PREPARATION OF PHYTIN FROM COTTONSEED MEAL

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The amount of phytin obtained from rice husks far from satisfies the demands of the national economy. We have previously reported the isolation of phytin from cottonseed meal (from the wastes of the production of protein) with a yield of about 3% [1]. In the present communication we considered some questions of obtaining technical phytin, containing about 39% of P_2O_5, which is an intermediate for the production of medicinal phytin and can also be used directly in animal husbandry.

The greatest energy-consuming stage in the production of phytin is its drying. Chamber driers have a low productivity and do not ensure uniformity of drying [2]. In view of the increase in the production of phytin, it is desirable to use continuous driers. We have employed a spray-drier. Under conditions of almost instantaneous drying, the temperature of the surface of the particles of material only slightly exceeds the temperature of diabatic evaporation of the pure liquid, in spite of the high temperature of the drying agent, and consequently drying takes place under mild conditions permitting the production of a high-quality powdered technical phytin requiring no further comminution [3].

For the experiments we took a phytin slurry obtained by extracting phytin from cottonseed meal with acidified water and precipitating it by neutralizing the extract with a dilute solution of NaOH to pH 7.5-8.

The deposit of phytin was separated from the mother liquor in an SGO-100 centrifuge and was diluted with water to a concentration of 6-8% of the precipitate in the slurry.

The main indices of the phytin slurry were as follows:

Index	In the slurry	Calculated on the absolutely dry precipitate
Phosphorus pentoxide content (P_2O_5), %	2.8	40
Crude protein content, %	0.49	7
Ash content, %	0.08	1.2
Moisture content, %	96	-
Density, kg/m^3	1030	400-450
pH	7.5-8	7-7.5
Residue after sieving through a 0.25 mm sieve, %	0.1	-

The drying of the slurry was carried out on an Anhydro (No. 1, Denmark) laboratory spray-drier with disk and nozzle atomization. The best indices both with respect to the quality of the dried phytin and with respect to the productivity of the drier were obtained with disk atomization at a speed of rotation of the atomizing mechanism of about 30,000 rpm. The maximum productivity of the drier with a volume of the drying chamber of 0.8 m^3 and a power of the electric heater of 9 kW is 14 kg/h of evaporated moisture.

The technical phytin was dried at a temperature of the heat carrier at the inlet of 150-300°C and at the outlet of 70-95°C. The results of the investigation showed that the quality of the technical phytin depends on the tempertaure of drying, although phytin is regarded as a fairly non-thermolabile substance:

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Temperature of the heat carrier at the inlet to the drying chamber, °C	Temperature of the heat carrier at the outlet from the drying chamber, °C	P_2O_5 Content in technical product, %	Moisture content of the final product, %	Productivity of the drier with respect to the slurry, liters/h
150	80	39—40	14.7	5
160	80	39—40	14.2	5
160	70	39—40	15.5	5.5
160	90	39—40	12.8	4.8
170	80	39—40	12.0	6
180	80	39—40	11.2	6.5
190	80	39—40	10.8	6.9
200	80	39—40	9.6	7.5
220	80	39—40	8.4	8.9
240	80	39—40	7.5	10
260	80	39—40	7.1	11.5
280	80	39—40	6.5	13
290	80	37—38	6.2	13.5
300	80	36—37	6.0	14.5

As can be seen from the figures given, with a rise in the temperature of the heat carrier at the inlet to the drying chamber, in addition to a rise in the productivity of the drier the final moisture content of the dried phytin decreases.

A rise in the temperature of the air at the inlet (to 290°C and above) leads to partial decomposition of the phytin and thereby to a decrease in the amount of phosphorus pentoxide in the final product. It also leads to an intensification of the color of the dried phytin, which is due to the oxidation of the ballast substances present in the technical product.

Thus, from the results of the experiments performed it may be considered that the optimum temperature for the drying of technical phytin obtained from cottonseed meal is 250-280°C at the inlet to the drier and 80-90°C at the outlet, with a concentration of the main product in the slurry of about 7%. Under these conditions, the specific consumption of air for the drier used amounts to 120 liters/min, and the removal of moisture from unit volume 7 kg/m^3·h.

EXPERIMENTAL

Comminuted cottonseed meal (50 kg) was extracted with 400 liters of acidified water (pH 5) in a reactor with a stirrer for 30 min.

The extract of phytin was separated from the insoluble residue on an NOGSh-325 N centrifuge and was clarified in an SGO-100 supercentrifuge. The phytin was precipitated from the clarified extract by the addition of a 5% solution of NaOH to pH 7.5-8. The phytin precipitate was separated from the mother solution in an SGO-100 supercentrifuge and was washed with 20 liters of water.

The phytin paste was ground in a homogenizer and passed through a 0.25-mm sieve. The ground slurry of phytin was dried in an "Anhydro" No. 1 drier at a temperature of the heat carrier at the inlet of 250°C and at the outlet of 80°C.

The yield of technical phytin was 5% on the weight of the initial meal, i.e., 2.5 kg. The phytin obtained contained about 7% of moisture and 39-40% of phosphorus pentoxide.

SUMMARY

The optimum conditions for the drying of phytin from cottonseed meal have been determined.

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