THE POTENTIAL OF SOME ROMANIAN ZEOLITES TO IMPROVE BIOECONOMY RESULTS

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Abstract

The volcanic zeolites tuffs represents a ecoalternative resource of the future so it is important to know and disseminate information regarding their efficient use in the bio economy. In Romania, there are 4 major areas where there are zeolites, respectively, Transylvania basin, Maramures basin, Prahova Valley and Persani area. Only Rupea mine has a production capacity of 5000 tone monthly, with this capacity would reach zeolites for 100 years. Generally, the Romanian volcanic tuffs have a high content of clinoptilolite, which give them a high value. Although it Romania is plenty of high quality zeolite tuffs, they are not fully exploited because of the inexistence of a policy for promoting their capitalization. In this paper we intend to do a review of the effects of using zeolites in various in various fields of animal husbandry, in order to highlight the positive impact on the bio economy. They were analyzed a series of research conducted in Romania, upon various species of animals in terms of production and animals health, have been performed comparisons with the data from the international literature and were indicate those areas where Romanian future research should focus.

Key words: volcanic zeolites tuffs, bioeconomy results, Romania

INTRODUCTION

Freiherr Axel Fredrick Cronstedt discovered zeolites in 1756. Since than, there have been discovered 45 natural species of zeolites and more than 100 species have been synthesized in the laboratory. After the discovery of large minerals deposit in the U.S.A., the Soviet Union, Japan and Turkey, the inters for studying zeolites and their use in bioeconomy has grown constantly [11].

In Romania, the research in this field started only in 1978 in Cluj Napoca′ area (The Biology Research Center Cluj in cooperation with Ecology and Aquaculture Laboratory –Piatra Neamt. It follows a decade of timid research in the laboratory. After 1990 professor Salajan Gh et col. started new research regarding the use of zeolites in animal feeding. In 2000 young Romanian researchers began studying zeolites and the ways of using them in animal breeding and their effects. According to a study by the EFSA (European Food Safety Authority) since 2007, the additives based on zeolite have been declared safety for final consumer of meat, milk or eggs from animals that have received zeolite in feed or litter. The clinoptilolite zeolite is registered in Europe Community as food additives DIN 53 770 and in U.S.A. no. 21 CFRCH.I, §182 SubpartC.

In Japan, zeolites were approved as food additives in 1996; in human medicine 39 patents have been applied since 1986 worldwide.

The purpose of this paper is to review the potential use of natural zeolites in animal productions and indicate those areas where Romanian future research should focus.

MATERIAL AND METHODS

A total of forty-one experiments have been cited involving the use of zeolite in cows and poultry production. The zeolites had been included in diets or litter. The type of zeolite wasn't named in all studies. In 80% of experiments natural clinoptilolite was

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used. Not all experiments provided information on particle size, chemical composition or mineralogical composition.

Three out of the twentytwo experiments conducted on cows evaluated the calves health fed with zeolite in colostrum. Seven experiments were cited where zeolites had been included in diets for broiler, one experiment for turkey broilers and thirteen on laying hens. Were analysed the results regarding food intake, growth rate, feed effiency ratio, egg production, egg weight, mortality and microclimate parameters.

RESULTS AND DISCUSSIONS

Reference [40] reported an improve of immunological capacity of calves fed with colostrums and addition of clinoptilolite. The best results were obtained when the calves were fed with 1,5 l colostrums and 5 g clinoptilolite/l. Similar results were obtained by administration 1 g clinoptilolite per kg of body weight per day in new born calves food [27]. Vrzgula L., 1988 studied the addition of zeolite in the colostrums (1 gram/kg body weight of every feeding). The results highlight the calves fed with zeolite in colostrums have registered a decrease of diarrhea and an associated respiratory syndrome compare to the control lot. This treatment offers a possibility to decrease of use of expensive antibiotics.

In international literature are cited much more experiences on the use of zeolites in feeding cows.

Sherwood D.M. and al., 2005 evaluated the effects of adding clinoptilolite zeolite clay at 1,2% of the diet on steer performance and nitrogen volatilization loss. Small improvements have been observed in ADG and F : G for steer fed zeolite. They didn't observe any differences in steer performance, removed manure composition or N balance. Clinoptilolite in the diet for dairy cow (fed with urea or other sources of non protein nitrogen) lowers the risk of toxicity by preventing a pH increase and ammonium increase in the blood serum [4]. Sweeney T.F., 1983, did not find any difference in the growth rate or average daily intake due to the use of clinoptilolite in dairy cow feed, except the improvement of digestion, metabolism, fibre digestion and rumen fermentation.

One experiment found not effect of clinoptilolite on milk quality [16]. In this experiment the diet of experimental lot included 6% zeolites versus control. Rumen ammonia was lowered by the addition of zeolite that means an improve utilisation of protein. Serum Ca, Mg, K and Na was not affected by diet.The researchers believe that better results would be achieved if the clinoptilolite is used in an earlier stage of lactation.

Experiment performed by [9] showed conflicting results. Was noticed initial slight decline in calcium concentration in sera and urine of dairy cows fed with zeolite wich was likely caused by decreased availability of calcium from zeolite containing diet. Serum Mg and P was also decreased partly caused by interference of zeolite with intestinal absorption and partly by a marginal dietary supplementations of these minerals. One experiment reported favorable results regarding daily live weight gained [5] in favor of treatment with zeolite.

Grabherr H. et al., 2008 reported the feed intake post partum as well as the milk yield were not affected by zeolite supplementation. They also showed a daily dose of 90g zeolite/kg dry matter is not acceptable for preventing milk fever.

Sanders K.J. et al., 2000 gave conflicting results. In this experiment on black baldy steers the zeolite diets (2 and 8% clinoptilolite) increased feed intake with 8% producing the grates feed intake. The addition of zeolites to high concentrate diets did not improve performance or carcass traits of steers. The addition of 2% clinoptilolites gave a more favorable response than other levels.

Katsoulos P.D. et al., 2005 reported that 1,25 and 2,5% of clinoptilolite in the concentrated feed of dairy cows did not affect the blood analysis, either in the long term or during the monthly samplings, suggesting that erythropoiesis was not impaired by clinoptilolite. Similar results were reported on steers by [17].

From the data of [13,14,15], the FEEDAP Panel concludes that a daily dose of 500 g

Zeolite given for two weeks prior to calving is effective in reducing the risk of milk fever [8].

In the present study it is also reviewed the application of natural zeolites for poultry. In poultry production zeolites can be used as a feed additive to improve performences, to assist in manure and litter management and to assist in controlling air quality in poultry farms enviroments.

Many experiments reported no difference on body weight or growth rate between zeolite and non zeolite diets of laying hens [21, 28, 36].

References [31, 28, 35] gave informations regarding the zeolites effects upon the egg production and eggs parameters. The results showed no difference between zeolite and non zeolite diets.

References [12] reported no significant differences in henday egg production, egg weight, egg mass, daily feed consumption, corrected feed efficiency, body weight and body weight loss due to dietary treatment with different dozes of zeolite.

In 2004 romanian researches from USAMV Iasi reported an improvement of the production parameters generated by the binding aflatoxines by zeolites in gastrointestinal tract [23].

Dragotoiu D. et al., 2010 reported informations on mortality in broiler. Results obtained showed a reduced mortality when diet containing 2% volcanic zeolites tuffs.

The results regarding the effect on body weight were conflicting when we are talking about broilers.

In experiments cited the zeolit level in feed varied from 0 to 10%, with 5% zeolite in most cases.

Mallek Z. et al., 2012 reported positive results of zeolite upon performance indicators at broilers. Broilers that were fed on the zeolite diet were growing to a faster rate ($p < 0,05$) compared with those of the control group. The administration of clinoptilolite (0,5 and 1% of the commercial additive ZeoFeed) in the feed mixtures for the chickens in the experimental group was positively reflected in performance indicators.

These results agree with previous reports in which it was found that zeolite added in the broiler feed increased body weight [10] and increased growth rate [19]. This positive effect of zeolite on performance production could be due to its ability to reduce toxic effects of materials such as aflatoxins as it has been reported in several studies [18, 29, 23].

High atmospheric ammonia in poultry farms is associated with respiratory diseases, diarrhea, high mortality and uneconomical performances [7, 2].

Wu-Haan W. et al., 2007 reported an increase in performance on zeolit diets compare to controls at pullets and laying hens.

Forms of zeolite have been used to remove ammonium from aqueous solutions [38] and help in reducing ammonia production by broilers [3, 6].

Marin M. et al., 2014 reported information regarding the use of volcanic zeolite tuffs in turkey broilers. In this experiment zeolite was introduce in compound feed 3% in the first two phases of growth and 5% in the rest. Also, volcanic tuff was applied in the hall where it was used as a mineral additive in a proportion of 40%, 60% being the wood shavings. Results showed that volcanic tuff use in compound feeds improve bio registered parameters of turkey chicks, especially the final weight, which is important for turkey meat producers.

CONCLUSIONS

Zeolites remove ammonia from slurry by trapping and exchanging it in its crystaline structure [26]. The zeolite clinotilolite has a specific affinity for ammonium ions and ammonia [24].

Zeolites are non toxic, non-hazardous and valuable soil conditioners when added to the soil with manure [1].

Zeolite supplementation did not any negative impact on milk yield of lactating cows or on plasma electrolyte concentration of calves born from zeolite treated cows.

The addition of zeolites to high concentrate diets doesn′t improve performance or carcass traits of steers.

Zeolite addition can improve the digestion, metabolism, fibre digestion and rumen fermentation.

The addition of zeolite to colostrums decrease diarrhea and an associated respiratory syndrome and offers a possibility to decrease of use of expensive antibiotics.

Better results could be obtained if the zeolite addition is used in earlier stage of lactation.

Zeolite can remove ammonia excess both in the digestive tract (feed supplemented) and litter [25].

The results regarding the use of zeolites upon food intake, growth rate, egg production, egg weight, weight gain are in dispute.

The experiments cited showed zeolites have favorable effects on nutrient utilization, litter condition and feed effiency ration.

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