as NPU and PER is 84% and 3.4% respectively compared to that of casein. The product remains acceptable for 3 months.

Key words: Soy-flakes, Soybean, Soybean meal.

Introduction

The population of the world including developing and developed countries is in need of well balanced and nutritious protein rich diet. Soybean has been an important protein food in the diet of the oriental people for many centuries. A number of important applications exist in which soybean protein alone and in combined form with cereals is used. These are specially important for extension and supplementation purposes. The addition of soy protein to animal protein increases the yield and decreases the cost of the finished product. Supplementation refers to addition of soy-protein to cereals, containing either insufficient quantity of the amino acid content or lacking some of the most essential amino acids which improves the nutritive value of the product. There are various methods employed for processing of the soybean. The effect of processing condition i.e. moisture content, pressure and length of time on the nutritional value of soy protein and that of mixtures of soy protein with cereals is essentially the same in all cases except, that of heat treatment. It is the most important single, process variable, which determines nutritive value. For example in extrusion cooking soybean products are subjected to temperature and pressure of different intensities for varying period of time. Adequate control of temperature moisture and pressure during extrusion inactivate antinutritional factors, but on the other hand amino acid content, suggesting excessive heat treatment during extrusion [1]. Present work has been carried out to prepare a product by utilizing soybean cake left after the extraction of oil for the fortification of various cereals in different combination. A comparatively low cost and rich source of protein product has been obtained by using soybean meal with maize. Wheat and broken rice which is obtained as an inexpensive by product of rice milling.

Materials and Methods

Whole soybean flour, soybean meal obtained using oil

expeller and soybean meal by solvent extraction, maize, rice and wheat flours were used for the preparation of soyflakes.

Whole soybean flour was mixed with water to make a slurry. Slurry was cooked in autoclave for one hour at 15 lbs. pressure and then flakes were prepared using drum dryer (Crompton Pakistan Doncester SQA 864R109) at 80 lbs. steam pressure.

The following products were made from wheat, rice, maize and soybean flour and soybean cake in different ratio by above mentioned procedure:

1. Soybean flour + Rice flour 1:1
2. Soybean flour + Rice flour 2:1
3. Soybean flour + Maize flour 1:1
4. Soybean flour + Maize flour 2:1
5. Soybean flour + Wheat flour 1:1
6. Soybean flour + Wheat flour 2:1
7. Soybean meal (Oil expeller + Rice flour) 1:1
8. Soybean meal + Maize flour 1:1
9. Soybean meal + Wheat flour 1:1
10. Soybean meal (solvent extraction) + Rice flour 1:1
11. Soybean meal (solvent extraction) + Maize flour 1:1
12. Soybean meal (solvent extraction) + Wheat flour 1:1

Analytical work. Soy-flakes were analysed for total protein, oil and moisture content, ureas activity, Peroxide value [2].

Biological evaluation.

Determination of protein efficiency ratio (PER). For finding the PER value of soy-flakes 12 albino rats weighing 170-210g were divided into 3 groups one keeping control and other two were given soy-flakes (Sample No. 10) and casein respectively along with their normal diet. Feeding was continued for a period of 30 days and record of food intake and

weight gain was maintained PER was calculated by dividing the weight gain with protein intake during the experimental period (Table 1).

TABLE 1. DETERMINATION OF PROTEIN EFFICIENCY RATIO OF SOY-FLAKES.

| Source of protein diet | Protein Intake | Weight PER gain |
|------------------------|----------------|-----------------|
| Soy Flakes | 12.0 gms. | 40.0 gm 3.33% |
| Casein | 15.0 gms. | 52.0 gm 3.42% |

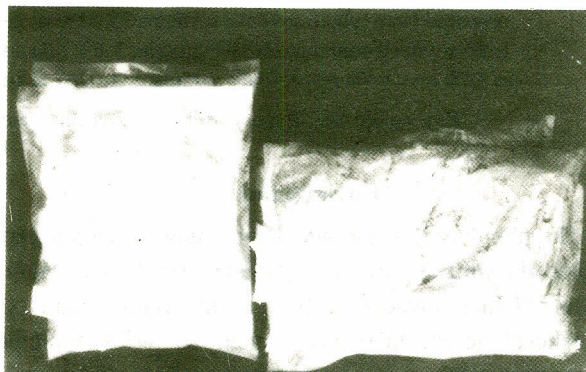
Determination NPU%. Net protein utilization of soy-flakes was determined using 8 albino rats. For this purpose two groups of albino rats of 240g each were made. To one group soy-flakes containing 100 g protein (Sample No. 10) 200 g. maize flour and 150 g. fat, 150 g. glucose 100 g. potato starch was given daily and to the other group soy-flakes were replaced by 10 g casein. After every 24 hours faeces were collected. This procedure was repeated for 4 days (Table 3). Faeces and urine of all the 4 days were collected mixed thoroughly and nitrogen was determined by kjeldahl method (Table 1). One control group of 4 rats of 240g each was made and fed with 200 g alaze, 50 g fat, 150 g glucose, 110 g potato starch. Urine and faeces were collected after 24 hours and nitrogen was estimated as above.

$$\text{NPU} = \text{Digestibility} \times \text{BV NPU} = \frac{I - (F - M) - (U - UK)}{I} \times 100$$

Bacteriological status. Product was examined micro-biologically for total count, yeast and mould, coliform, E. Coli

and salmonella [4].

Preservation and storage. Soybean flakes were stored in polyethylene bags, at room temperature and were analysed for protein, moisture, oil content, urease activity [5] and peroxide value after every two weeks upto a period of four months (Fig.1).



Results and Discussion

Effect of storage on the quality of flakes. Flakes prepared from whole soybean and from soymeal contain protein, moisture, and oil content given in Table 1. Protein and oil content has been reduced in almost all the samples during a storage period of 3 months. A difference from 0.2–0.6% in protein content and 0.1–0.8% in oil has been observed from

TABLE 2. EFFECT OF STORAGE ON THE NUTRITIVE VALUE OF SOY-FLAKES

| S. No. | Constituents | Ratio | Moisture Contents % | | Protein contents % | | Oil content % | | Urease Activity (Ph change) | | Peroxide value meg/Kg. | |
|--------|--|-------|---------------------|----------------|--------------------|----------------|---------------|----------------|-----------------------------|----------------|------------------------|----------------|
| | | | O.Time | After 3 months | O.Time | After 3 months | O.Time | After 3 months | O.Time | After 3 months | O.Time | After 3 months |
| 1. | Whole Soybean + Rice | 1:1 | 6.0 | 6.5 | 25.0 | 24.8 | 11.7 | 10.9 | 0.08 | 0.07 | 18.0 | 20.1 |
| 2. | Whole Soybean + Rice | 2:1 | 5.9 | 6.2 | 30.0 | 28.7 | 15.4 | 15.1 | 0.09 | 0.08 | 17.5 | 18.4 |
| 3. | Whole Soybean + Maize | 1:1 | 6.3 | 6.6 | 26.1 | 25.9 | 13.3 | 13.0 | 0.07 | 0.07 | 19.8 | 20.0 |
| 4. | Whole Soybean + Maize | 2:1 | 6.6 | 6.8 | 31.0 | 30.8 | 24.2 | 24.0 | 0.07 | 0.65 | 19.0 | 19.7 |
| 5. | Whole Soybean + Wheat | 1:1 | 6.5 | 6.9 | 27.5 | 27.2 | 12.0 | 11.5 | 0.14 | 0.13 | 18.0 | 19.1 |
| 6. | Whole Soybean + Wheat | 2:1 | 6.2 | 6.7 | 31.1 | 30.8 | 23.0 | 22.4 | 0.15 | 0.11 | 18.7 | 20.0 |
| 7. | Soybean meal (oil expeller) + rice | 1:1 | 5.0 | 5.2 | 26.7 | 26.3 | 4.7 | 4.5 | 0.13 | 0.12 | 15.5 | 18.7 |
| 8. | Soybean meal (oil expeller) + maize | 1:1 | 5.1 | 5.7 | 27.8 | 27.5 | 6.2 | 6.0 | 0.08 | 0.05 | 14.0 | 16.1 |
| 9. | Soybean meal (oil expeller) + wheat | 1:1 | 5.3 | 5.8 | 28.7 | 28.1 | 5.0 | 4.9 | 0.07 | 0.06 | 16.5 | 17.3 |
| 10. | Soybean meal (solvent extracted) + rice | 1:1 | 5.2 | 5.4 | 29.3 | 28.8 | 3.3 | 3.1 | 0.06 | 0.05 | 8.0 | 10.2 |
| 11. | Soybean meal (solvent extracted) + maize | 1:1 | 5.1 | 5.8 | 33.8 | 33.2 | 4.8 | 4.5 | 0.08 | 0.07 | 7.6 | 9.7 |
| 12. | Soybean meal (solvent extracted) + wheat | 1:1 | 4.9 | 5.3 | 31.3 | 30.9 | 3.6 | 3.3 | 0.1 | 0.09 | 6.5 | 7.1 |

initial to the final value.

Moisture content has increased from 0.2% to 0.7% which indicates that rate of absorption of water in these samples is insignificant. Urease activity ranges from 0.06 to 0.15 (pH change) which is within the normal value [6]. Flakes when prepared has peroxide value from 6-19 meg/kg. At the termination of storage a negligible increase in the peroxide value has been observed. This shows that the product remain acceptable for 3 months.

Effect of constituents. Sample No. 10,11,12 showed better results than the sample No. 7,8,9 as with the samples prepared from meal obtained from the oil expeller, the protein gets denatured to a certain extent and it also retains more oil and shows higher peroxide value than the meal prepared by solvent extraction method.

Nutritional evaluation of the product. The results of both the protein efficiency ratio (Table 1) and net protein utilization obtained (Table 3) in rat feeding indicates that the products are of the same general values as that of casein.

Bacteriological status. The overall bacteriological status of the product (Table 4) was excellent. Low total count indicates that the sanitary conditions are suitable for the process.

TABLE 3. DETERMINATION OF NET PROTEIN UTILIZATION OF SOY-FLAKES.

| Source of Protein diet | Protein intake | Protein in faeces | Protein in urine | NPU % |
|------------------------|----------------|-------------------|------------------|-------|
| Soy-flakes | 10.0 gms. | 1.0 gms. | 0.6 gms. | 84.0% |
| Casein | 10.0 gms | 1.0 gms | 0.8 gms | 82.0% |

Protein in the faeces and urine of the control was negligible (0.001 to 0.002)

TABLE 4. BACTERIOLOGICAL STATUS NUMBER OF ORGANISMS PER GRAM OF SAMPLE.

| S. No. | Total Count | Yeast mould | Coliform | Salmonella | E. Coli |
|--------|-------------|-------------|----------|------------|---------|
| 1. | 100 | 5 | 0 | Nil | Nil |
| 2. | 50 | 2 | 1 | Nil | Nil |
| 3. | 90 | 1 | 1 | Nil | Nil |
| 4. | 60 | 1 | 0 | Nil | Nil |
| 5. | 450 | 1 | 0 | Nil | Nil |
| 6. | 89 | 0 | 0 | Nil | Nil |
| 7. | 50 | 0 | 1 | Nil | Nil |
| 8. | 760 | 0 | 0 | Nil | Nil |
| 9. | 700 | 1 | 1 | Nil | Nil |
| 10. | 107 | 1 | 1 | Nil | Nil |
| 11. | 90 | 2 | 1 | Nil | Nil |
| 12. | 735 | 1 | 0 | Nil | Nil |

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