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AMMONIA AND GREENHOUSE GAS EMISSIONS IN PIG PRODUCTION IN BRAZIL - THE USE OF AUTOMATED SYSTEMS TO CONTROL THE ENVIRONMENT

de Oliveira, P.A.V[1]., Coldebella, A[1]., Marcanzoni, V.C.B[2]., Tavares, J.M.R[3,4].*

[1]Embrapa Suínos e Aves, BR 153, Km 110, Concórdia 89715-899, Brasil
[2]Universidade do Estado de Santa Catarina, Chapecó 89815-630, Brasil
[3]Instituto Politécnico de Beja - Escola Superior Agrária, Apartado 6155, 7800-295 Beja, Portugal
[4]FibEnTech-UBI, Universidade da Beira Interior, 6201-001 Covilhã, Portugal

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Abstract:

Brazil is one of the largest emitters of greenhouse gas (GHG) and ammonia in the world. Among various animal species, cattle, pigs, and poultry together represent the major sources of carbon emissions, with pork production presenting 14% in the agricultural sector (second biggest contributor). One of the challenges of pig production in Brazil involves adapting the internal environment of the housing buildings to existing climate variations, which have a major influence on: GHG and ammonia emissions; animals' performance; and several economic issues of the farms. Thus, the aim of this study was to evaluate the importance of choosing the methodology (Mass Balance end Gas Flow) for determining emissions and how it can differ considerably according to the building's ventilation one production room (growing-finishing phase) at the west of Santa Catarina State in southern Brazil, determining the gas flow and emission factors [carbon dioxide (CO_2), methane (CH_4), nitrous oxide (N_2O), and ammonia (NH_3)]. The experiment consisted in a single treatment [room with controlled environment (length: 16.8 m; width: 13.05 m; ceiling height: 2.8 m; partially concrete slatted floor) 20 pens with a máximum capacity of five animals per pen - area of 1.35 m_2/pig (length: of 3.0 m; width: 2.5 m)], during 14 months, and considering four production cycles (100 pigs per cycle; housing average period: 98 days). The room was equipped with automated systems for: recording temperatures (Munters Sensor Temperature) and internal relative humidity (Munters RHS Humidity Sensor); measurements of CO_2 concentrations (Munters Rotem Sensor) and NH_3 (Dräger Sensor Polytron C 300); water supplied to the pigs (Renova Hydrometer ¾"); and air velocity (TSI Model 8455-12; CR 1000/Campbell Scientific). To assess the quality of measurements of CO_2 and NH_3 gases it was used an infrared photoacoustic gas analyser INNOVA®1412 (LumaSense Technologies, Inc., Denmark). The temperature and humidity observed in the room (means) were 21.1±1.9 °C and 87.3±4.1 %, respectively. The means absolute minimum and maximum internal temperatures recorded were 17.8 and 24.6 °C, with external means temperature being 20.8±4.2 °C, and varying from 13.0 (minimum) to 26.4 °C (maximum). The emissions and gas flows for pigs at growing-finishing phase are shown in Table 1. The values of ammonia and GHG were similar when compared to several studies reported in the literature. However, it is important to refer that some of the results can differ considerably in accordance with ventilation room and the script of method used for determination. Following, it was calculated for average, máximum and minimum of air speeds (ventilation air, m^{-1} s^{-1}): mean 0.21; mean of max. 0.95; mean of min. 0.08). In this sense, it is important to exercise with caution when applying literature data to estimation the ammonia and GHG.

Table 1. Gas flow and emissions at growing-finishing phase with automated system to control environment.

Parameters	Gas Emission (mass balance)[1]					Gas Flow (Ventilation Air)[2]				
	Mean	σ†	Max.	Min.	Mean	σ†	Max.	σ†	Min.	σ†
CO_2, kg p^{-1} d^{-1}	2.23	0.89	3.72	1.01	1.44	0.65	2.86	1.09	0.62	0.32
CH_4 g p^{-1} d^{-1}	18.17	8.42	33.11	7.21	19.83	3.38	34.82	5.81	9.71	1.52
N_2O g p^{-1} d^{-1}	1.29	0.63	2.60	0.44	1.46	0.69	2.97	1.28	0.62	0.33
NH_3 g p^{-1} d^{-1}	2.25	1.27	5.23	0.79	4.68	3.47	9.75	7.74	1.82	1.46

† Standard deviation; 1 Method: mass balance; 2 Method: calculated for air flow: mean, max., min..

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