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MECHANICAL FRACTIONATION AS THE PROCEDURE FOR INCREASING FEEDING VALUE OF ANIMAL FEEDSTUFFS

S. Sredanović, J. Lević

Faculty of Technology, University of Novi Sad, Bulevar cara Lazara 1, 21000 Novi Sad, Yugoslavia

A b s t r a c t. The biological value of sunflower meal, alfalfa meal, brewer's dried grains and some other feedstuffs proteins is impaired drastically due to the enormous amounts of lignocellulosic matters in these feedstuffs. Thus, the problem when using these feedstuffs in poultry and swine feeding is just this impairment of the proteins. The intend of this work is to examine the possibilities for mechanical fractionation of sunflower meal, alfalfa meal and brewer's dried grains into the protein and cellulose fraction and to study the influence of different screen hole sizes on the yield and quality of the final products. The fractionation of the sunflower meal and brewer's dried grains was carried out in a separator with the 1.5, 2.0 mm screens and of the alfalfa meal with the 0.6, 0.8, 1.0, 1.2, and 1.5 mm screens.

Based on the experimental data on the technical efficiency of fractionation it can be concluded that the crude protein content was significantly increased with a concomitant reduction in the crude fibre content in fine fraction (passing material) of all feedstuffs investigated. The gradual decreasing of screen hole diameter rendered the logical and regular increase of crude protein content by 3.6 % in sunflower meals, 3.75-6.83 % in alfalfa meal and 5.2-9.0 % in brewer's dried grains. Concomitantly, the content of crude fibre in the fine fraction that passed through the screen (passing material) was reduced by 3.3-6.7 %, 4.22-7.23 % and 1.7-4.7 % in sunflower meal, alfalfa meal and brewer's dried grains, respectively.

K e y w o r d s: fractionation, centrifugal separator, sunflower meal, alfalfa meal, brewer's grains

INTRODUCTION

The biological value of the proteins in sunflower meal, alfalfa meal, brewer's dried grains and some other feedstuffs is impaired drastically due to the enormous amounts of lignocellulose matters in these feedstuffs [1-4]. Thus, the problem when using these feedstuffs in poultry and swine feeding is just this inpairment of the proteins.

These feedstuffs are mostly used for feeding ruminants degrading, in this way, their feeding and commercial value.

Based on the morphologically-anatomic and physico-chemical properties of these feedstuffs, the investigations were performed with the aim to separate the crude cellulose fraction from fine protein fraction containing also fat and digestible carbohydrates. The fractionation of the sunflower meal, alfalfa meal and brewer's dried grains was carried out in a centrifugal separator already employed in milling

industry. The residual parts of endosperm are separated from grain hull in this separator. The endosperm particles separated are conveyed through the cylinder of perforated sheet metal and bran is separated as the material that flows over the screen (flowing material).

The intend of this work is to examine the possibilities for mechanical fractionation of sunflower meal, alfalfa meal and brewer's dried grains into the protein and cellulose fractions and to study the influence of different screen hole sizes on the yield and quality of the final products.

MATERIALS AND METHODS

The sunflower meal after oil extraction that has not been crushed or ground before fractionation, dried and coarsely ground alfalfa meal and brewer's dried grains were used as the raw materials. The fractionation of the meals was carried out in a semi-industrial separator consisting of a fixed centrifugal screen and a rotor for conveying and loosening the meal.

The fractionation of sunflower meal and brewer's dried grains was carried out with 1.5, 2.0, and 2.5 mm screens and alfalfa meal with the 0.6, 0.8, 1.2, and 1.5 mm screens. The experimental results of the production of the protein fraction (passing material) and cellulose fraction (flowing material) were registered. The contents of moisture, crude protein, crude fat and mineral matters were determined in the fractions separated by the AOAC methods [5].

RESULTS AND DISCUSSION

The technical efficiency of fractionation and chemical composition of original meals and fraction produced are shown in Table 1.

The fractionation of the original meal with 37.40 % crude protein on a 1.5 mm screen rendered high quality protein fraction (43.80 % crude protein) and satisfactory yield (43.30 %).

It is interesting to note that relatively high quality (41.00 and 42.10 % crude protein) and very good yield (50.20 and 65.60 %) of protein fraction was obtained with the 2.0 mm and 2.5 mm screens, respectively.

Based on the results shown in Table 1, it can be seen that high yield (74.85 % and 70.23 %) and good quality of alfalfa meal protein fraction (25.23 % and 25.40 % crude protein) was obtained with the 1.5 mm and 1.2 mm screens, respectively.

The fraction of alfalfa meal with the 0.6 mm screen rendered protein fraction that obtained high content of crude protein (28.48 %) but the yield of this fraction was low (37.11 %).

The original meals should contain at least 20 % crude protein and they also should be milled in a hammer-meal with an 8 mm or even larger screen to obtain the results shown in Table 1. The 1.5 mm and 1.2 mm screens are recommended for industrial fractionation since they allow the production of high percentage of alfalfa meal protein fraction.

The technical efficiency of fractionation can be recognized comparing the characteristics of the original meal and of the protein fraction. The best results of the brewer's dried grain fractionation were obtained with the 1.5 mm screen. The protein fraction yield was 38.00 % and it contained 35.2 % crude protein and 10.40 % crude fibre.

Based on the experimental data on the technical efficiency of fractionation it can be concluded that the crude protein content was significantly increased with a concomitant reduction in the crude fibre content in fine fractions (passing material) of all feedstuffs investigated. The gradual decreasing of screen hole diameter rendered the logical and regular increase of crude protein content by 3.6 % to 6.4 % in sunflower meal, 3.75 % to 6.83 % in alfalfa meal and 5.2 % to 9.0 % in brewer's dried grains. Concomitantly, the screen (passing material) was reduced by 3.3 % to 6.7 %, 4.22 % to 7.23 % and 1.7 % to 4.7 % in sunflower meal, alfalfa meal and brewer's dried grains, respectively.

Table 1. Results of fractionation in %

Parameters	Moisture	Crude protein	Crude fibre	Crude fat	Ash	N-free extract	Yield
				Sunflower			
Original meal	6.50	37.40	19.20	1.70	6.70	28.50	100.0
1.5 mm screen							
Protein fraction	6.70	43.80	12.50	1.60	6.90	28.50	43.30
Cellulose fraction	6.40	32.50	25.10	1.80	6.40	28.80	56.70
2.0 mm screen							
Protein fraction	6.70	42.10	15.20	1.60	6.80	27.60	50.20
Cellulose fraction	6.40	32.60	24.00	1.80	6.60	28.60	49.80
2.5 mm screen							
Protein fraction	6.60	41.00	15.90	1.60	6.90	28.00	65.60
Cellulose fraction	6.20	30.80	25.70	1.80	6.30	29.20	34.40
				Alfalfa			
Original meal	9.59	21.65	22.35	4.17	9.07	33.17	100.0
0.6 mm screen							
Protein fraction	9.61	28.48	15.12	5.08	11.01	30.70	37.11
Cellulose fraction	9.89	17.44	26.62	3.64	7.93	34.48	62.89
0.8 mm screen							
Protein fraction	8.68	28.06	15.67	4.68	10.65	10.65	54.17
Cellulose fraction	9.71	14.39	30.23	3.56	6.13	6.13	45.83
1.0 mm screen							
Protein fraction	9.11	27.14	15.69	5.24	11.09	31.73	57.72
Cellulose fraction	9.65	13.13	31.42	2.69	7.20	35.91	42.28
1.2 mm screen							
Protein fraction	9.01	25.23	17.67	4.91	10.42	32.76	70.23
Cellulose fraction	9.01	12.92	33.43	2.41	6.66	35.57	29.77
1.5 mm screen							
Protein fraction	9.41	25.40	18.13	4.70	10.18	32.18	74.85
Cellulose fraction	9.44	11.72	34.87	2.58	5.98	35.41	25.15
				Brewer's dried grains			
Original meal	7.50	26.20	15.10	7.20	3.80	40.20	100.0
1.5 mm screen							
Protein fraction	8.20	35.20	10.40	10.00	3.60	32.60	38.00
Cellulose fraction	7.30	20.60	17.90	5.50	3.90	44.80	56.70
2.0 mm screen							
Protein fraction	7.90	33.20	12.20	9.10	3.70	33.90	44.30
Cellulose fraction	7.30	20.50	17.50	5.80	3.90	45.00	55.70
2.5 mm screen							
Protein fraction	7.90	31.40	13.40	8.30	3.70	35.50	49.00
Cellulose fraction	7.60	21.30	16.80	6.20	3.80	44.30	51.00

The fraction obtained can be used at the much higher level in the diets for swines and poultry due to their significantly improved feeding value.

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