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EVALUATION OF TWO DIFFERENT METHODS FOR AMMONIA ANALYSIS FROM INTENSIVE POULTRY FACILITY

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Introduction

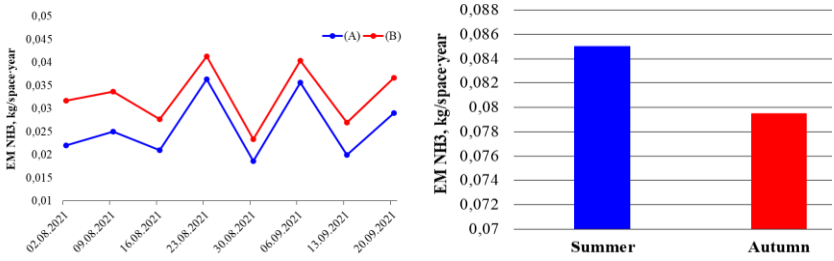
Air pollution is an area of particular importance in assessing the quality of the environment due to its special impact on human health. Ammonia (NH_3) is the main gas produced in the technological processes of poultry farming (>80%), also having a strong impact on human health and environmental quality. In general, the concentrations of NH_3 in poultry farms depends on several factors, such as nutrition, waste control, ventilation, volatilization, temperature and humidity. High NH_3 levels (>25 ppm) in farms reduce the body weight gain, survival ability and immune system of poultries. Methods of analysis tested allow the determination of NH_3 in the air, expressed in $\mu g/m^3$, in order to be related to the limits introduced by the new environmental reglementation (BAT conclusions for the intensive rearing of poultry and pigs). In this case, it is necessary to estimate the annual NH_3 emission (EM_{NH3}), expressed in kg of $NH_3 \cdot space^{-1} \cdot year^{-1}$, by developing new methods. The limit provided by legislation for EM_{NH3} is <0,08 kg of $NH_3 \cdot space^{-1} \cdot year^{-1}$.
In this study were analysed the results of the tests performed to verify the real conditions for performing of two methods for estimating the annual EM_{NH3} in the air from poultry layer facilities developed in a" Nucleu" Research Project.

Materials and methods

These two methods tested were based on N-balances and the ratio of nitrogen (N) to ash, respectively. The first method estimates nitrogen emissions or losses in the environment by the difference between all measurable inputs and outputs of the system (A). The alternative method is more complexed and eliminates the monitoring of the amount of layer and involves the monitoring of ash (B). To determine the N content of feed, eggs and layer (NF_{feed}, $NF_{retention}$, NF_{layer}), average samples were taken. After we have prepared the samples by lyophilization, the total N content was established using Dumas method. NH_3 samples were determined in parallel by using both methods, and in addition, were used automatic measurements of NH_3, NO_2, H_2S, CO_2 and CO. The information was needed to calculate the EM_{NH3} like feeding formula, amount of feed consumed, number of eggs per day, weight of egg and poultrys were provided by poultry farm, which were monitored and checked daily.

Results and conclusions

The tests were performed within poultry farm in two sampling campaigns (August - September 2021). NF_{feed}, $NF_{retention}$, NF_{layer} was calculated and data analysis showed that the highest amount of nitrogen in poultry facility comes from the diet of poultrys (~50%). By using both methods in tests, EM_{NH3} was calculated between 0,01-0,05 kg·space^{-1}·year^{-1} (A) and between 0,022-0,053 kg·space^{-1}·year^{-1} (B). Slightly higher results were obtained by using method B, but are comparable and do not exceed the limits set by the legislation, the difference between them being 10% (Figure 1a). More than that, it was found that the highest values of EM_{NH3} were identified during the summer due to high temperature and humidity (Figure 1b).



a) b)

Fig.1. a) Estimation of EM_{NH3} using: (A) the N-balance method and (B) the N to ash ratio method; b) The amount of NH_3 emitted during the seasonal period

In Table 1 were compared the results identified in the tested period that are in the limits established by the specific legislation. Based on the data obtained for the average of NH_3 concentration, the volume of the hall, the number of poultries and the ventilation information, the EM_{NH3} was 0,035 kg·space^{-1}·year^{-1}. This result is similar to the average value obtained by using method B.

Table 1. The results of NH_3, H_2S, CO and CO_2 concentrations obtained using direct measurements.

	NH_3		**H_2S**		**CO**		**CO_2**	
	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm	mg/m^3	ppm
Average	**1,96**	**2,82**	**0,05**	**0,03**	**0,15**	**0,13**	**1216**	**675,5**
Limit value		**20**		**5**		**40**		**3000**

In conclusion, both methods could be used to calculate the annual emission value of EM_{NH3} in the air from the technological processes of poultry farming, the B method being more suitable to predict the EM_{NH3}. The results obtained are in the ranges of concentrations observed in other studies of similar literature, being also under the range of emission limit values introduced by the BAT conclusions.