Floor heating and heat exchanger as an ammonia mitigation technique for broiler housings

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Topic

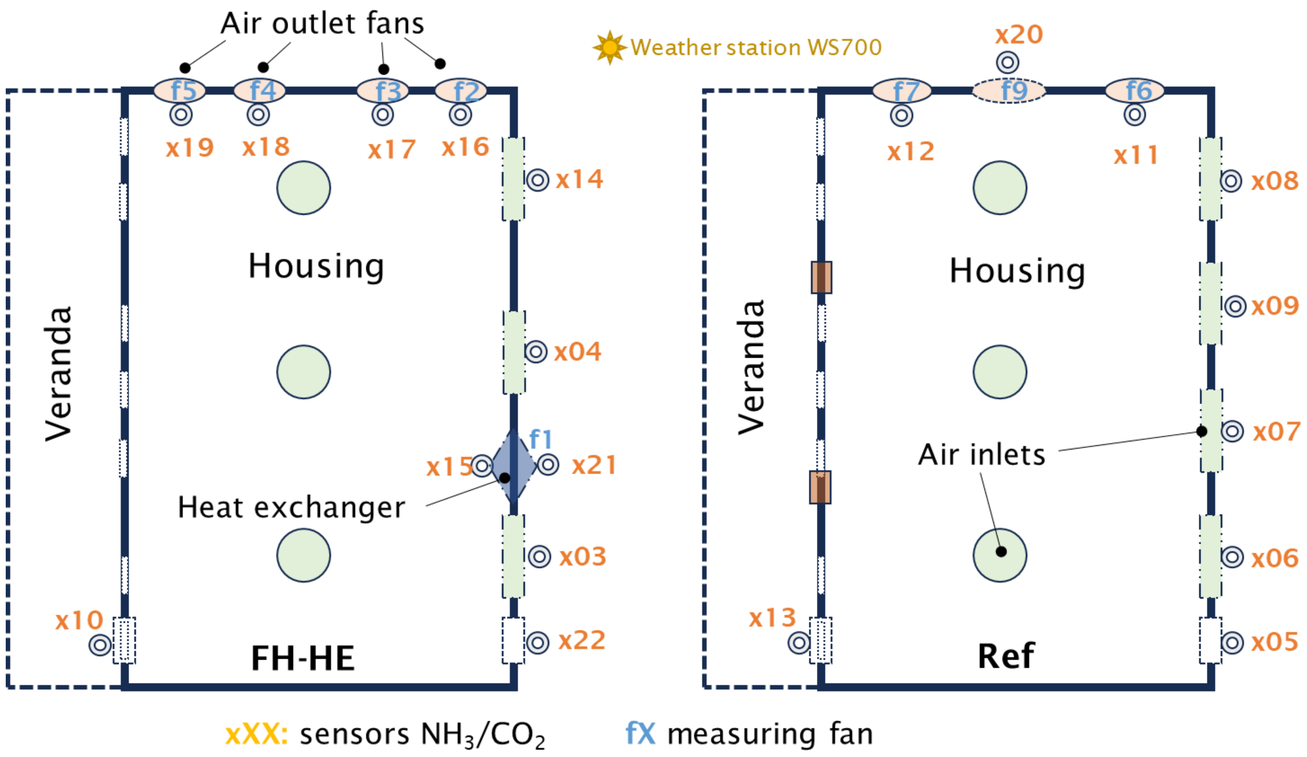
- Broiler housings are significant point sources for ammonia (NH_3) emissions
- To protect surrounding semi-natural ecosystems from adverse effects, emission mitigating techniques are required for broiler housings
- Floor heating (FH) and heat exchanger (HE) are expected to keep the litter dry and thus diminish the break-down of urid acid in the excreta to NH_3

Objectives

- Determination of NH_3 emissions at the farm scale in a case-control study over ≥4 production cycles during a year using two identical broiler houses with forced ventilation (negative pressure) for 10'000 birds each
- Case, FH-HE: broiler house with floor heating and heat exchanger
- Control, Ref: broiler house without mitigating techniques

Materials and methods

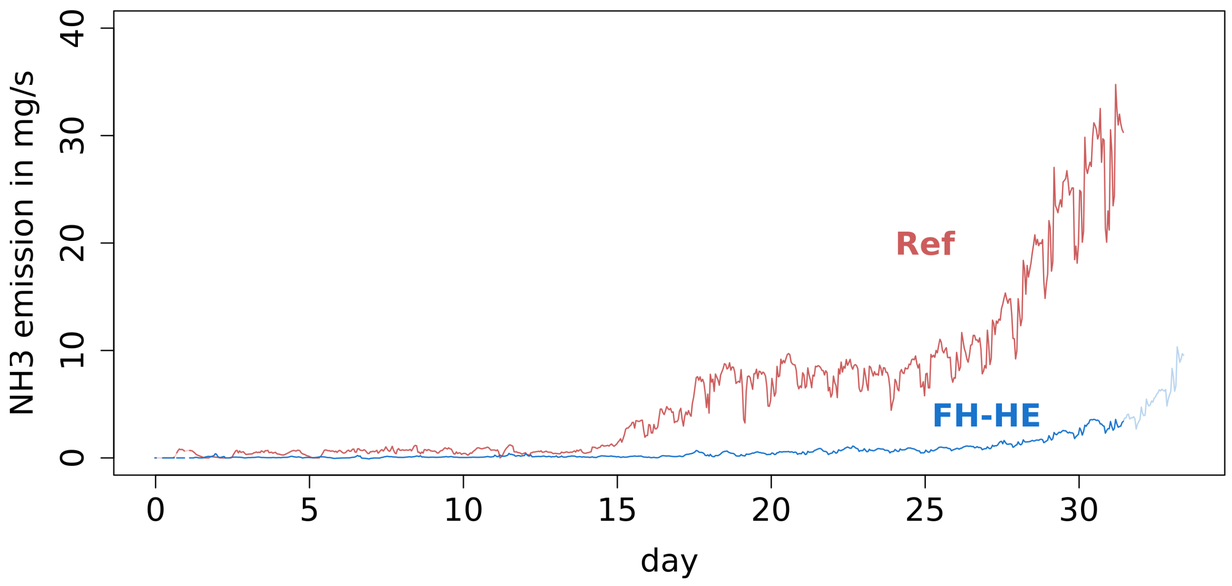
- Concentration measurements and quality control
  - Dräger X-Node sensors (Drägerwerk AG Co. KGaA, Lübeck, GE) for NH_3 and CO_2 with external pumps (accuracy: ± 1.5 ppm for NH_3 and ± 30 ppm for CO_2; flow rate: 0.7 l/min)
  - Intercomparison between X-Node sensors after, and intercomparison with wet chemical method during each measurement campaign plus calibration of sensors with 4 different gas standards
- Air exchange rates determined with measuring fans (AQC, Stienen, Nederweert, NL) placed at all outlets



Setup of broiler houses and measurement devices

Results

- Production cycle length: 35 days FH-HE; 33 days Ref
- Feed conversion rate: 1.62 for both FH-HE and Ref
- In-house NH_3 concentrations up to 18 ppm for Ref and up to 5 ppm for the FH-HE.
- Emission reduction due to floor heating and heat exchanger: 90% (preliminary value to be verified)



Evolution of NH_3 emissions over the production cycle in the broiler house with floor heating and heat exchanger (FH-HE, blue) and the broiler house without mitigating technique (Ref, red)

Conclusions and outlook

- Emission measurements using low-cost sensors produced reliable emission data as shown by intercomparison with wet chemical method
- Floor heating and heat exchanger are promising options to significantly reduce emissions from broiler housings
- To be done:
  - Crosscheck of the ventilation rate based on measuring fans using a CO_2 balance method
  - Detailed analyses of inhouse climate parameters and litter properties to elucidate the differences in emission levels between the two houses
  - Additional measurement campaigns

NH_3 / CO_2 sensors and measuring fans in front of two air outlet fans

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