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Improvement of Poultry Welfare and Production, in Chickens' Farms, by Applying an Enzymatic Product

Grétel Burguet Fernández, José Pablo Paredes Sánchez and Jorge Xiberta Bernat*

Department of Energy, University of Oviedo, Spain

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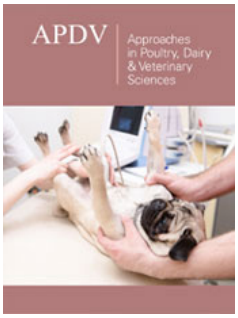

***Corresponding author:** Jorge Xiberta Bernat, Department of Energy, University of Oviedo, c/Independencia, 13, 33004 Oviedo, Spain

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Introduction

The poultry sector presents a positive growth trend in many countries, because of the world population raiser, which leads to an increase in the volume of waste and emissions generated. This means new management and treatment challenges [1]. Poultry industry waste includes a mixture of excrement (manure), bedding material (wood shavings, straw ...), food debris, dead birds, broken eggs, feathers, etc. It is commonly referred as a chicken manure. This chicken litter has a high value in nutrients (nitrogen, phosphorus and potassium), and has been used as an organic fertilizer, using techniques of direct dumping on land [2]. However, excessive application of this material can result in too high enrichment of water nutrients, resulting in eutrophication, spread of pathogens, and generation of toxic substances, air pollution and emissions of greenhouse gases [3].

On the other hand, the agricultural community has considered ammonia as a problem inside poorly ventilated or managed livestock facilities. In particular, ammonia that accumulates within animal housing systems can have a negative impact on animal health and, consequently, production. The main harmful effects they produce are the following [4]: reduction of food consumption, with the consequent weight loss, membrane irritation, painful illnesses, and with very high ammonia concentrations, the "normal" behavior of birds is altered. Reduced final body weights have been observed in poultry produced in houses with indoor ammonia levels of approximately 25 parts per million (ppm) or higher.

In a deeper analysis about this type of biomass or "bio-product", worldwide, an enzymatic product was found, developed and used in Colombia as an accelerator of composting, in order to produce a fertilizer of greater added value. Given its properties, it was decided to conduct an experimental study in Ireland and Holland, in order to improve the environmental conditions of the farms and reduce, therefore, the emissions, and at the same time obtain a biomass with higher calorific value.

The case study was developed in Irish farms during the chicken growth cycle. Two objectives were sought by applying the product during the growth cycle of chickens, and therefore along residue generation: reducing the moisture of the final residue (poultry litter) and reducing ammonia emissions. A drier poultry litter is beneficial in terms of animal welfare, production and a waste with a higher calorific value is also achieved. And reducing ammonia emissions, environmental conditions inside the buildings are improved, in the same ventilation and acclimatization context.

Materials and Methods

Biodegradable organic matter, in the presence of aerobic organisms and with oxygen from the environment, decomposes into humus (compost), releasing CO2, heat and water.

At the end of 2009, research began on the Colombian enzymatic product called Bioterre, used in this country mainly as an accelerator of composting, an aerobic biological process in

which organic matter is decomposed by the action of microorganisms quickly. The resulting product, compost, is a fertilizer used in agriculture. The main difference with natural decomposition is that in composting the variables that take part in it are controlled. The limiting factors of the process are those that influence the development of microorganisms, namely: temperature, humidity, aeration, nutrients, pH, C/N ratio and microbiota composition.

The Bioterre is prebiotic, that is, a no digestible food ingredient that stimulates the growth or activity of one or more types of bacteria in the organic matter decomposition process. Since the product has to be sprayed on the largest possible waste surface, an ultra-low volume sprayer was used. For the analysis of the poultry manure at the end of each cycle, we collected, in each case, a sample of the residue from different random points along the housing.

The result for each shed is the average of two satisfactory analytics performed for each sample. Moreover, the MS-70 moisture analyzer from A&D was used in our laboratory to carry out this study. The equipment supplies the percentage value in moisture. To take measure the concentration of ammonia inside the housings, we used a Gastec pump with colorimetric tubes.

For the development of the present study, we carried out the application of the enzymatic product tests in twenty-four Irish farms during the growth cycle of the broilers, in different stages. Each farm had between two and six sheds, so we worked on a total of more than seventy chickens' sheds. The product was applied inside farms with three scenarios: 15-18-day-old chickens, 10-day-old chickens and 7-day-old chickens.

Results and Discussion

In the first case (18-day-old chickens), the poultry manure moisture at the end of the cycle was lower than those not treated, remaining in all cases below 40%. On average, the moisture in the treated farms was 32%, compared to 47% in the untreated ones. The ammonia measurements were made inside the housings during the chicken growth cycle. The particular way of operating in each farms conditions its state. That is, the human factor is a relevant variable in the development of the activity.

The concentration of gases inside the housings will depend largely on the ventilation cycles, which are the responsibility of the farmer. This, along with the fact that we cannot ensure that the farms were not ventilated before making the measurements, makes the results between farms not comparable, so that the analysis of the results obtained must be individualized for each of the farms under study. The average reduction of ammonia was 70%.

In the second case carried out, the product was applied inside farms with 10-day-old chickens. Again, the moisture content of the poultry manure in treated sheds was lower than in untreated ones. In this case, the average was 30% in the treated, compared to 49% in no treated (taking into account only the untreated farms studied in this second test). Ammonia analysis inside the farms showed that the average reduction was 74%.

In third case (7-day-old chickens), we only have moisture data of untreated poultry manure. What can be affirmed is that the moisture average of the poultry manure (at the end of the cycle) of the poultry sheds treated at seven days was 27%, compared to 47% of those not treated. During this test, ammonia measurements could not be made in the untreated farms, so it has not been possible to determine the reduction implied by treatment after 7 days. What can be assured is that in the treated sheds the concentration measured in any case exceeded 6ppm.

Conclusion

The enzymatic product Bioterre can be applied inside the farms, during the growth cycle, without any risk to the broilers or significant modifications in their infrastructure. The study of its use in Irish poultry farms is a first step for commercial use in the EU. According to the data collected and the samples analyzed, the optimal application time would be between 7/10-day-old chickens.

The moisture average of poultry manure, at the end of the cycle, in treated sheds of different farms was 27%, compared to 47% in the untreated ones. Ammonia emission records at different stages of the production cycle in treated poultry sheds did not exceed 6 ppm, while in untreated sheds that record was always higher, exceeding in some cases 35ppm.

In the farms where we were able to measure the concentration of ammonia in treated and untreated poultry sheds, the reduction was between 70 - 74% with the application of the Bioterre [5].

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