

THE INVESTIGATION OF KINETICS OF HIGH-TEMPERATURE EXTRUSION PROCESS IN GRAIN MIXTURES AND ALBUMINOUS PASTE MATERIALS

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Abstract. The investigation of kinetics of high-temperature extrusion process has allowed to find optimum technological regimes of the new process of production of medicinal and prophylactic, albuminous paste from leaf-caulescent biomass and production in mixtures the extruded fodder additives.

Key words: extrusion, grain mixture, albuminous paste materials

INTRODUCTION

Fodder and food deficit in Ukraine from merely production positions is caused first of all with a deficiency of fodder protein of full value.

The main source of fodder albumen of full value for developed countries is soybean, its part in albuminous ration reaches 80 %. Quite another balance of fodder albumen is typical for Ukraine, Byelorussia and Russia where about 60 % fall on albumen of sown grass, coarse and rich fodder (mainly in the form of silage, hay, haylage) and about 40 % - concentrated fodder, the rest of albumen is obtained owing to fodder yeast and waste of food industry (meat and bone meal and others).

If we consider prospects of soybean production in Ukraine, rather not bad situation may be seen about 60 sorts of soybean are divided into districts on the level of industrial exploitation. The main questions now are:

- finding key factors of personal interest of economic executives in sharp extension of soybean sowing area;

- development of harvesting and transport complex allowing to gather soybeans without harvesting losses;

- development and mastering of technologies and equipment on processing of soybean to ground oil-cakes, oil, soybean milk and food additives.

So long as there will be inevitable necessity of wide-scale exploitation in the nearest future of such crop as soybean, at present the technology of production of protein concentrates from green plants is considered proceeding from the experience of operation of works in Byelorussia, Estonia and Russia.

Operational experience of these installations has shown that traditional sown grass (lucerne, clover, lupine, some cereals grass mixtures) is a reliable local source of fodder albumen of full value. So, for example, according to the Ukrainian head designing institute of agriculture, in order to cover a half of deficiency of fodder protein of full value for a type administrative district in all zones of Ukraine it is enough to have 1 or 2 works with an output of 12.5 t/h of green mass with area of sown grass of 700 to 900 ha. The rest of deficiency may be covered by the development of soybean production and perfect reclamation of waste of meat-processing and milk industries.

Production lines or plants (works) include complex fractionation of biomass of sown grass. Variants of technological moduli

give a possibility to make the following products of fractionation:

- protein concentrate;
- chloroplast medicinal and prophylactic preparation;
- cytoplasmic (food albumen);
- biostimulants for chemical, pharmaceutical industry;
- carbohydrate and mineral complex;
- inhibitor of trypsin.

The peculiarities of process of chloroplast medicinal and prophylactic remedy production from biomass of green plants are examined in this paper.

MATERIALS AND METHODS

Medicinal and prophylactic remedies (chloroplast albumen) were singled out of the leaf-caulescent biomass of lucerne, rape, clover, and lupine. Sap was subjected to heating at specific temperature conditions, it was centrifuged up to precipitation of albumens, then albumens in the form of paste mass were mixed in specific proportion with grain materials and were extruded with the help of special extruding machines.

As a result the extruded mixture, humidity 10-12%, enriched with albuminous medicinal and prophylactic additives was produced. Heat formed as a result of heavy pressures and friction of fodder mixture in operational zone of extruder was used for drying of that portion of humid paste which was dosed into grain mixture.

Norms of applying humid paste of medicinal and prophylactic remedy into grain mixture were determined. Zootechnic experiments on feeding the product to pigs and poultry were carried out.

RESULTS AND DISCUSSION

Conditions of heat treatment of the products exert essential influence upon their quality which depends not only on temperature and rate of effect but on phenols and carbohydrates residual content of treated material.

Taking into consideration kinetics of formation of albumen-carbohydrate-phenol complexes it is obvious that the influence of heat effects on products of processing must be determined on the basis of complex study of a series of biochemical indicators of products made under different conditions.

Different effects of temperatures both in value and in duration gave a possibility to determine characteristics of peculiarities of attacks on albumens of leaf protein by pepsin and trypsin. Characteristics of curves of peculiarities of attacks on albumens of protein concentrate, chloroplast medicinal and prophylactic extruded mixture is somewhat changed in comparison, for example, with analogue: a curve of peculiarities of attacks on albumens of casein.

However, this difference is unessential and we can say about a possibility of choice of extrusion regimes with production of the high-quality product.

The peculiarity of this process lies in the fact that in process of extrusion of grain mixture moistened with chloroplast paste, the grain mixture under the influence of compression is failed and filled in uniformly by humid inclusions of albuminous paste. When getting the product out of the zone of high pressure into area of atmospheric pressure, the energy accumulated by the product is eliminated that is followed by further profound transformation of structure.

Porous elements are formed which are filled in uniformly by chloroplast fraction.

The heat formed as a result of heavy pressures and friction of fodder mixture in the operational zone of extruder is used for drying of humid paste which is in the initial mixture for extrusion.

With the purpose of determining the efficiency of use of the produced extruded mixture, the experiments on replacement in rations of sucking-pigs the milk deprived of fat and the fodder yeast were carried out, 3 groups of pigs - nonsuckers, each of 15 heads, were formed for that. Experimental feeding was carrying out for 137 days. Rations in all

experimental groups were the same in energy level. It is ascertained in the experiment that productive effect of extruded with chloroplast paste fodder in rations of pigs is the same as that of milk deprived of fat and of fodder yeast. As for expenditure of fodder, in comparison with control group when enriching the fodder with albuminous paste it accounted in the second group for 101 % and in the third 140 %.

With estimation of meat productivity and chemical composition of muscular tissue essential differences between the first and the second groups are not ascertained. Morbidity of pigs in groups under investigation was lower by 10 %.

CONCLUSION

The developed new process of production of medicinal and prophylactic albumin-

ous paste from leaf-caulescent biomass and production in mixtures the extruded fodder allows in technical plan to produce with minimum energy expenditure the new in quality fodder additive. The use of fodder additive in rations of feeding of pigs provides replacement of milk reworkable waste which may be turned to food-stuff production.

The investigation of kinetics of high-temperature extrusion process has allowed to find optimum technological regimes of the process.

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