Summary Model: Submit before December 15th to:
iwaodours2021@olores.org

9th IWA Odour & VOC/Air Emission Conference
26-27 October 2021 Bilbao, Spain

ABSTRACT

REMOVAL OF LIVESTOCK ODORANTS USING DIELECTRIC BARRIER DISCHARGE REACTOR AND BYPRODUCTS FORMATION

Xianwang Kong[1], Dezhao Liu[1*], Zhen Cai[1], Zhen Liu[2], Keping Yan[2]
1. Key Laboratory of Equipment and Informatization in Environment Controlled Agriculture, Ministry of Agriculture and Rural Affairs, College of Biosystems Engineering and Food Science, Zhejiang University, Hangzhou 310058, China
2. College of Chemical and Biological Engineering, Zhejiang University, China

Non-thermal plasma technology has proved to be efficient for treating various gas pollutants from industrial sectors, with very few cases applied for odorants removal from livestock. This lab-scale study was performed to investigate the removal of typical livestock odorants in a dielectric barrier discharge reactor (DBD) and its byproducts formation.

The DBD reactor was a cylindrical quartz tube inserted with a stainless steel rod as electrode, resulting a discharge gap of 2 mm. Four specific energy density (SED, 56.5, 97.1 112.9 and 143.8 J L^{-1}) were evaluated at gas residence time of ca. 0.2 s. The tested odorants were NH_3, organic acids (acetic acid, propionic acid, butyric acid, n-valeric acid), sulfur compounds (H_2S, dimethyl sulfide, dimethyl disulfide, dimethyl trisulfide), phenols (*p*-cresol, 4-ethylphenol) and indoles (indole, skatole).

Preliminary results showed that: NH_3 (6.2-41.2 ppmv inlet) and H_2S (930 and 1854 ppbv inlet) were sufficiently removed (>95%) at all SED, while SO_2 was detected as a byproduct following H_2S removal. As for VOCs, increased SED in general had positive effect on compounds removal. The sulfur compounds achieved >95% removal at all SED, and similar result was found for p-cresol. The 4-ethylphenol had a removal efficiency between 84-92%, while indoles had relatively lower removal (68-86%). The removal patterns varied among organic acids. The butyric acid had the highest removal efficiency with more than 92% at all SED. For propionic acid and *n*-valeric acid, low SED yielded only about 30% removal, and the removals dramatically increased to *ca.* 80-98% at SED of 112.9 and 143.8 J L^{-1}. A production of 27-265% of acetic acid was detected and increased SED could largely reduce the production. The O_3 concentrations at stable stage of four SED was 420, 630, 508 and 332 ppmv, respectively. The formation of greenhouse gas nitrous oxide (N_2O) were also evaluated and the concentrations of reactor outlet were 2.3, 6.2, 8.0 and 9.2 ppmv at four SED as compared to background concentration of *ca.* 0.33 ppmv. Furthermore, addition of 19.6 ppmv NH_3 increased the N_2O production by 88, 51, 52 and 63%, respectively.

To conclude, DBD reactor could efficiently remove most of the livestock odorants, while the formation of byproducts and its environmental effects need to be considered when using this technology.

Indicate preference of kind of presentation

■ Oral Communication

Indicate topic of your work for the conference:

☐ Policy and associated regulations for odour and air quality.
☐ Odour/VOC measurement, monitoring&sensor technologies.
☐ Odour/VOC perception, impact, formation and dispersion.
☐ GHG emissions particulate matter and industrial emissions.
☐ Source characterization and odour/VOC mapping.
■ Odour/VOC abatement, mitigation and neutralization.
☐ Odour/VOC from waste water, sewer systems and livestock.
☐ Air emissions and sustainable solutions for waste handling
☐ Community engagement, social media and citizen action.
☐ Other (suggest a new topic):

The scientific committee can examine the kind of presentation and session where authors propose to include their works.