

ISOLATION OF PROTEINS FROM COTTONSEED MEAL.

III. INFLUENCE OF MOIST HEAT TREATMENT ON THE SOLUBILITY OF COTTONSEED PROTEINS

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UDC 664.38+582.796

We have studied the dependence of the yield of protein and its nitrogen content on the type of meal obtained with various methods of defatting cotton seeds (Table 1). It follows from Table 1 that the highest yields of protein are observed in the benzene-acetone [1] and water-acetone [2] methods of defatting the seeds. The lowest yield is obtained from industrial meal.

In view of this, it appeared of interest to determine how the yield of protein falls during the industrial process used for the production of meal (see Table 1, 'a-e). The seeds were defatted by the aqueous acetone method.

TABLE 1

Method of obtaining the meal	Yield of protein	Nitrogen content
Benzene-acetone	28-32	17-16,5
Water-acetone	30-34	16,5-16,0
Gasoline (direct extraction)	24-26	15,5
Fore-pressing	13-17	15,5-14,8
a) crushed seed	25	16,0
b) pulp	22	15,6
c) husks	20	15,2
d) meal (before the worm evaporator)	19	14,7
e) commercial meal	15	14,8

TABLE 2

System	Soluble gossypol in ether	Soluble protein (in 10% NaCl)	Insoluble product
1) Mixture of gossypol and hemoglobin (or globulin), 1:2, without moist heat treatment	30	63,8	0
2) Mixture of gossypol and protein (1:2) after heating at 120°C:			
a) hemoglobin	7,2	5,9	81,5
b) globulin	12,0	15,8	72,2

Institute of the Chemistry of Plant Substances, Academy of Sciences of the Uzbek SSR. Translated from *Khimiya Prirodnikh Soedinenii*, No. 1, pp. 110-111, January-February, 1975. Original article submitted June 25, 1974.

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To obtain protein by the salt method [3] we used 20 g of powder (without sifting out the husks). The figures in Table 1 show that the yield of protein fell mainly in the following stages: in the preparation of the pulp for pressing (moist heat treatment at 70-80°C), in fore-pressing ($\approx 130^\circ\text{C}$), and in the worm evaporator during the elimination of the gasoline with live steam (120-150°C), and also after the extraction of the residual amount of oil from the meal. The same stages are effective in reducing the toxicity of the gossypol as a result of its binding to the proteins [4, 5]. We performed experiments to determine the action of a high temperature on the yield of protein.

To extract the protein we took gossypol-free flour previously kept at 80-150°C for from 30 to 150 min. The yield of protein in all cases was 28-32%. At the same time, the presence of gossypol during moist heat treatment converted the proteins into an insoluble state. The hemoglobin and the globulin of the cotton seed retained their solubility only to the extents of 8.6 and 23%, respectively (Table 2).

Thus, the action of a high temperature in a moist medium is the main process lowering the yield of protein. Consequently, the decrease in the yield of protein takes place through the interaction of the cottonseed proteins with gossypol in a moist medium.

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