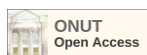




UDC 636.085.55-03:[636.085.7:66.094.6]
DOI <https://doi.org/10.15673/gpmf.v24i4.3005>



I. Chernega, PhD. Sc., Associate Professor, E-mail: ilonamalaki@gmail.com

<https://orcid.org/0000-0002-9507-8489>, Researcher ID: C-1457-2016

L. Fihurska PhD. Sc., Associate Professor, E-mail: fihurstka@gmail.com

<https://orcid.org/0000-0002-5555-6888>, Researcher ID: C-5633-2016

B. Iegorov, Doctor of Technical Sciences, Professor, E-mail: bogdanegoroff58@gmail.com

<https://orcid.org/0000-0001-7526-0315>, Researcher ID: Q-1365-2015, Scopus ID: 56578802600

A. Makarynska, Doctor of Technical Sciences, Associate Professor, E-mail: allavm2015@gmail.com

<https://orcid.org/0000-0003-1879-8455>, Researcher ID: C-5217-2016, Scopus ID: 57192819060

O. Tsiundyk, PhD. Sc., Associate Professor, E-mail: malik2008ts@gmail.com

<https://orcid.org/0000-0003-1846-3110>, ResearcherID:C-1401-2016

Department of grain and compound feed technologies

Odesa National University of Technology, 112, Kanatna Str., 65039, Odesa, Ukraine, +38487124113



INNOVATIONS IN THE USE OF ACIDIFIERS: MODERN SOLUTIONS FOR LIVESTOCK PRODUCTION AND INTELLECTUAL PROPERTY ASPECTS

Abstract

The article examines innovative approaches to the use of acidifiers in animal husbandry, their impact on animal productivity and health, as well as intellectual property aspects associated with the development and implementation of such solutions. The growing demand for animal products, in particular meat and eggs, leads to an increase in the number of animals and poultry and the need for effective solutions for their complete nutrition. This increases the demand for effective feed additives. The market for feed acidifiers is actively gaining momentum, as they meet modern requirements for efficient, safe and economical farming. Acidifiers help maintain an optimal pH level in the digestive system of animals, which contributes to better absorption of nutrients and reduces the risk of digestive disorders. They also stimulate the development of beneficial microflora in the gastrointestinal tract, which has a positive effect on the general condition of animals. In many countries, stricter restrictions on the use of antibiotics in livestock farming are being introduced due to concerns about bacterial resistance to drugs. Therefore, acidifiers are becoming an effective alternative to maintaining animal health without the use of antibiotics. In addition, acidifiers can increase the efficiency of feed processing, which allows you to reduce feed costs and increase the feed conversion ratio. This is important for farmers, as it allows achieving better results at lower costs. With the development of industrial animal husbandry, there is a need for more effective feeding methods, which makes feed acidifiers an important tool in maintaining animal health and productivity. The article examines the global and domestic market for acidifiers. A literature review of the results of the use of feed acidifiers in animal and poultry feeding by leading domestic scientists is presented. The results of tests are presented, which showed that the use of feed acidifier in feeding young pigs has a significant effect on biochemical blood parameters, meat quality and animal growth rate. Other data showed that adding acidifiers to the diet of broiler chickens contributed to an increase in survival, leads to feed savings while increasing productivity. The article also presents the main prospects, problems of using acidifiers in compound feed production and ways to solve them.

Key words: acidifier, intellectual property aspects, feed, additive, state, prospects, production, compound feed.

Introduction

High demand for animal protein and poultry products, particularly eggs, and increased investment in the sector are driving the growth of the poultry population. The population has grown significantly in recent years, mainly due to increased demand for chicken meat and eggs in consumer diets. The shift to poultry meat products in the US has been driven by rising prices for other meats, such as pork. Egg consumption in Europe increased by 4.6 % between 2017 and 2021, reaching 6.135 tones in 2021. The Asia-Pacific region is the largest producer of poultry, with production increasing by 6.6 % in 2022 compared to 2017. This growth was driven by increased demand for animal protein following the outbreak of African swine fever, which reduced pork supplies. China, which accounts for 40 % of the world's poultry production, has over 900 million laying hens, and the country's largest poultry center produces up to 60 million chicks annually [1].

The Middle East is also expected to witness a surge in poultry production between 2023 and 2029. Companies, including Almarai in Saudi Arabia, have invested heavily in the industry, spending US\$ 1.12 billion to set up new farms to expand produc-

tion. The increasing demand for poultry products and increasing investment in the industry are expected to drive the growth of compound feed production. This, in turn, is expected to boost the demand for feed additives in the global market in the coming years. Owing to these trends, the poultry industry is poised for significant growth in the near future [1].

Poultry farming, however, is accompanied by certain difficulties. In industrial poultry farming, diseases of the digestive tract are the second most common problem after viral infections. This often leads to a decrease in productivity and death of the bird. These diseases are especially dangerous for young birds, which are particularly vulnerable to diseases during the first 19 days of life. The digestive tract also acts as a barrier against infections, so its main functions - the absorption of nutrients and protection against diseases - require a certain level of acidity and proper microflora. This emphasizes the importance of using biologically active substances and natural growth stimulants, such as acidifiers, organic acids, probiotics, prebiotics and other natural additives, to ensure balanced feeding of poultry [16].

Thus, projections of global population growth, increased production of livestock products and com-



pound feeds, and increased awareness of acidifiers as an alternative to antibiotics will contribute to the development of the feed acidifier market in the coming years [1].

Purpose and objectives of the analysis.

The purpose of this article is to analyze the status and prospects for the use of acidifiers in the production of compound feed products for farm animals and poultry.

Results and its discussion

Global Acidulants Market Overview.

The growing need to improve feed efficiency and animal performance is one of the key factors driving the growth of the global feed acidulants market. Acidulants are additives consisting of organic and inorganic acids and other components used in animal nutrition to improve growth, increase feed efficiency, and prevent microbial contamination [4-5]. Acidulants help maintain an optimal pH level in the digestive system of animals, which improves nutrient absorption and reduces the likelihood of digestive disorders. This increases the demand for acidulants as farmers strive to increase feed conversion ratio, reduce feed costs, and improve overall animal health and performance [3]. The global feed acidulants market has emerged as one of the major segments of the feed additives market, accounting for 7 % of the global market in 2022. Feed acidulants play an important role in stimulating animal growth, improving metabolism, and increasing resistance to harmful pathogens such as bacteria, making them an effective alternative to antibiotics [1]. The feed acidulants market grew from US\$ 2.69 billion in 2023 to US\$ 2.89 billion in 2024. It is projected to grow at a CAGR of 7.51 %, reaching US\$ 4.47 billion (Fig. 1) by 2030 [1, 4].

The major sub-segment in the feed acidifiers market is the organic acid type. Acids such as formic, propionic, and lactic are widely used as acidifiers due to their antimicrobial properties and ability to maintain healthy intestinal microflora in animals. They help control bacterial growth, prevent feed spoilage, and improve nutrient absorption [3]. Propionic acid was the most popular feed acidifier, accounting for the largest share of the global feed acidifiers market in 2022, valued at US\$ 0.8 billion. This is due to its antimicrobial properties and ability to inhibit the growth of molds and some bacteria even at low concentrations. It is followed by fumaric acid and lactic acid in terms of value (Fig. 2). The share of other feed acidifiers is expected to grow at a CAGR of 5.6 % during 2024-2029.

The fastest growing sub-segment in the feed acidifiers market is mixed acidifiers. They combine several organic acids or acid salts to achieve a broader spec-

trum of antimicrobial activity and improved efficacy. Due to the synergistic effect of mixed acidifiers, they can act on various pathogens, making them increasingly popular in animal and poultry feed. Their ability to improve feed processing efficiency and maintain animal health contributes to their growing popularity in the market [3]. The global feed acidifiers market includes both established companies and new entrants. Players in the market are focusing on research and development activities aimed at improving the efficiency and performance of feed acidifiers. In addition, strategic collaborations, partnerships, and mergers and acquisitions are actively used to expand the market presence of companies. Technological innovations, government regulations, and the ability to offer cost-effective and sustainable solutions also influence the competitive landscape [3].

The feed acidifier market is fragmented, with the top five companies controlling 38.97 % of the market. The major acidifier producers in the world include large chemical corporations that specialize in the production of various chemical products, such as acids and alkaline compounds. The largest acidifier producers in the world include:

- BASF SE. The German company BASF is one of the largest chemical manufacturers in the world, producing a wide range of chemical products, including various acids.
- Dow Chemical Company. This American company is a leader in the field of chemical materials and produces numerous acids and other chemical products.
- Solvay SA. The Belgian company Solvay is a leader in the production of chemicals and offers a wide range of acids and related products.

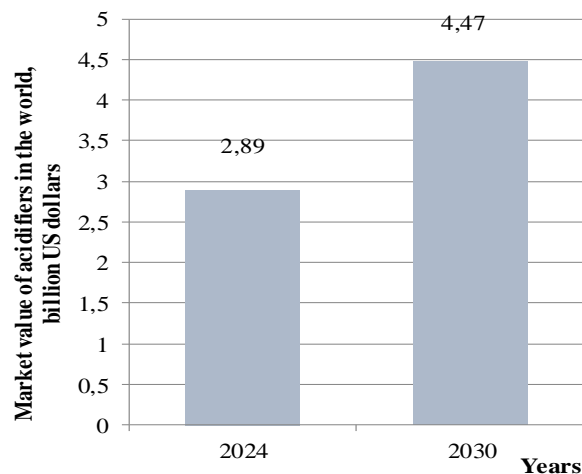


Fig. 1. Projected growth of the acidifiers market in the world in 2024-2030, billion US dollars [4]

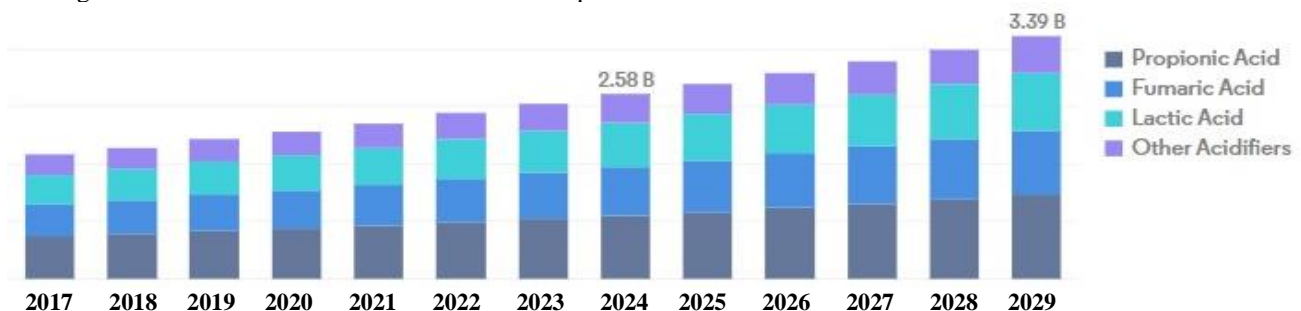


Fig. 2. Variety of acidified feeds by categories of subadditives in the world for 2017-2029, billion US dollars [1]



Fig. 3. Size of the acidified feed market in the world by region for 2019-2032, billion US dollars [5]

– INEOS Group Holdings SA. The British chemical corporation INEOS is one of the world's largest chemical manufacturers and produces a variety of acids for various applications.

– Arkema SA. The French company Arkema specializes in the production of chemical products, including various acids.

Other important companies include Alltech, Cargill Inc., Borregaard AS, Impextraco NV, Kemin Industries, Yara International ASA, DSM Nutritional Products AG and SHV (Nutreco NV) [1]. The main segment of the market is divided according to the geographical principle, since regional differences have a significant impact on market dynamics and consumer behavior. Within this geographical segmentation, the market is divided into five main sub-segments (Fig. 3) - North America, Europe, Asia-Pacific, Latin America, Middle East and Africa.

Each of these sub-segments has unique market characteristics and growth potential, driven by regional differences in agricultural practices, livestock production volumes, economic conditions, legal regulations and cultural advantages. The North American market is growing due to advanced livestock production practices, high awareness of animal health and strict feed additive standards. Europe shows similar trends, but with a greater emphasis on sustainability and stringent environmental requirements. The Europe Feed Acidifiers Market size is estimated at US\$ 616.2 million in 2025, and is expected to reach US\$ 784.8 million by 2030, growing at a CAGR of 4.96 % during the forecast period (2025-2030) [24]. Asia Pacific is characterized by the rapid industrialization of livestock production, rising meat consumption and increasing awareness of the benefits of feed acidifiers, especially in populous countries such as China and India. The Middle East and Africa markets show growing potential due to increasing meat consumption and a shift to more intensive livestock farming practices. Latin America is leveraging its strong agricultural base, particularly in Brazil and Argentina, to drive demand for feed acidifiers, supported by rising meat exports and domestic consumption. Each region creates unique opportunities and challenges that play a key role in the global expansion and market penetration strategies of feed acidifier manufacturers and suppliers [5]. As statistics show, the largest production of feed acidifiers occurs in countries with developed agriculture and numerous livestock

farms. The above-mentioned countries have favorable natural conditions and climate for agricultural production, as well as well-developed infrastructure for the production and distribution of feed acidifiers.

Overview of the domestic acidifier market.

There are several companies in Ukraine that produce feed acidifiers and are active in the agro-industrial market. Some of these companies also produce other feed additives and preparations. Here are some of these manufacturers:

- AgroBioTech. A company specializing in the production of biological products for agriculture, in particular feed acidifiers and probiotics.

- BioAgroControl. A Ukrainian manufacturer of biological products for the agricultural sector, in particular acidifiers and biological preparations for plant protection

- EKOPROM. A company that produces biological products for crop production and livestock, in particular feed additives, including acidifiers.

- BioTechNologiya. A manufacturer of biological products for agriculture, including acidifiers and probiotics for animals.

- Agrovetmarket. A company that produces feed additives and preparations for livestock, including acidifiers and probiotics [6-7, 8].

These are just a few examples of Ukrainian manufacturers of feed acidifiers. The market may include many more companies producing similar products. Today, among the most common acidifiers used in the production of compound feed in Ukraine are the following preparations: Biotronik, ULTRACID, Salmo-Mil, CuxAcid, Biacid, Acid Lac [6-7].

Feeding trial of pigs and poultry. The use of acidifiers in pig feed has become increasingly common in most farms. This trend is logical, since it meets modern farming requirements. The use of acidifiers helps to achieve several important results in pig farming, such as improved feed digestibility, reduced development of harmful microflora and strengthening of the overall health of animals [9-11]. There are studies (Bomko L.) on the use of dry feed acidifier based on organic acids and its effect on the productivity and health of young pigs in the first weeks after weaning and during the growing period. The study was conducted on young pigs of the hybrid breeds Large White and Landrace, weaned on the 27th ... 28th day of life. All groups were kept in



the same feeding and housing conditions, but 2 kg of the preparation per 1000 kg of compound feed were added to the compound feed for the experimental group. The basis of the preparation was a microgranulated acidifier containing formic acid (39 %), lactic acid (11 %) and propionic acid (9.5 %). The use of this preparation in the diet of young pigs contributed to better absorption of feed: feed consumption per 1 kg of gain in animals of the experimental group decreased by 6.7 % compared to the control group [9].

A study conducted by Voloshina M. studied the effectiveness of using the feed acidifier SK PRO in feeding young pigs and showed a significant effect of this preparation on the biochemical parameters of blood, meat quality and growth rate of animals. "SK PRO" consists of organic acids such as lactic, benzoic, propionic, formic, as well as an aluminosilicate carrier. The preparation improves the microflora of the gastrointestinal tract, due to a combination of various acids and microelements, and also increases the efficiency of protein digestion in the stomach. The use of feed acidifier increased the average daily gain of pigs by 9.9 %, while feed consumption decreased by 10.1 %. The addition of SK PRO acidifier in the amount of 2 kg per 1 ton of compound feed for young pigs contributed to an increase in the level of total protein and albumin in the blood, which indicates stimulation of protein metabolism. The effectiveness of the feed acidifier was demonstrated in the improvement of animal slaughter rates without a negative impact on the chemical composition of muscle tissue [13].

There is a known experience of research (Demicheshin O.V.) on the possibility of using an acidifier (in particular, Fidacid Max L) in industrial breeding of broiler chickens. The results showed that adding this acidifier to the diet of broiler chickens in liquid form for 27 days contributed to an increase in survival by 4.6 %. The total mortality of chickens decreased by half, reaching 4.3 %, which corresponds to the norm of up to 5 %. The study also showed that the use of the acidifier led to feed savings with increased productivity. Feed consumption per chicken decreased by 8.7 %, and feed conversion in the experimental group decreased by 0.19 units, which indicates improved digestibility and assimilation of feed. On the 43rd day of rearing, the broiler chickens from the experimental group had a greater live weight by 47 g and a carcass weight by 30 g, which is 1.8 % and 1.6 % of growth, respectively [14]. The results of a study (Mazur Yu.S., Mashkin Yu.A.) on the productivity of young Pharaoh quails are also presented, in which the effect of various concentrations of lactic acid as an acidifier in compound feed was studied. As a result of the experiment, it was found that adding an acidifier to the main feed for quails helps to reduce feed consumption per 1 kg of live weight gain. Birds that received compound feed with an acidifier (3 ml/kg) demonstrated the lowest feed costs per 1 kg of live weight gain throughout the experimental period (1...49 days), and their weight was higher than that of the control group birds by 2.3...6.0 % depending on age. During the experiment, it was revealed that the stagnation of lactic acid in one-year-old young quails practically does not contribute to their savings, which was lost at a high level, becoming 97...98 % [15].

The effectiveness of acidification in year-old

quails has been actively studied by other scientists, including Ibatullinim I.I., Nechaim N.M., Deineko R.M. and Otchenashkom V.V. They presented experimental data that showed the effectiveness of various types of acidifying agents and probiotics in young Pharaoh quails. The research they carried out showed that the best result is the addition of mixed feed to the quail diet with an acidified rare form based on lactic acid (0.3 ml per 100 g), with added mineral elements. This approach resulted in a significant increase and increase in the productivity of young animals, increasing body weight by 9.1...13.0 %, average and absolute growth by 9.6 %, as well as reducing feed consumption per 1 kg increase in body weight by 4.8 % over the growth period from 1 to 35 days [16].

Cattle feeding trials. Some researchers (Gutsol A.V., Dmitruk I.V.) studied the effect of fumaric and lactic acids on the meat productivity of young cattle. During the main study period, the average daily gains were higher in the young animals of the second experimental group, which received lactic acid, by 63 g (or 8.5 %), and in the young animals of the third group, which received fumaric acid, by 74 g (or 10 %). The difference was statistically significant in both cases compared to the control group. During the main study period (90 days), the consumption of feed units per 1 kg of gain in the second experimental group, which received lactic acid in the diet, was 0.21 feed units less, and in the third experimental group, which received fumaric acid, it was 0.29 feed units less compared to the control group. The increase in average daily gains of young cattle due to the use of fumaric and lactic acids can be explained by the fact that they have a shorter path in the energy formation process compared to glucose, and also stimulate the production of enzymes of the pancreas, intestines and stomach [17]. However, when using acidifiers, it is important to consider their physical state. Liquid acidifiers are usually added to water or liquid feed, and sometimes to dry feed. Solid acidifiers are used only as additives to feed. If solid acidifiers contain organic acids, which are usually in a liquid state, they are produced by applying liquid acids to an inactive carrier.

The use of liquid acidifiers is appropriate only for disinfection of water supply and drinking systems from pathogenic microorganisms. Solid acidifiers are more diverse in chemical composition, have a wider spectrum of action and provide a more pronounced effect. They allow you to solve problems more effectively, making the process more accurate and targeted. However, for their correct operation, effective mixers are necessary, since insufficient mixing of components using simple equipment can negatively affect the final quality of compound feed. The production of modern and high-quality compound feed requires the use of advanced technologies, so companies must have modern technological lines and the latest equipment at their disposal [18, 11].

In addition to the physical state, acidifiers also have different compositions. They may differ in component composition, concentration or ratio of individual components. If it is necessary to lower the pH level of the feed to improve its digestibility and suppress the growth of undesirable microorganisms, then acids, rather than



their salts, are the most effective for achieving this goal [19]. However, it is worth considering that excessive use of feed acidifiers or exceeding the concentration of acids can have negative consequences. This can lead to the suppression of beneficial intestinal microflora, in particular lactic acid bacteria. Therefore, it is not recommended to use one drug and one concentration for different sex and age groups of animals [20]. In addition, it is important to consider the volatility of some drugs, which requires special attention when storing and dosing them. For example, unlike formic acid, lactic acid does not evaporate and has low corrosive activity, which not only extends the service life of the equipment, but also does not affect the effectiveness of its use [20]. When using formic and acetic acids, it is worth considering that they have a distinct odor and can cause burns upon contact with the skin or eyes, and also have a strong corrosive effect [18].

However, in all cases of using feed acidifiers, it is important to ensure appropriate conditions for their storage, dosing and mixing with feed components. It should be borne in mind that acids have a high corrosive activity, so their addition to an old or damaged feed pipeline can significantly worsen its condition. For this reason, the use of acid complexes in the form of specialized preparations is more effective [20]. Therefore, the use of acidifiers in feed production is important for improving the quality of feed and ensuring animal health. They reduce the pH of feed, improving its digestibility, preventing the development of pathogenic microorganisms and promoting better absorption of nutrients.

The main prospects for the use of acidifiers in compound feed production:

- Improving feed digestibility. Acidifiers help reduce the pH in the gastrointestinal tract of animals,

which helps improve the activity of digestive enzymes and reduces the excretion of undigested feed particles. This is especially important for young animals, whose digestive system is not fully formed.

- Controlling pathogens and microbiological safety. Acidifiers help reduce the pH level in compound feeds, which creates unfavorable conditions for the development of pathogenic microorganisms, such as Salmonella, E. coli, and other harmful bacteria. This allows you to increase feed safety and reduce the risks of infectious diseases among animals.

- Improving the absorption of minerals and vitamins. Lowering the pH of feed can positively affect the bioavailability of minerals (especially calcium, magnesium, phosphorus) and vitamins. This allows animals to better absorb nutrients, which contributes to their health and growth.

- Increasing the efficiency of feed use. The use of acidifiers can reduce feed costs because animals use nutrients more efficiently. This, in turn, can reduce overall production costs and increase economic efficiency.

- Improving the quality of compound feed. Acidifiers help stabilize feed, reducing the risks of oxidation and spoilage. This allows the feed to be stored longer without losing its nutritional value and prevents the formation of toxic compounds.

- Regulating the acid-base balance in the animal body. For some animals, such as pigs and poultry, maintaining an optimal acid-base balance is an important aspect of their health. Acidifiers can help balance this process, improving the general condition of the animals and reducing stress.

- Environmental and economic aspects. The use of acidifiers can reduce the need for expensive antibiotics and chemical additives, which has a positive effect on the

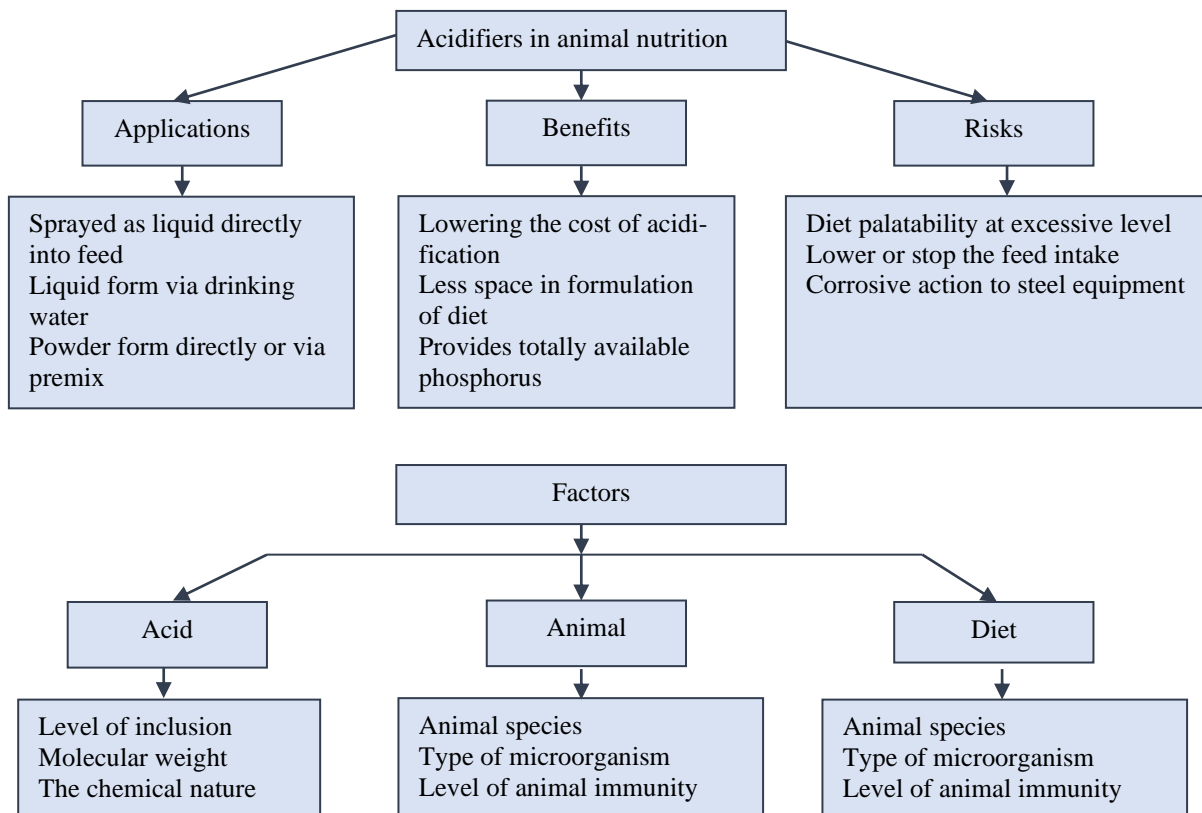


Fig. 4 - Use of acidifiers in animal nutrition [22]



environmental safety of production. This also reduces the cost of veterinary services and medicines.

However, despite all the prospects, the improper use of acidifiers in feed production can lead to some problems.

The main problems of using acidifiers in compound feed production:

- Insufficient pH control. Incorrect dosage of acidifiers or insufficient control of the pH level can lead to failure to achieve the optimal level of acidity in the feed. This can affect the efficiency of animal digestion of the feed.

- Deterioration of palatability. Some acidifiers can have an unpleasant taste or odor, which can affect the eating of the feed by animals. This can lead to a decrease in feed consumption and animal productivity.

- Risk of acid corrosion of equipment. Some acidifiers can be aggressive to metal equipment used in compound feed production. This can lead to damage or failure of the equipment due to corrosion.

- Negative impact on microflora. The use of acidifiers can affect the microbial composition of the feed and the gastrointestinal tract of animals, which can have negative consequences for their health and the efficiency of feed digestion.

- Costs. Some acidifiers can be quite expensive or require significant transportation, storage, and application costs. This can increase the overall cost of compound feed production.

All of these problems can arise from improper use of acidifiers in compound feed production, so it is important to follow appropriate technological processes and control the quality of the final product. Careful determination of optimal doses and control of pH levels in production can help avoid inappropriate effects of acidifiers on feed and ensure optimal conditions for digestion and consumption by animals. In addition, it is important to choose acidifiers that have the least negative impact on the taste, odor, and microflora of the feed, and do not damage metal equipment.

And the use of methods such as ultrafiltration or vacuum processing in production processes can help reduce costs, improve quality, and reduce the negative impact of acidifiers on the final product.

Therefore, the use of acidifiers in feed production is quite effective and economically beneficial. Due to the improvement of the hygienic properties of feed, the use of acids improves the digestion of animals, stabilizes their gastrointestinal microflora, etc. However, in order to reduce the negative impact of acidifiers on the production of compound feed and ensure high-quality and safe feed for animals, it is necessary to conduct innovative research and develop new methods of processing or using acidifiers in the production of compound feed [22, 23].

Intellectual property aspects of acidifiers relate to the following issues: protection of new acidifier for-

mulations, manufacturing processes and methods of application. Key challenges include avoiding patent infringement when developing similar formulations and ensuring robust intellectual property protection across multiple jurisdictions. Regulatory considerations: Compliance with feed safety standards and EU/US feed additive guidelines. Evaluation of acidifiers as safe alternatives to antibiotics within the legal framework. Ensuring the proper protection of the rights of acidifiers contributes to the development of innovation, increased competitiveness and the secure availability of products on the product market. Acidifier producers should invest in research and development to create more effective formulations, ensure compliance with regulatory standards, protect intellectual property, prioritize sustainability, conduct regular market research, and educate customers to build trust and promote the safe use of their products. Detailed patent search: Before filing an application for a patent, it is recommended to conduct a detailed patent search in order to avoid infringement of the rights of others and to evaluate the novelty and patentability of the development. Consultations with intellectual properties (IT) lawyers: Obtaining patent attorneys and lawyers specializing in IT will help you correctly fill out applications and ensure proper protection of rights. Market monitoring: Regular market monitoring allows us to identify violations of rights and immediately respond to instances of counterfeiting or unfair competition. Advancement of technology protection: Advancement of technology, such as QR codes or other means of identification, can help partners and partners verify the authenticity of a product.

Conclusions

Acidifiers are promising additives in compound feed production, as they can significantly improve feed digestibility, reduce the level of pathogenic microorganisms and promote better nutrient absorption. By reducing the need for antibiotics and reducing feed costs, acidifiers can also help reduce the environmental impact of livestock farming, in particular by reducing emissions of harmful substances into the environment.

That is why, as statistics show, the global market for feed acidifiers has become one of the main segments of the feed additives market and will continue to gain momentum in the world.

However, it is necessary to take into account potential risks and adhere to optimal dosages to achieve the desired effect without harming animal health. It is important to choose the right acidifiers that will have the least negative impact on the taste, smell and microflora of the feed, and will not harm metal equipment. It is also necessary to take into account the physical state and composition of acidifiers, as well as ensure appropriate conditions for their storage, dosing, and mixing with feed components.

REFERENCE

1. Feed Acidifiers Market size & share analysis – growth trends & forecasts up to 2029 [Veb-sayt]. - Odesa, 2024. URL: <https://www.mordorintelligence.com/industry-reports/global-feed-acidifiers-market-industry>
2. Animal Feed Market Size: 2031 Statistics [Veb-sayt]. - Odesa, 2024. URL: <https://www.linkedin.com/pulse/animal-feed-market-size-2031-statistics-info-wave-kmr-ioxwc>
3. Feed Acidifiers Market Size, Share, Growth Analysis, By Type (Organic acids and blended acidifiers), By Region – Industry Forecast 2024-2031 [Veb-sayt]. - Odesa, 2024. URL: <https://www.skyquestt.com/report/feed-acidifiers-market>



4. Feed Acidifiers Market by Compound, Form, Livestock, Type - Global Forecast 2025-2030 [Veb-sayt]. - Odesa, 2024. URL: <https://www.researchandmarkets.com/reports/5454941/feed-acidifiers-market-by-compound-form>
5. Feed Acidifiers In Animal Nutrition Market Size And Forecast [Veb-sayt]. - Odesa, 2024. URL: <https://www.verifiedmarketresearch.com/product/feed-acidifiers-in-animal-nutrition-market/>
6. Syrovatko K.M., Zotko M.O. Tekhnolohiya kormiv ta kormovykh dobavok [Veb-sayt]. - Odesa, 2024. URL: <http://repository.vsau.org/getfile.php/25142.pdf>
7. Iegorov B.V., Makarynska A.V. Suchasni al'ternatyvy kormovym antybiotykom dobavok [Veb-sayt]. - Odesa, 2024. URL: <https://ena.lpnu.ua:8443/server/api/core/bitstreams/f1b41404-db56-4cea-8d55-55978af2d81f/content>
8. Naykrashchi vyrobnyky kormiv dlya tvaryn u sviti u 2023 rotsi, shchob otrymaty dostup do dilovoyi doskonalosti [Veb-sayt]. - Odesa, 2024. URL: <http://surl.li/ftvxxs>
9. Bomko L. Vplyv orhanichnoho pidkyslyuvacha u skladi kombikormu dlya pokrashchennya rostu svynei [Veb-sayt]. - Odesa, 2024. URL: https://ibn.idisi.md/sites/default/files/imag_file/6_Camenetsk-Podolsk.pdf#page=200
10. Deshchenko O.S., Lykhach A.V. Vplyv preparativ «Baktsynol» i «Aktvyil-3» na vidtvoryval'ni yakosti svynomatok v umovakh promyslovyoi tekhnolohiyi [Veb-sayt]. - Odesa, 2024. URL: https://nubip.edu.ua/sites/default/files/u104/zbirnik_tez_nubip_2022.pdf#page=149
11. Zastosuvannya pidkyslyuvachiv v hodivli svynei [Veb-sayt]. - Odesa, 2024. URL: <https://agro.press/storage/journal/83/parts/1271/cffdd07d34b31234e5a83f463f50f4ae.pdf>
12. Kuzmenko L.M., Vyslanko O.O., Bankovska I.B., Zinoviyev S.H. Efektyvnist vykorystannya novoho preparatu – pidkyslyuvacha kormiv iz vmistom khelatnykh spoluk mikroelementiv u hodivli molodnyaku svynei [Veb-sayt]. - Odesa, 2024. URL: <https://dspace.pdau.edu.ua/server/api/core/bitstreams/99fa928c-223a-4838-b4d5-faf7ab74d936/content>
13. Voloshyn M., Syrovatko K. Efektyvnist' vykorystannya pidkyslyuvachiv kormiv v hodivli molodnyaku svynei // Zbirnyk student-s'kykh naukovykh prats'. Sil's'kohospodars'ki nauky. – 2022, № 3(7), s. 408-413.
14. Demychshyn O.V. Efektyvnist' zastosuvannya pidkyslyuvachiv u promyslovomu vyroshchuvanni kurchat-broyleriv // Naukovy visnyk LNUVMBT imeni S.Z. Gzhyts'koho. 2016. t 18. № 2 (67), s. 81-84.
15. Mazur YU.S., Mashkin YU.O. Zastosuvannya pidkyslyuvacha pid chas vyroshchuvannya perepeliv m'yasnoho napryamu produktyvnosti // Novitni tekhnolohiyi vyrobnytstva ta pererobky produktsiyi tvarynnystva: materialy mizhnarodnoyi naukovy-praktychnoyi. 2020. s. 9-11.
16. Ibatullin I.I., Nechay N.M., Deyneko R.M., Otchenashko V.V. Efektyvnist' zastosuvannya pidkyslyuvachiv ta probiotyky za vyroshchuvannya molodnyaku perepeliv // Biolohiya tvaryn. 2016. t. 18. № 1. s. 33-39
17. Hutsol A.V., Dmytruk I.V. Vplyv fumarovoyi ta molochnoyi kyslot na m'yasnu produktyvnist' molodnyaku velykoyi rohatoyi khudoby // Kormy i kormovyrobnytstvo. 2021. Vyp. 92. s. 129-136.
18. Bomko V.S., Syvachenko YE.V., Smetanina O.V. Kormy i kormovi dobavky ta efektyvnist' yikh vykorystannya v hodivli tvaryn // Navch. posibnyk. – Bila Tserkva. 2023. 225s.
19. Yaroshko M. Pidkyslyuvachi kormiv u ratsionakh svynei – choho vid nykh chekaty [Veb-sayt]. - Odesa, 2024. URL: <https://agroexpert.ua/pidkisluvaci-kormiv-u-racionah-svinei-cogo-vid-nih-cekati/>
20. Nikolayenko S. Rol kormovykh pidkyslyuvachiv u suchasnomu svynarstvi [Veb-sayt]. - Odesa, 2024. URL: <https://agroexpert.ua/rol-kormovykh-pidkyslyuvachiv-u-suchasnomu-svynarstvi/>
21. Orhanichni kysloty dlya pokrashchennya zdorov'ya ta rostu svynei [Veb-sayt]. - Odesa, 2024. URL: <https://pigua.info/uk/post/organichni-kisloti-dla-pokrasenna-zdorova-ta-rostu-svinej-uk>
22. Denisenko D.V., Chermega I.S., Tsyundyk O.G., Fihurska L.V. Features of the use of acidifiers in the production of combined feeds // Zbirnyk naukovykh prats 78-yi Mizhnarodnoyi naukovy-praktychnoyi konferentsiyi «Suchasni tekhnolohiyi u tvarynnystvi ta rybnystvi: navkolyshnye seredovyshe – vyrobnytstvo produktsiyi – ekolohichni problemy». - Kyiv, 2024. s. 144-146.
23. Patent CN101690544B. Animal feed additive for piglets and preparation method thereof. Published. 08/14/2013. URL: <https://patents.google.com/patent/CN101690544B/en>

УДК 636.085.55-03:[636.085.7:66.094.6]

І.С. Чернега, канд. техн. наук, доцент E-mail: ilonamalaki@gmail.com
Л.В. Фігурська, канд. техн. наук, доцент E-mail: fihurska@gmail.com
Б.В. Сгоров, д-р техн. наук, професор E-mail: bogdanegoroff58@gmail.com
А.В. Макарянська, д-р техн. наук, доцент E-mail: allavm2015@gmail.com
О.Г. Цюндик, канд. техн. наук, доцент E-mail: malik2008ts@gmail.com

Кафедра технології зерна і комбикормів

Одеський національний технологічний університет, вул. Канатна, 112, м. Одеса, 65039, Україна

ІННОВАЦІЇ У ВИКОРИСТАННІ ПІДКИСЛЮВАЧІВ: СУЧАСНІ РІШЕННЯ ДЛЯ ТВАРИННИЦТВА ТА АСПЕКТИ ІНТЕЛЕКТУАЛЬНОЇ ВЛАСНОСТІ

Анотація

У статті розглядаються інноваційні підходи до використання підкислювачів у тваринництві, їх вплив на продуктивність та здоров'я тварин, а також аспекти інтелектуальної власності, пов'язані з розробкою та впровадженням таких рішень. Зростання попиту на тваринні продукти, зокрема м'ясо та яйця, призводить до збільшення поголів'я тварин та птиці і потреби в ефективних рішеннях для їх повноцінної годівлі. Це підвищує попит на ефективні кормові добавки. Ринок кормових підкислювачів активно набирає оберти, оскільки вони відповідають сучасним вимогам щодо ефективного, безпечного та економічного ведення сільського господарства. Підкислювачі допомагають підтримувати оптимальний рівень рН в травній системі тварин, що сприяє кращому засвоєнню поживних речовин і зменшує ризик травних розладів. Вони також стимулюють розвиток корисної мікрофлори в шлунково-кишковому тракті, що позитивно впливає на загальний стан тварин. У багатьох країнах вводяться суворіші обмеження на використання антибіотиків у тваринництві через побоювання щодо стійкості бактерій до ліків. Тому підкислювачі стають ефективною альтернативою для підтримки здоров'я тварин без застосування антибіотиків. Крім того, підкислювачі можуть підвищити ефективність переробки кормів, що дозволяє знижувати витрати на корм і підвищувати коефіцієнт конверсії корму. Це важливо для фермерів, оскільки дозволяє досягати кращих результатів за менші витрати. З розвитком промислового тваринництва виникає потреба в більш ефективних методах годівлі, що робить підкислювачі кормів важливим інструментом у підтримці здоров'я та продуктивності тварин. У статті досліджено світовий та вітчизняний ринок підкислювачів. Представлено літерату-



рний огляд результатів використання провідними вітчизняними вченими кормових підкислювачів у годівлі тварин та птиці. Наведено результати випробувань, які показали, що використання кормового підкислювача годівлі молодняка свиней має значний вплив на біохімічні показники крові, якість м'яса та інтенсивність росту тварин. Інші дані показали, що додавання підкислювачів до раціону курчат-бройлерів у сприяло збільшенню виживаності, призводить до економії кормів при зростанні продуктивності. Також у статті наведені основні перспективи, проблеми використання підкислювачів у комбікормовому виробництві та шляхи їх вирішення.

Ключові слова: підкислювач, інтелектуальна власність, корм, добавка, стан, перспективи, виробництво, комбікорм.

Received 25.10.2024

Reviewed 18.11.2024

Revised 28.11.2024

Approved 26.12.2024

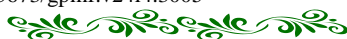


Cite as Vancouver Citation Style

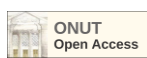
Chernega I., Fihurska L., Iegorov B., Makarynska A., Tsiundyk O. Status and prospects of using acidifiers in compound feed production. Grain Products and Mixed Fodder's, 2024; 24 (4, 96): 31-38. DOI <https://doi.org/10.15673/gpmf.v24i4.3005>

Cite as State Standard of Ukraine 8302:2015

Status and prospects of using acidifiers in compound feed production. / Chernega I. et al. // Grain Products and Mixed Fodder's. 2024. Vol. 24, Issue 4 (96). P. 31-38. DOI <https://doi.org/10.15673/gpmf.v24i4.3005>



UDC 636.085:2.087.2



DOI <https://doi.org/10.15673/gpmf.v24i4.3006>

¹O. Khodakivskiy, Master of ONUT, E-mail: jur_@ukr.net

^{1,2}Ye. Baranovskiy, Deputy Director for Development of LLC "Mega Korm", postgraduate student of ONUT,

E-mail: bjdkharkov@ukr.net

¹Odesa National University of Technology, 112, Kanatna Str., Odesa, 65039, Ukraine

²LLC "Mega Korm", 12, Stepova St., Zmiiv, Kharkiv Region, 63401, Ukraine

VETozYM MULTI - AN INNOVATIVE SOLUTION FOR THE POULTRY INDUSTRY

Abstract

The materials of the article describe the role and purpose of enzymes in feed production, in particular for poultry farming. The composition of the multienzyme preparation Vetozym Multi from the company "Vetsintez" is characterized, which contains a complex of enzymatic activities: glucanase, xylanase, cellulase, protease, amylase, mannanase, phytase. The practical results of using the multienzyme preparation Vetozym Multi as part of compound feeds for broilers are presented. The recipes of the compound feed Grower for broilers are calculated and the optimal rate of enzyme introduction is established in the amount of 100 g per 1 t. The percentage of microcomponents introduced into the compound feed Grower for broilers is compared and the nutritional indicators of compound feed without and with the use of the multienzyme preparation Vetozym Multi are calculated. It was established that the introduction of the enzyme allows to reduce from 20 to 30% monocalcium phosphate in the composition of the recipe, due to the existing phytase activity. Vetozym Multi significantly increases the efficiency of feed use, an increase in average daily weight gain of broilers by 1..2.5 g is observed, the conversion rate of compound feed for poultry is reduced by 0.02...0.07 and the cost of recipes is reduced by 300-500 UAH/t, which became possible due to the optimization of the use of sunflower and grain products with a high fiber content. The presence of thermostable enzymes in the composition of the Vetozym Multi preparation allows it to be used in the production of compound feeds with advanced heat treatment at a conditioning and granulation temperature of up to +90 °C, which will contribute to a more complete breakdown and assimilation of raw material components, in particular carbohydrates, proteins and fiber. Calculation of economic indicators shows that the drug Vetozym Multi not only provides balanced nutrition for poultry, but also allows you to reduce the cost of feed due to more efficient use of less expensive components.

Keywords: enzymes, activity, drug Vetozym Multi, feed, efficiency, poultry farming.

Introduction

In the modern world of poultry farming, where every parameter of productivity and efficiency is of great importance, the indispensable desire for innovation is key. The market is constantly looking for ways to optimize production processes, reduce costs and improve the quality of livestock products. In this context, the entry into the feed production market of the multi-enzyme composition "VETOZYM MULTI" from the company "Vetsintez" in fruitful cooperation with leading specialists of the company "MEGA KORM" has become a real breakthrough, offering an effective solution for a wide range of challenges faced by poultry farms.

Literary review and formulation of the problem

Poultry farming issues

Poultry farms are constantly faced with the need to increase productivity and product quality while reducing costs. The main challenges consist of the following issues:

1. The high cost of feed, which accounts for a significant share of production costs.
2. The need to ensure balanced poultry feeding, which requires precise recipes and compliance with certain standards.
3. Problems with poultry health, in particular with digestive disorders due to poor-quality or incomplete, unbalanced feeding.