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RATIONAL USE OF WASTES FROM PLANT PRODUCTS PROCESSING

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Abstract

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This article analyses the use of wastes of plant products processing in the compund feeds production.

The scientifically based formulations of the feed additives from wastes of plant products processing for different kinds of the farm animals were developed. Storage time was established for the feed additives.

*Key words***:** compound feeds, feed additive, formulation, feed flour from grape waste processing, corn germs, zeolitic feed additive

Introduction

Wholesome feeding represents balanced feeding which covers requirements of the animals in nutrients and biologically active substances in accordance with the scientifically based feeding standards. For successful development of the compound feed industry it is necessary to extend the fodder base and decrease the high nutrient and inexpensive raw materials shortage.

Annually approximately 7000 tons of cake and marc and 820 tons of feed flour are produced in the fruit and vegetable processing plants of the Republic that will serve as additional raw reserve for the compound feed industry. Waste products resulted from grapes, apples, tomatoes, etc. by its chemical composition completely meet the requirements for components of the compound feeds. But flow ability, volume weight and hygroscopic properties of grape and tomato polyuria do not meet the requirements to the compound feed production.

Grape polyuria is dark-brown, heavy, paste-like liquid. It is chemically non-aggressive and transported as simple molasses. In addition to sugar and alcohol, grape polyuria contains also nitrous, pectic, tannic and coloring substances, fats, cellulose, organic (tartaric, apple, ethanedioic, glyconic, citric) acids and their salts. Polyuria may contain up to 95% of water, in pressed condition – up to 55%.

At such quantity of water and sugar, polyuria is a good culture media for development of microflora promoting the process of lactic and acetic-acid fermentation. Fresh piled polyuria become warm very quickly and turn acidify 2-3 days. It became molded and unsuitable for use as the animal feed (Dudikova, 2004).

Animal productivity depends on content of nutrients in the feeds. Vitamins, especially vitamin A, play the special role in the animal feeding. Vitamin A deficiency in rations of the farm animals and birds results in sufficient decrease in their productivity.

According to Prangishvili et al. (1977) flour from green vegetative wastes of grapevine by its content of carotin is highly competitive with grass meal from lucerne. Cost of production of 1 hwt of the vegetative waste flour is 1.97cop. (28.2%) less than cost of production of grass meal.

All-Union Scientific Research Institute (AUSRI) of viticulture and enology developed a technology of complex vine industry waste processing. According to this technology, following the sugar and tartrate compounds extraction from the grape polyuria, processed sweet and wet polyuria shall be pressed and dried by ABM-0.4 aggregates (Gumenuk et al., 83).

Use of inexpensive raw materials from waste products of the wine industry allows saving of 15-30% of expensive corn components and does not affect productivity of fattening young stock (Magomedov et al., 1982).

To rations of steers, grape polyuria shall be added in quantity of 3.6 and 9% instead of sunflower cake and wheat bran (Compound Feed Industry Abroad, 1984).

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Purpose of study is development of resource saving technologies for production of the compound feeds and highly effective feed additives for cattle, horses and pigs using indigestible waste from the plant products processing and feed zeolites providing the improvement in quality and reduction of costs of finished products.

Materials and Methods

In this work we determined the physical and mechanical properties and chemical composition of the feed additive components: feed flour from grape polyuria (FFGP); feed flour from tomatoes processing wastes (FFTPW); feed flour from dehydrated potatoes wastes (FFDPW); zeolites from Chankainai deposit of Almaty region (ZCD); wheat germs (WG), corn germs (CG); and corn gluten (CGl) by the following methodologies: moisture content (GOST 13496.3-92); nitrogen and crude protein content (GOST 13496.4-93); crude fat content (GOST 13496.15-97); crude fiber content (GOST 13496.2-91); crude ash content (GOST 26226-95); soluble and easy hydrolysable carbohydrates content (GOST 26176-91); total acidity (GOST 13496.12-92); volume weight and angle of natural slope (GOST 28254-89); fat acidity value (GOST 13496.18-85); fat peroxide number (GOST 26593-85); shungites chemical composition (Instruction № 246-C).

Results and Discussion

Analysis of physical and mechanical properties of waste products from plant processing showed that they have unfavorable physical and mechanical properties: feed four from grape polyuria has minimum volume weight and maximum mean particle size. If compared to other components, feed flour from the tomatoes processing wastes has also the worst physical properties; and moreover, as a result of storage within 4-6 days, acidity of these products increases by 18-22%.

Chemical composition of feed zeolite: Zn -0.08; Cu-0.015; Mn-0.2; Co-0.002; P-0.2, Al_2O_3-10; SiO_2>60; CaO-6; Fe_2O_3–6; MgO -2; Na_2O-0.3; K_2O-2.0; etc.

According to the abovementioned date, zeolite feed additive contain macro- and microelements necessary for the feed enrichment with mineral elements. The content of heavy metallv in zeolite supplements, mg/kg: mercury - not detected; cadmium – 0.001; lead – 0.5; fluorine – not detected; arsenic – traces; chromium – 0.04; content of radionuclides, Bk/kg: cesium -137-not detected,strontium–90-59.2. The results of study show that heavy metals and radionuclides content are within acceptable limits for use of these minerals for the farm animal feeding.

Chemical composition of the wastes from plant products processing is provided in Table 1.

According to these data, each kind of waste products from the plant product processing contains the nutrients by which feeding value of raw materials for the compound feeds is assessed, at that protein content in the flour from grape polyuria is 9.82%, in the flour from potatoes processing waste – 6.22%, and high content of protein – in wheat and corn germs and in the corn gluten. Using these types of wastes from processing of the plant products when forming the feed additives, all nutrients present shall be accounted, but wastes from processing of grape, tomatoes, and dehydrated potatoes contain sufficiently less quantity of fiber that can result in decreased digestibility of nutrients contained in the formed feed additive.

One of the most important and complex problem in the technology of feed additive production is development of formulation. Each waste product has a number of its own advantages and disadvantages. At the same time, being in combination, these products can form the highly nutrient feed with high content of protein, starch, fat, and with low cost of production.

Chemical instability of these feeds and their non-adaptability for production of the feed additive are the important factors show necessity in giving them a new form with the set quality parameters.

6 formulations were developed for preparation of the feed additive: for cattle, horses and pigs, different by proportion of the feed flour from grape polyuria, feed flour from wastes

Table 1
Chemical composition of the wastes from plant products processing

Parameter	FFGP	FFTPW	FFDPW	WG	CG	CGl
Crude protein, %	9.82	8.77	6.22	12	14.74	16.76
Crude fat, %	2.12	2.02	1.14	4.1	3.84	2.78
Crude fiber, %	17.8	13.72	12.64	8.7	7.82	7.02
Total sugar content, %	26.4	19.3	21.2	3.3	4.1	5.02
Dextrins content, %	18.2	11.34	16.55	-	-	2.1
Metabolizable energy, MJ/kg	9.3	8.24	7.72	10	9.78	11.74

of tomatoes processing, feed flour from wastes of dehydrated potatoes processing, wheat and corn germs, corn gluten and wheat bran, and content of the feed zeolite, chalk and boiled salt is constant (Table 2).

Physical and chemical composition and nutrient value of the feed additives are provided in Table 3.

According to Table 3, humidity content in the feed additive is within 10.75…12.25%, such humidity level is neither considered as nor high. Content of crude protein is from 17.45 to 19.10%, and it depends on added corn gluten. Fat content in the feed additive is 4.02…4.84%, subject to the formulation. Content of crude ash in dry product is 7.14…8.76 and depends on adding of feed flour from grape polyuria. Crude fiber content is varied from 15.80 to 19.44% and depends on adding of the feed flour from wastes of tomatoes processing and wastes from dehydrated potatoes.

Studies of pilot batches of the feed additives according to the developed formulations showed that addition of the feel flour from grape polyuria and wastes from tomatoes processing in quantity more than 12% is unacceptable, because it results in decreased protein and fat content and increased fiber and ash content. In the feed additives where content of the flour from grape polyuria and wastes of tomatoes processing is more than 15%, decrease of the organoleptic indicators and processing properties is observed. Therefore, their addition to composition of the feed additive shall be limited up to 12%, and that of the flour from dehydrated potatoes wastes – up to 10%, which in combination with other components provides optimal nutrient value of the feed additive.

Feed additive production technology includes the following operations: dosing in the volumetric measurer of flowable components of the feed additive according to the formulation and their supply to the mixer; simultaneous two-stage fragmentation of the feed mixture; graining of the flowable feed additive in the press-granulator and grains cooling in the tray cooler; screening of the granulated feed additive for the purpose of separation of shortcuts and storage of the finished product.

According to the proposed technology, pilot batches of the feed additive were produced.

For the purpose of assessment of the product storage conditions, pilot batches of the feed additive prepared in accordance with formulation 1, 3, 5 were placed for to the floor storage of the experimental compound feed shop. Experiments have been carried-out for 4 months, from June to September. During this period, temperature in the storage varied from +8 to +25^{0}C; relative humidity – from 45.7 to 84%.

Table 2
Formulations of the feed additive based on wastes from the plant products processing

Components	Compositions, %					
	Cattle		Pigs		Horses	
FFGP	12	15	10	15	8	10
FFTPW	10	15	12	15	7	10
FFDPW	8	10	10	12	5	10
WG	11	15	14	10	10	7
CG	10	8	12	8	8	5
CGl	13	10	15	10	12	8
Wheat bran	23	14	14	17	37	37
Feed zeolite	4	4	4	4	4	4
Feed chalk	6	6	6	6	6	6
Boiled salt	3	3	3	3	3	3
Total:	100	100	100	100	100	100

Table 3
Physical and chemical composition and nutrient value of the feed additives

Parameter	Composition for					
	Cattle		Pigs		Horses	
Humidity, %	11.7	12.25	11.22	12	10.75	11.22
Crude protein, %	18.02	17.64	19.1	18	17.7	17.45
Crude fat, %	4.52	4.02	4.84	4.4	4.22	4.02
Crude fiber, %	16.06	16.24	15.8	16	19.2	19.44
Crude ash, %	7.14	7.66	8.01	8.5	8.44	8.76
Nitrogen-free extractive substances, %	45.82	46.02	47.68	47	48.05	48.1
Dry substance, %	88.3	87.75	88.78	88	89.25	88.78
Total acidity, Turner degree	17.5	17.7	18.1	18	17.2	17.1
Total sugar, %	17.2	17.1	19.3	19	14.8	15
Metabolizable energy, MJ/kg	11.38	10.8	11.72	11	10.25	9.8
in 100 g of feed	102.6	100.2	103.24	99	89.95	82.7

The results of performed studies show that humidity content in the feed additive is within the range of 10.75…11.81% that indicates good dehydration ensuring stable storage. No significant losses were observed in protein fraction of the feed additives within 4 months of storage. Quality of fat in the feed additive was assessed by the acidity and peroxide number, which were considered as indicators of fat hydrolysis and oxidation.

Some increase in the acidity and peroxide number was observed in all samples during the period of storage. According to the provided data, nutrient value and purity of protein and lipid fraction are significantly preserved during the period of storage of the feed additive.

Conclusion

Scientifically based formulations of the feed additives from the wastes of plant products processing were developed for different kind of the farm animals. The formulations include up to 12.0% of the feed flour from grape polyuria and up to 12% of wastes of tomatoes processing, up to 10% of the feed flour from dehydrated potatoes wastes, up to 14% of corn gluten, up to 37% of wheat bran, up to 4.0% of feed zeolite, up to 6.0% of feed chalk, up to 3.0% of boiled salt, and up to 0.03% of probiotic preparation "Biokons". Content of the components in the formulations determines the balancing additive to the compound feeds subject to the resources of waste product formation and create conditions for producing of the feed additive of processible and stable form.

Allowable storage period for the feed additive from wastes of the plant products processing is 4 months.

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