The Importance of Using Natural Zeolite in Livestock

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***Abstract*— The increase in the world population and the rising demand for agricultural products have led to intensive farming practices in both crop and livestock production. Health considerations were often secondary in intensive production methods, prioritizing higher yields per unit area. Unregulated and excessive drug use in animal farming has resulted in drug residues in animal products, posing health risks to consumers. In this study, current studies will be included as natural zeolite increases both milk yield in cattle and egg yield in chicken.**

***Index Terms*—**Milk yield in cattle, Egg production in chicken, Natural Zeolite

I. INTRODUCTION

The use of nitrates and other chemical residues in animal feed has raised significant concerns regarding food safety and public health. Additionally, conditions such as Creutzfeldt-Jakob disease (CJD) and Bovine Spongiform Encephalopathy (BSE) have highlighted the risks associated with non-hygienic feed sources (House et al., 2020).

Basic guidelines for organic animal husbandry include choosing the right breeder and breeds, providing suitable housing, caring for animals well, and using the organic feed. Compound feeds today, chemical additives used as well as their unintentional use in animal products and food cause health issues in consumers. significant developments in animal health. Uses of compounds in animal nutrition include feed additives that do not deteriorate and boost output. In this regard, research has also been conducted on zeolite, a natural mineral resource . (House et al., 2020; Ogunade et al., 2018)

In recent years, both in our nation and around the world, the proportion of eggs and chicken meat in human nutrition has increased. Our 1984 egg production totaled 300 thousand tons, and our 260 thousand tons of chicken meat production. This level is being reached via genetic studies, nutrition, business, marketing, and other things. The availability of basic and active nutrients in the proper quantity and quality from the mixed feeds plays a significant role among these factors, which are all of high economic significance (House et al., 2020; Ogunade et al., 2018).

A. Importance of Zeolite

Zeolite minerals include phillipsite, heulandite, lomantite, erionite, chabazite, analcime, and clinoptilolite, with clinoptilolite being the most abundant and technologically significant, which includes metal ions and water vapors, is one of the best among others. Being acid and a natural base that can endure bases (pH: 1.5-11), this mineral can keep toxic substances in a changing state at temperatures up to 750 ºC (Banerjee & Khan, 2022; Górniak, Popiela, Szuba-Trznadel, Konkol, & Korczyński, 2022; House et al., 2020; Vila-Donat, Marín, Sanchis, & Ramos, 2018).

Agriculture and Rural Affairs in Turkey Ministry of Organic Agriculture Principles and 10 June of the Regulation on the Implementation Annex 7/D.6 of the Law No. 25841 of 2005 Natural zeolite (clinoptilolite) mineral as a feed supplement in organic cattle. According to the article, the 70/524/EEC directive was approved by the Feed Commission on June 16, 1999, in the European Union and Europe (House et al., 2020; Manjaiah et al., 2019; Vila-Donat et al., 2018).

II. ZEOLITE EFFECTS ON LIVESTOCK PRODUCTS

A. Chemical and Physical Fundamentals of Zeolite

Zeolites possess a honeycomb-like structure with exchangeable cations and water, featuring millions of channels ranging from 2 to 12 Å in size. It has little trouble fitting the spaces into its framework. It has a "molecular sieve" structure made of alkaline earth ions and changeable liquid and gas molecules. Because of its ion exchange capability, the buffer completes its task by absorbing one cation and desorbing the other. It is insoluble in water and its surroundings, in contrast to several clay minerals. They are minerals with a large cation exchange capacity with a long shelf life. For instance, in 100 g of soil, zeolite is 195 meq, the turban is 150 meq, and clay is 30 meq (Banerjee & Khan, 2022; Górniak et al., 2022; Manjaiah et al., 2019; Smith & Girish, 2012).

Due to its popularity and lack of hazardous ingredients, natural zeolite minerals of the non-fibrous clinoptilolite type are ideal for organic cattle production. Alkaline and earth alkali cations like Na, K, Ca, and Mg; naturally occurring zeolites, such as clinoptilolite; and elements including hydrous aluminosilicate (Table 1). United States, Japan, Canada, Australia, Cuba, China, the former Soviet Union, Italy, Hungary, Bulgaria, and Korea are among the nations that produce zeolite. Turkey has 45.8 billion tons of zeolite reserves, with deposits in Ankara, Kütahya, Manisa, İzmir, Balikesir, and Cappadocia (Banerjee & Khan, 2022; Górniak et al., 2022; Manjaiah et al., 2019; Smith & Girish, 2012).

TABLE I
CHEMICAL PROPERTIES OF CLINOPTILOLITE MINERALS

Content	Ratio (%)
CaO	2,5-3,7
SiO_2	65-72
Al_2O_3	10-12
Fe_2O_3	0,8-1,9
K_2O	0.9-1.2
TiO_2	2.3-3.5
LOI	0-0.1
MnO	9-12
SiO_2/Al_2O_3	0-0.08

LOI: loss of ignition.

III. AREAS OF ZEOLITE USE

Natural zeolites are used in many industries, but they are not used for fertilization and soil preparation, agricultural conflict, soil pollution control of wastewater, flue gases, oil spill cleanup, oxygen production from coal production, natural gas purification, solar energy utilization, production of petroleum products, mineral exploration, paper industry, construction, health, and detergent widely used in industry (Banerjee & Khan, 2022; Górniak et al., 2022; Manjaiah et al., 2019; Smith & Girish, 2012).

Global zeolite usage is 750 thousand tons per year, with 70% of this consumption going toward detergent, 10% going toward adsorbent, 8% going toward the manufacture of desiccant, and 8% going toward other uses (Banerjee & Khan, 2022; Górniak et al., 2022; Manjaiah et al., 2019; Smith & Girish, 2012).

A. Animal Nutrition Use

Zeolite use has been raised since 1965 for use in feed research; variations in their absorption into compound feeds at levels that boost live weights without harming animal health are noted. As a feed supplement, fat is typically employed as clinoptilolite and mordenite types. 75–85% of the zeolites used. Clinoptilolite must be present, and the boron content must be less than 10 ppm (House et al., 2020; Vila-Donat et al., 2018).

Clinoptilolite increases the effectiveness of feed consumption by absorbing toxins and nutrients from the feed when it is introduced to diets. It makes digestion easier and more efficiently delivers nutrients and other chemicals. serves as a consumable. By raising the value of clinoptilolite bait, the cost of production is reduced and the fattening time is cut down. also It continually exchanges ions and is active from the time it enters the digestive system until it is eliminated. Although the aluminosilicate structure is unaffected, it does not build up in the body or mix with the blood before being eliminated (House et al., 2020; Wang et al., 2020) (Vila-Donat et al., 2018).

Natural zeolites do not interact with other feed ingredients, such as vitamins, antibiotics, trace elements, or phosphates. Feed conversion rate, performance, and feed minimize the negative effects of aflatoxin on consumption, and animal livers lower mycotoxin concentrations (House et al., 2020; Vila-Donat et al., 2018).

3.2. Use in Poultry

Clinoptilolite improves calcium absorption, enhancing eggshell quality and reducing the occurrence of shell-less or cracked eggs. Additionally, it improves eggshell texture, maintains natural color, extends shelf life, and sustains production efficiency in older hens. It minimizes the disturbance of the herd, lowers mortality rates, boosts productivity, and decreases the water content of the feces by strengthening the bone structures of the animals, which also removes deformities of leg, particularly in the breeding of broilers. The cleanliness of the poultry is ensured by the feces' dryness, which also guards against disease in the animals (Dschaak, Eun, Young, Stott, & Peterson, 2010; Vila-Donat et al., 2018).

The amount of 20 g/kg of clinoptilolite of volcanic origin in the broiler feed should consist of at least 85% clinoptilolite and at most 15% feldspar, mica, clay, quartz, and fiber-free volcanic alumina oxide form (Đuričić et al., 2020; Vila-Donat et al., 2018).

Natural zeolites, which make up 1.5% of egg chicken rations, have been found to enhance egg production. Zeolitin, which makes up 2.5–3.5% of the rations but was not statistically significant, reduced feed intake and so had a favorable impact on feeding (Folnožić et al., 2019; Voigt, Howard, & Beresford, 2007).

The rate of damaged eggs was decreased by adding natural zeolite to egg chicken feeds at levels of 1%, 2, and 3. In a study where clinoptilolite was added to egg chicken diets at 3.5%CA + 1% and 2%, it was found that feed consumption and egg weight were the highest and that 6.25% of the feeding was cured by 2% clinoptilolite (El-Nile et al., 2023; Voigt et al., 2007).

By incorporating natural zeolite at levels of 1%, 2%, and 3% into egg chicken feeds, the rate of damaged eggs was reduced. In a study, whoitolite was added to egg and chicken diets at 3.5%Ca + 1% and 2%, and it was discovered that 6.25% of the feeding was consumed as well as egg weight (El-Nile et al., 2023; Voigt et al., 2007).

Iv. CONFLICT OF INTEREST

The author declares that there is no conflict of interest

V. ACKNOWLEDGMENTS

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