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INFLUENCE OF APPLYING EFFECTIVE MICROORGANISM (EM) IN CONTROLLING AMMONIA AND HYDROGEN SULPHIDE FROM POULTRY MANURE

NURZILLAH M.*, NORFADZRIN F. AND HARYANI H.

Veterinary Institute Malaysia, KM 13, Jalan Batu Pahat, Beg Berkunci 520, 86009 Kluang, Johor.
* Corresponding author: nurzillah.dvs@1govuc.gov.my

ABSTRACT. Poultry layer houses are mostly open house system that generally faced with flies and odour and has become nuisance factors to society and the environment. This study was aimed to determine the effectiveness of applying EM in controlling pollutant gas emission at poultry layer house. A commercial poultry layer farm was selected. Two treatments were carried out, the control without any application of microorganisms and the treated group with commercial microorganism application. Atmospheric ammonia and hydrogen sulphide were measured using a special instrument called 'multi-gas detector'. The levels of ammonia and hydrogen sulphide were measured twice a week. Odour production cannot be completely prevented on a farm. Therefore, most odour control methods are designed to keep or dissipate odours within the farm boundary, thus minimising odour complaints from surrounding neighbours. This paper reports that applying of effective microorganisms into the manure showed some positive influence in controlling atmospheric ammonia levels.

Keywords: effective microorganism, odour, poultry layer house, manure, ammonia, hydrogen sulphide

INTRODUCTION

Over the past decades, the poultry sector's growth and trends towards intensification and concentration have given rise to a number of environmental concerns. A direct consequence of these structural changes (industrialization, geographical concentration and intensification) in poultry production is that far more waste than can be managed by land disposal is produced, resulting in environmental problems. Poultry facilities are a source of odour and attract flies, rodents and other pests that create local nuisances and carry disease. Odour emissions from poultry farms adversely affect the life of people living in the vicinity.

Odour associated with poultry operations comes from fresh and decomposing waste products such as manure, carcasses, feathers and bedding litter (Kolominskas *et al.*, 2002; Ferket *et al.*, 2002). On-farm odour is mainly emitted from poultry buildings, manure and storage facilities. Odour from animal feeding operations is not caused by a single compound, but is rather the result of a large number of contributing compounds including ammonia (NH_3), volatile organic compounds (VOCs), and hydrogen sulphide (H_2S) (IEEP, 2005). Of the several manurebased compounds which produce odour, the most commonly reported is ammonia.

Ammonia gas has a sharp and pungent odour and can act as an irritant when present in elevated concentrations. Odour is a local issue, which is hardly quantifiable. The impact greatly depends on the subjective perception of populations neighboring the farm. The emission of odors mostly depends on the frequency of animal-house cleaning, the temperature and humidity of the manure, the type ofmanure storage and on air movements.

Hydrogen sulfide also one of the pollutant gases related to chicken manure. It is a colorless gas with a strong and generally objectionable rotten egg odour. It is produced in anaerobic (oxygen-deprived) environments from the microbial reduction of sulfate in water and the decomposition of sulfur-containing organic matter in manure. Acute human health effects include respiratory and cardiovascular irritation, as well as headaches. Hydrogen sulfide is considered the most dangerous gas when at acute concentration has been responsible for many animal as well as human deaths (Donham *et al*., 1982).

Many technologies have been developed and investigate in order to reduce odour from poultry operations including the using of effective microorganism (EM). EM is a mixture of microbial inoculums developed by Professor Teruo Higa of Ryukyus University in Japan in the early 1980s. The culture contains 125 species (Higa, 1993), mixed in a solution of lactic acid bacteria and maintained at pH 3.0 to 3.5. It was developed on the hypothesis that it is feasible to culture and maintain a mixture of microbes (photosynthetic, nitrogen fixing and lactic acid bacteria) and yeast together. The use of EM or beneficial microorganisms in poultry manure was claimed to be effective in preventing odour and flies and has no known adverse effects on plants, animals, humans, or environment after over a decade of application (Higa and Wood, 2007).

MATERIALS AND METHOD

In the trial, a commercial poultry layer farm located at Batu Pahat, Johor was selected. The laying house is an open house system with capacity of +10,000 animals per house. A commercial beneficial microorganism in powder form available in the market was applied. Two treatments were carried out, the control without any application of microorganisms and the treated group with commercial microorganism application. The ratio of 1:10 microbial material and wood shavings was mixed as directed by the manufacturer was applied to the manure. Before starting the trial, the chicken manure was allowed to accumulate for 5 days to meet the appropriate amount in order to run this trial. On the first day of the trial, the microbial mixture was spread on the manure of the treated group. The next day, additional mixture of microbes was spread in the treated group. The procedure was repeated every 20 days. The trial lasted for 60 days. Atmospheric ammonia and hydrogen sulphide were measured using a special instrument called single gas detector (Gasman, H2S and NH3). The levels of ammonia and hydrogen sulphide were measured twice a week. The data was analysed using the Statistical Package

Table 1. Atmospheric ammonia level (ppm) produced from poultry manure

Group	Day 0	Day 21	Day 41	Day 61
Control	$1.5^a \pm 0.55$	$1.17^b \pm 0.41$	$2.0^a \pm 0.01$	$1.83^a \pm 0.41$
Treatment	$2.0^a \pm 0.63$	$2.83^a \pm 0.75$	$1.67^a \pm 0.52$	$1.17^b \pm 0.41$

* Means with same superscript letter in same row are not significantly different (p>0.05)

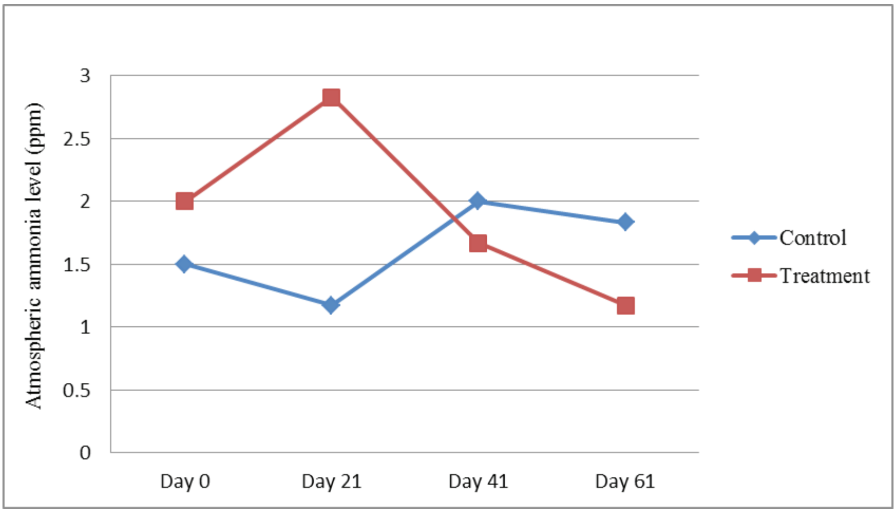

Figure 1. Graph of atmospheric ammonia level (ppm) produced from poultry manure

for Social Science™. Statistical significance of differences between group means and variances were tested by one-way ANOVA followed by Duncan post-hoc test. A *p* value of less than 0.05 ($p<0.05$) was considered statistically significant. Ammonia was the largest contributor to foul odours being emitted from poultry facilities. The level of ammonia was noted to increase from day 0 to day 41 in the control group (Table 1).

RESULTS AND DISCUSSION

The accumulation of manure leads to the increase of ammonia which contributes to odour problems. However, the application of microbes seemed to have an effect on ammonia levels starting from day 41 until end of the trial. The ammonia levels were significantly decreasing in the treatment group compared to the control group. The multi-gas detector shown there was no hydrogen sulphide presence in the environment (0 ppm) in both groups.

In comparison, a previous study by Yongzhen and Weijiong (1994) indicated that the use of probiotic EM in drinking water reduced ammonia concentrations within chicken houses by 42.12%. The use of EM fermented feed reduced ammonia concentrations by 54.25% and the combination of the two techniques reduced ammonia concentrations by 69.7%. Another case study reported from the Aichi

Prefecture, Japan on a farm of 150,000 laying hens showed a significant reduction in the foul odour of the poultry houses and the dung. EM was mixed in the drinking water, used to ferment 1% to 2% of the feed and also sprayed throughout the inside of the poultry houses once a week. The ammonia concentration in the chicken houses was reduced from 4.4 ppm to 3.9 ppm after the introduction of EM in the system. It must be mentioned that the data obtained previous to the use of EM was taken with the doors open and the data obtained after using EM was taken with the doors closed. In conclusion, this study found some positive influence on the ammonia level presence in the environment by adding EM into the manure. The absence of hydrogen sulphide could mean that the microbes significantly breakdown the sulphur containing compounds in the manure. Further studies should be perform on the consistent usage of beneficial microorganisms to validate the findings in actual on-farm scenario.

CONCLUSION

In conclusion, this study found some positive influences on the ammonia level present in the environment by adding EM into the manure. The absence of hydrogen sulphide could mean that the microbes significantly break down the sulphur containing compounds in the manure. Further studies should be performed on the consistent usage of beneficial microorganisms to validate the findings in actual on-farm scenarios.

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