

## ANALYSIS OF FACTORS OF INFLUENCE ON THE QUALITY OF COMPOUND FEED DURING ITS STORAGE

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*Ensuring the most effective use of compound feed when feeding animals depends on the level of balance of nutrients in the composition of the manufactured feed and the conditions for its storage. Solving this problem is an urgent problem for both modern feed manufacturers and consumers of such products. The increase in the various prescription components of compound feed, taking into account the age of animals and their industrial purpose and the growth of requirements for their quality, necessitate not only the manufacture of a homogeneous mixture, but also determine the requirements for the conditions of their storage period without compromising quality. The homogeneity of the manufactured feed and the action of external factors have a significant impact on their feed quality, as well as changes in the structure of vitamins, micro and macro elements contained in the feed. It should be noted that the change in the quality of the compound feed occurs along the line of the physical characteristics of the compound feed, i.e. its density, granulometric composition, bulk density, as well as the duration of storage of mixed fodders, is significantly influenced by the index of the frequency of air exchange in the space between particles and others. The off-duty ratio during storage of mixed fodder with the introduction of active ventilation of bulk components has a significant impact on the process of intensive evaporation of moisture  $I B$  into the environment and it is characterized by an indicator of the active moisture transfer surface  $Fm_2$ , taking into account the difference in saturated water vapor pressure. During the storage of compound feed, accumulation of water is observed due to the sorption of water from water vapor in the air. Understanding the factors that determine the change in the quality of compound feed during its storage is an important element in the manufacture and use of compound feed.*

**Key words:** *compound feed, quality, structure, storage, duty cycle.*

**Formulation of the problem.** Loose feed for pigs was chosen as the object of study. The growing nomenclature and quantitative differences of biologically active substances in the preparation of optimal rations, species, and age of animals, determine the need for homogeneous mixtures to be stored, taking into account indicators that can ensure no deterioration.

**Analysis of recent research and publications.** The main direction of further development of the feed industry is related to solving urgent problems of improving equipment and technology, increasing the level of feed use of raw materials, improving quality, increasing yield and expanding the range of finished products prepared for long-term storage. Increasing the productivity of livestock is based on the use of compound feeds balanced in nutrients, vitamin, mineral, amino acid composition, content of antibiotics, antioxidants and other biologically active substances that meet scientific zootechnical requirements. The development of effective diets that ensure the highest efficiency of animal feeding, determines the main task of industrial feed production. Spoilage of compound feeds is due to the intensive activity and respiration of microorganisms that are in large quantities among the components of compound feeds. At technological property no more than 14% decrease in intensity of breath at the expense of their decrease in physiological processes is observed also development of spore fungi is suppressed. But in the process of storage there may be an accumulation of moisture which occurs due to the sorption of moisture from water vapor in the air. Providing conditions that prevent sorption processes creates storage conditions for feed without significant deterioration and loss. Relative humidity should be about 70%. Regular ventilation prevents the growth of mold. If there is enough space, an additional ceiling fan provides air circulation. Smooth floors, such as linoleum and tiled walls, are a good choice because they are quick to clean and disinfect. Floors and shelves should be washed and wiped regularly, but do not use too much water, otherwise the humidity level will be disturbed. As long as the feed remains dry and cool, most of these living organisms remain suspended or low in activity. If the grain reaches a moisture level above the recommended 12%, these organisms become active. Bacteria invade grain, fungi

multiply, insects and mites multiply faster and produce even more water, all of which destroys investment. To meet ideal conditions, microorganisms in food grow and produce toxins. When eating contaminated food, toxins are absorbed through the epithelial lining of the intestine and cause local tissue damage. In some cases, toxins can reach organs such as the kidneys or liver, the central nervous system, or the peripheral nervous system, where they can cause some damage. Aerated silos are equipped with fans that pass a controlled amount of air through the bulk mass. With proper aeration, the grain is cooled, and the temperature and humidity of the grain are equalized throughout the silo. Advantages of aeration Lower temperatures allow you to safely store wet grain for a long time. The uniform temperature of the grain mass in the silo prevents the migration of moisture. Prevent the development of hot spots. The growth of mold slows down, and the development of insects is sharply reduced. Seeds stored in a cool place retain their viability and energy longer. The uniformity of distribution of feed components contained in small quantities (vitamins, trace elements, antibiotics, etc.) significantly affects the feed quality of feed and shelf life. It is proved that the lack and uneven distribution of phosphorus and calcium delays the development of the skeletal system, the growth of the animal. Studies have shown that the lack of certain vitamins or groups of them in the diet leads to significant metabolic disorders in the animal, causing beriberi. Uneven distribution of chemically pure salts and trace elements leads to inactivation of vitamins. Where direct contact with micronutrient salts and vitamins is reduced, the quality of feed, namely its completeness, is significantly improved. The main ones are frictional properties, with certain coefficients of external and internal friction, particle size distribution, duty cycle, bulk density, density, hygroscopicity, thermal conductivity, gas permeability of air into the mixture particles and volumes between them. Studies have shown that the applications, which must be within the required limits, significantly affect the homogeneity of the mixture. The particle size of feed components should be determined by the amount of feed, which is especially important for biologically active components. The duration of storage of compound feeds produced according to different recipes is significantly influenced by physical properties [1,2]. The porosity of the mixture of feed components affects a group of indicators, the most important of which are the bulk density and duration of storage. The bulk density in the state of free filling  $\gamma_0$  (g / l) depends on the laying of particles of bulk material and during grinding tends to decrease. All other things being equal, the higher the value of the duty cycle, the less bulk density and vice versa. Toughness is an indicator, the value of which depends on the laying of particles, geometric dimensions and surface characteristics. With increasing humidity of the particles of mixed feed, the duty cycle increases, which leads to a decrease in bulk density and an increase in the angle of natural slope [2, 3]. Food storage is a vital component of the economic and social package.

**Research results.** Processing of research results, storage of bulk feed, performed on the review of work carried out in laboratory and industrial conditions, allowed to obtain empirical dependencies describing the change of the main parameters that affect the storage process. If the volume of particles of bulk material is taken as a unit, the duty cycle  $C_m$  will be determined by the ratio of the volume of partial spaces  $E$  to the total volume of the mixture  $1 + E$ :

$$C_m = E / (1 + E) \cdot 100\% \quad (1)$$

With increasing value of the duty cycle, the less bulk density and vice versa. When the density of the substance particles  $p$ , the bulk density of the mixture is determined by the expression:

$$\gamma = \rho / (1 + \delta) \quad (2)$$

With active ventilation, self-heating can be eliminated, and drying of the bulk mass and rapid cooling for preventive measures can be achieved. Since the duration of storage of feed is significantly influenced by the rate of air exchange in the space between the particles, at a height  $h_c$ , aerodynamic drag is determined by the expression:

$$H = h_c (acvb + bc v^2b) \quad (3)$$

where  $v_b$  is the velocity of air in the space between the particles;

$ac$ ,  $bc$  - coefficients, the values of which are determined by the duty cycle.

During storage with active ventilation of bulk materials, a significant effect of duty cycle on the intensity of moisture evaporation is known  $I_B$ , into the environment, which is determined by the size of the active surface before moisture transfer  $F_{M2}$ , the pressure difference between saturated water vapor and ambient vapor  $\Delta p$ , the value of barometric pressure  $H\delta$ , coefficient  $K_v$ , depending on the rate of air filtration, determined by the value of the duty cycle, and is expressed by the dependence:

$$I_B = F K_v \Delta p / H \delta \quad (4)$$

**Conclusions.** Empirical expression of the intensity of moisture evaporation into the environment was determined during the preservation of compound feeds with active ventilation of bulk materials.

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#### АНАЛІЗ ФАКТОРІВ ВПЛИВУ НА ЯКІСТЬ КОМБІКОРМУ ПРИ ЙОГО ЗБЕРІГАННІ Дударев І., Уминський С., Яковенко А., Макачук В., Королькова М.

*Від рівня балансу корисних речовин у складі виготовлених комбікормів та належних умов його зберігання залежить забезпечення максимально ефективного використання комбікорму при годівлі тварин. Вирішення такого завдання є актуальною проблемою як для сучасних виробників кормів, так і для споживачів такої продукції. Збільшення різних рецептурних складових комбікормів, з врахуванням віку тварин і їх промислового призначення та зростання вимог до їх якості викликають необхідність не тільки виготовлення однорідної суміші, але й обумовлюють вимоги щодо умов періоду їх зберігання без погіршення якості. Однорідність виготовлених комбікормів та дія зовнішніх факторів здійснюють істотний вплив на їх кормову якість, а також на зміни структури вітамінів, мікро та макро елементів які містяться у комбікормах.*

*Слід зазначити, що зміна якості комбікорму відбувається за рядом фізичних характеристик комбікорму, тобто його щільності, гранулометричного складу, об'ємної маси, також на тривалість зберігання комбікормів значний вплив робить показник кратності повітрообміну в просторі між частками та інших.*

*Показники шпаруватості під час зберігання комбікормів з впровадженням активного вентилявання сипких компонентів здійснює істотний вплив на процес інтенсивного випаровування вологи  $I_B$ , у довілля і воно характеризується показником активної поверхні вологовіддачі  $F_{M2}$  з врахуванням різниці в тиску насиченої водяної пари. В процесі зберігання комбікорму спостерігається накопичування вологи за рахунок сорбції вологи з парів води у повітрі. Розуміння факторів обумовлюючих зміну якості комбікормів при його зберіганні є важливим елементом виготовлення та використання комбікормів .*

**Ключові слова:** комбікорм, якість, структура, зберігання, шпаруватість.