

Potential application for Odor Control using Ferrate Modified Biochar

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Abstract:

Biochar made by pyrolyzing agricultural and forestry by-products and other organic wastes has potential not only as an eco-friendly fertilizer but also as pollutant adsorbent because of its porous structure. In this study, the commercially available biochar are evaluated for potential usage as odor adsorbents. Adsorption characteristics of two types of biochar (Low temperature pyrolysis biochar (LTPB) and high temperature pyrolysis biochar (HTPB)) and activated carbon are analyzed using ammonia and hydrogen sulfide which are major odor substances in livestock farms. Biochar and activated carbon (AC) used in the study was modified with ferrate solution, sulfuric acid and phosphoric acid. The adsorption of hydrogen sulfide and ammonia was more effective in activated carbon than in biochars. Low adsorption rate of biochar is considered because of larger pore size and 10 to 100x lower pore volume. Especially LTPB which is pyrolyzed at 250–350°C has 0.22–0.57 m²/L of specific surface area compare that HTPB showed 12–206 m²/L. However adsorption rate of ferrate modified AC was severely decreased in ammonia removal rather showed increase in both LTPB and HTPB supporting that metal salts modification dissolves the organic components of the biochar and enhances its adsorption capability. Acid modification increased ammonia adsorption in AC but not in biochars. This is because the acid modification increases acidic functional groups and improves the pore structure. For hydrogen sulfide, ferrate modification of LTPB showed 90% removal compare to non modified and acid modified with 10% removal. The higher concentration ferrate modified LTPB showed the better hydrogen sulfide removal implicating concentration dependent removal efficiency.

Keywords:

Biochar, odor adsorption, ammonia, hydrogen sulfide.