Recovery of gaseous ammonia released from livestock farms by recyclable adsorbent

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Abstract

We developed a new NH_3 adsorption system for recovery of gaseous ammonia released from livestock farms. The system works with our originally-developed NH_3 adsorbent with the performance of high NH_3-selectivity, high-capacity, and high-recyclability. With the system, the NH_3-concentraion in a pigpen was deceased by 70% compared with the case without the system. From a composting facility, we also succeeded to recover the most of NH_3 in the exhaust gas. The system enables to reduce the NH_3 emission to atmosphere, to make recovered NH_3 to the resource such as fertilizer, and to make the efficient breeding of livestock.

Keywords: NH_3, adsorbent, livestock

1. Introduction

Ammonia, NH_3, known as a precursor of PM2.5, is mainly emitted from agricultural sector to air. Livestock farm has a large contribution in the NH_3 emission. In addition, the odor problem of NH_3 is also often serious. Ammonia generated at livestock barns and composting facilities is usually released by air ventilation, but the method often affects negatively to the growth of the livestock due to the difficulty of temperature control in the barn. On the other hand, if the NH_3-emission into the air is stopped, the high concentration of NH_3 in the barn would have a bad influence on the livestock growth. To solve the problem, we developed a new NH_3-removal system with our originally-developed adsorbent. We tested the performance of the system at a realistic pigpen and a composting facility.

2. Materials and method

Our adsorbent was developed by the modification of Prussian blue, one of the porous coordination polymers as shown in Fig. 1 (Takahashi et al.(2016)). A NH_3 adsorpiton system including the adsorbent was installed in a pigpen with a limited ventilization, as shown in Fig. 2, in order to decrease both the NH_3 emission to the air and NH_3 concentration in the pigpen at the same time.

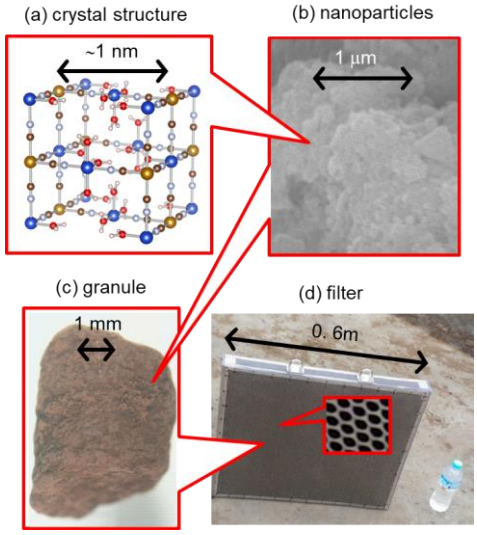

Fig. 1: Structure of ammonia-removal filters.

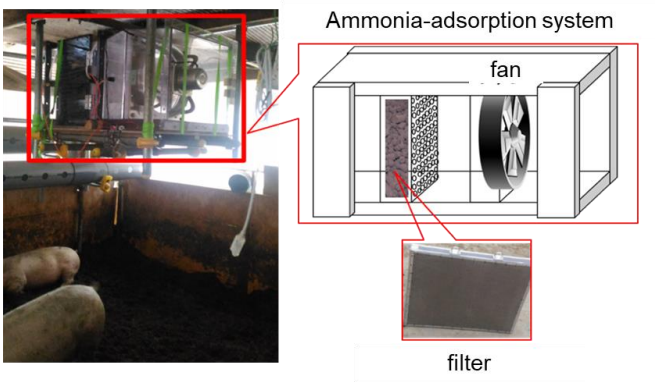

Fig. 2: Ammonia adsorption system installed in a pigpen.

3. Result

As shown in Fig. 3, the NH_3-concentraion in a pigpen was deceased by 70% compared with the case without the system. From a composting facility, we also succeeded to recover the most of NH_3 in the exhaust gas.

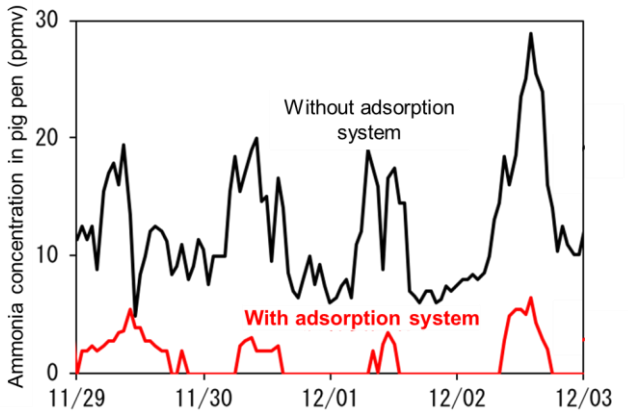

Fig. 3: Comparison of ammonia concentration in the pigpen with or without the ammonia adsorption system.

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References

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