

QUALITY OF THE PROTEIN OBTAINED BY A NONTRADITIONAL
METHOD OF TREATING COTTON SEEDS FOR COTTONSEED OIL

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The existing technology for processing cotton seeds does not ensure the retention of the quality indices of the extracted protein. The yield of protein in the processing of cotton seeds amounts to 40-50% of the total weight of the product [1].

The moist heat treatment of oil-containing materials is, in the main, carried out in roasters at 110-120°C for 50-70 min [2]. The prolonged treatment of the moist meal at a high temperature leads to a change in a number of the physicochemical characteristics of the initial material, which is accompanied by a fall in the quality indices of the products obtained and, correspondingly, their fodder and food value.

In order to obtain high-quality oil and protein, we have proposed a new method for the heat treatment of cottonseed meal which is carried out by the action of nontraditional physical methods.

The proposed method of treating cottonseed meal has been investigated by the CFD2k method of mathematical planning [3]. The two-level design of a complete factorial experiment permits not only the linear coefficients but also, and independently, the influence of inter-factor interactions on the yield of press oil and its quality and also on the yield of protein on the nontraditional method of processing cottonseed meal to be evaluated.

The factors investigated were varied at two levels indicated in Table 1 in dimensionless expression: upper level - (+) and lower - (-). As the parameters affecting the yield of oil and protein we selected the following: q) the density of heat flow; δ) the thickness of the layer of material being treated; τ) the time of treatment. The treatment of the cottonseed meal by the nontraditional method was carried out at an initial moisture content of 8% and a chamber temperature of 50°C.

The oil was extracted from the oil cake in laboratory presses at a pressure of 30 MPa. Table 1 gives the results of an investigation of the influence of the factors q , δ , and τ on the yield of press oil, Y_{yld} , after the nontraditional method of treating cottonseed meal.

TABLE 1. Plan of a CFD2k Complete Factorial Experiment and the Results of the Yield of Press Oil

Factor	Experiment No.							
	1	2	3	4	5	6	7	8
q	-	-	+	+	-	-	+	+
δ	-	+	-	+	-	+	-	+
τ	+	+	+	+	-	-	-	-
Y_{yld} , %	46,16	59,07	47,41	49,45	59,40	52,81	52,78	65,44

Analysis of the results of the investigation showed that in the nontraditional method of treating oil-containing material the yield of press oil was increased by a factor of 1.1-1.3 as compared with the traditional method. The isolation of the protein was carried out by the method of [4] and its amino acid composition was determined on an amino acid analyzer of the AAA-339 type (Czechoslovakia).

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TABLE 2. Amino Acid Composition and Yield of Protein from Needles, %

Name	Treatment by the current method	Before treatment	Nontraditional method of treatment
Protein	15-17	30-33	30-33
Amino acid			
Aspartic acid	7.37	8.89	10.50
Serine	3.76	2.00	2.20
Glutamic acid	14.55	28.80	18.20
Proline	6.00	9.00	7.22
Glycine	3.60	3.70	4.00
Alanine	3.60	3.33	3.70
Valine	5.44	3.40	3.50
Methionine	-	1.40	0.90
Isoleucine	2.80	3.50	3.10
Leucine	5.10	5.80	5.80
Tyrosine	2.35	5.40	3.10
Phenylalanine	5.20	5.80	5.80
Histidine	1.45	2.70	2.90
Lysine	2.50	5.30	5.70
Arginine	10.65	3.00	9.00
Total	76.52	95.20	87.82

Table 2 gives the amino acid composition and yield of protein from pulp treated under nontraditional and current regimes. As can be seen from Table 2, the proposed method of treating the meal is capable of retaining the quality and yield of protein.

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