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CLEANR^3 – DEVELOPMENT OF AN INNOVATIVE BIOSCRUBBER SYSTEM WITH ONE THIRD OF THE INVESTMENT AND OPERATING COSTS

N.Guingand[1]; Y.Rousselière[1]; F.Poisbeau[2]; T.Carlo[3]*

[1] Ifip-institut du porc, 35651 Le Rheu, France - [2] Sodalec, 35000 Rennes, France - [3] Sodalec Distribution, 35000 Rennes, France

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Abstract:

Air quality on pig farms has become increasingly important in recent years. From a regulatory viewpoint, the Industrial Emission Directive (2010/75/EU) requires implementing best available techniques (BAT) to reduce the amount of ammonia emitted from pig farms that have more than 2,000 places for pigs (over 30 kg) or 750 sows. Bioscrubbers are an effective technique for reducing emissions of ammonia, odours and particles from pig farms and they are recognised as a BAT in the latest version of the European Union BREF for Intensive Rearing of Poultry and Pigs. Nevertheless, their water consumption and costs are the main factors that limit their widespread use in pig farming. To address these obstacles, a new ventilation design that combines under- and over-floor extraction was developed (i.e. dual shared ventilation (DSV)) and connected to a bioscrubber that is one-third the size of a conventional bioscrubber. This bioscrubber can treat up to 30% of a room's maximum airflow. After an adjustment phase of the control unit, the CleanR^3 system (DSV+ bioscrubber) was tested under real-world conditions in a fattening room housing 60 pigs (25-120 kg) at the Ifip experimental station. Ventilation rates and ambient temperatures of the two extraction systems were recorded every 15 minutes when the pigs were presents. Ammonia concentrations were measured every 20 minutes during three 15 day-measurement campaign using an infrared photoacoustic analyzer (Innova 1412, LumaSense Technologies Inc.) Measurement wer achieved in the room's ambiant air mass, in the under-floor extraction duct that sent air to the bioscrubber, in the ambient-air-mass extraction duct that sent air to the atmosphere and at the bioscrubber outlet. Data analyses were conducted to determine the effectiveness of the bioscrubber and the entire CleanR^3 system (DSV+bioscrubber). Over the measurement campaigns, 60% of ammonia emissions were extracted from under the floor. The smaller bioscrubber is as effective as a conventional bioscrubber designed to treat 100% of the extracted air and consumes nearly one-third as much water. Thus, the CleanR3 system can overcome the economic obstacles of conventional bioscrubbers while mitigating ammonia emissions to the same degree.