

EVALUATION OF CAROTINE CONTENT IN COMBINED FEEDS

I. Dudarev, S. Uminsky, A. Moskalyuk, S. Zhitkov
Odessa State Agrarian University

Further increase in the productivity of agricultural animals and poultry is based on the use of compound feed balanced in terms of nutrients, vitamin, amino acid and mineral composition that meet zootechnical requirements. Protein-vitamin and mineral-feed additives play a special role in the production of complete feed, the lack of which in the feed ration leads to a significant disruption of metabolic processes in the body of farm animals and poultry. Production of balanced feeds allows to increase efficiency the use of compound feed when fattening consumers, therefore the main task of the development of feed production is to solve problems related to the filling of vital substances in the composition of compound feed produced. The basis for increasing the productivity of animal husbandry is related to the use of compound feed, which is balanced in terms of vitamin, mineral, amino acid and other constituent components that are necessary in the composition of the produced products. Protein-vitamin and mineral-feed additives play a special role in the production of complete feed, the lack of which in the feed ration leads to a significant disruption of metabolic processes in the body of farm animals and poultry.

Key words: *compound feed, carotene, method, analysis, substance.*

PROBLEM

For the standardized inclusion of vitamin supplements in the diet of compound feed, the accuracy of dosage and methods of express determination of their quantity in the conditions of existing technochemical laboratories of compound feed productions are of particular importance.

ANALYSIS OF THE LATEST RESEARCH

Carotenoids play an important role in maintaining the health and reproductive functions of animals. Carotenoids are an important component when filling compound feed, as an indicator of the quality of the products produced and the satisfaction of consumer requests, which makes the products competitive on the feed market [2]. The balanced inclusion of carotenoids in compound feed helps to prevent premature spoilage of manufactured products, when stored under conditions that provide for the necessary ventilation. Carotenoids are characterized by being an effective natural antioxidant. With a balanced filling of compound feed with carotenoids, there is an improvement in the color qualities of products, because color indicators are important quality indicators [1]. Practically all compound feed must include carotenoids, due to the fact that all groups and species of animals need them. Filling products with carotenoids is one of the factors that allows you to significantly increase and contribute to the indicators of the used compound feed recipe. It is important to achieve the conditions for constant access of carotenoids to the body of animals and poultry, which should take into account those carotenoids that are contained in other components of compound feed.

RESEARCH RESULTS

We considered the possibility of using rational accelerated methods of laboratory determination of the content of certain vitamins in compound feed and protein-vitamin supplements.

Vitamin A (carotene). Physical and chemical methods of direct spectrophotometry, fluorometry and colorimetry are used for the quantitative determination of vitamin A. The most operational and accessible of them for components that do not contain impurities, which have light absorption in the same region of the spectrum as vitamin A, is the method of direct spectrophotometry. The use of this method eliminates the need to prepare standard solutions and build a calibration graph [3,4]. In materials containing impurities that have light absorption at the same wavelengths as vitamin A, various methods of preliminary purification are used: saponification, chromatography, and obtaining chemically pure derivatives of vitamin A [4] (retinol, retinoic acid, and anhydrotretinol). If purification methods do not allow to isolate vitamin A with a characteristic spectral curve, then the colorimetric method is used. It was established that the method of direct

spectrophotometry should be used only when the absorbance value of vitamin A solutions at light wavelengths of 310 and 325 nm is 1. In this case, the absorbance value at 325 nm is used to calculate the vitamin A content. The fluorometric method, based on the ability of retinol to fluoresce under the influence of ultraviolet rays, is also promising. The resulting fluorescence has a maximum at 480 nm. Compounds that interfere with vitamin A by the fluorometric method include carotenoids, vitamin D, and phytofluene. To eliminate the influence of these impurities, it is recommended to use chromatographic purification using aluminum oxide. Currently, the colorimetric determination of vitamin A has significant errors when measuring the value of the optical density, due to the unusual ratio of the rates of two successive reactions - the formation and decay of the colored carbonium ion of vitamin A. The relative rate of decay of the carbonium ion is so great that the maximum intensity of the color is observed between the 5th and 10 seconds from the beginning of the addition of the reagent, therefore, when measuring the extension later than 10 seconds, the results are underestimated. This determined the need to find a more stable colored compound of vitamin A. For this purpose, phosphoric-molybdic acid was used. The literary sources contain information about the use of acid for the qualitative detection of vitamin A, but the conditions for the formation of the complex are not given. When studying the conditions of complexation, concentrations of vitamin A of about 10-5 g/ml, which correspond to the content of vitamin A in compound feed and BVS, as well as the necessary amount of phosphoric-molybdic acid to obtain a stable complex, were investigated. Research has established that the necessary amount of phosphoric-molybdic acid for the formation of a complex with vitamin A is 0.2 ml of a 10% solution. When studying the influence of pH on the value of the optical density, it was determined that it reaches its maximum value at a pH equal to 1-2, that is, the reaction takes place in a strongly acidic environment. When taking the spectral characteristics of the obtained complex compound on a spectrophotometer in the visible region, two maxima are observed at light wavelengths of 400 and 730 nm. The absorption maximum for the phosphoric-molybdic acid solution is in the spectrum at 400 nm. Therefore, for a more accurate measurement of the optical density and to reduce the photometry error, the measurement was performed at 730 nm. The size of the optical density depends on the nature of the solvent (Table 1). The maximum coloration was observed in benzyl alcohol and remained constant for 10 min. Thus, the relative stability of the obtained colored compound allows to increase the accuracy of determination of vitamin A.

Table 1. Dependence of the value of the optical density on time and the nature of the solvent at pH = 2.

Solvent	Optical density through, min					
	20	30	40	50	60	120
Allyl alcohol	0,077	0,090	0,097	0,127	0,445	
Acetone	0,685	0,835	0,930	1,010	1,100	0,500
Diethyl ether	0,022	0,022	0,020	0,028	0,039	0,425
Benzyl alcohol	1,300	1,720	1,720	1,610	1,550	1,300

The resulting colored compound obeys Beer's law in the vitamin A concentration range from $1.7 \cdot 10^{-5}$ to $1.2 \cdot 10^{-4}$ g/ml. To clarify the specificity of the reaction of vitamin A with phosphoric-molybdic acid, a study of the interaction of fat-soluble vitamins D₂ and E with this reagent was conducted. Optical density was measured on a spectrophotometer at 730 nm after 30 min using gasoline alcohol as a solvent. The results of measurements are given in table. 2.

Table 2 Dependence of optical density on the concentration of vitamins

Vitamin	Concentration, g/ml	Optical density through
A	$6,88 \cdot 10^{-5}$	0,82
D ₂ ,	$3,44 \cdot 10^{-4}$	0,09
E	$5,0 \cdot 10^{-3}$	0,15 4

CONCLUSIONS

A rational, accelerated method of laboratory determination of the content of carotenoids in compound feed and protein-vitamin supplements is considered and based on the results of the research, it is proposed.

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ОЦІНКА ВМІСТУ КАРОТИНУ В КОМБІКОРМАХ

І. Дударев, С. Уминський, А. Москалюк, С. Житков
Одеський державний аграрний університет

Подальше підвищення продуктивності сільськогосподарських тварин і птиці засноване на використанні комбікормів, збалансованих за поживними речовинами, вітамінним, амінокислотним і мінеральним складом, що задовольняють зоотехнічні вимоги. При виробленні повнораційних комбікормів особливу роль грають білково-вітамінні та мінерально-кормові добавки, нестача яких у кормовому раціоні призводить до суттєвого порушення обмінних процесів в організмі сільськогосподарських тварин і птиці. Виробництво збалансованих кормів дозволяє збільшити ефективність застосування комбікормів при відгодівлі споживачів, тому основним завданням розвитку кормовиробництва є вирішення завдань пов'язаних з наповненням життєво важливих речовин у складі комбікормів, що виробляються. Основа збільшення ефективності продуктивності тваринництва пов'язана з використанням комбікормів, які збалансовані за вітамінним, мінеральним, амінокислотним та іншими складовими компонентами, які є необхідними у складі виробленої продукції. При виробленні повнораційних комбікормів особливу роль грають білково-вітамінні та мінерально-кормові добавки, нестача яких у кормовому раціоні призводить до суттєвого порушення обмінних процесів в організмі сільськогосподарських тварин і птиці.

Ключові слова: *комбікорм, каротин, метод, аналіз, речовина.*