Enhanced Biofilter Control of CAFO Green House Gas Emissions

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In April 2017, a US District Court overturned the exemption concentrated animal feeding operations (CAFOs) enjoyed from air emission control rules. Odor, ammonia and/or hydrogen sulfide emissions are currently regulated. CAFO operations also generate significant amounts of methane, which has 23 times the impact of equivalent mass of carbon dioxide. Livestock operations are responsible for 17% of all US greenhouse gas emissions. This study compared the impact of natural and artificial copper sources on biofilter efficiency. Identical apparatuses were constructed but filled with three different substrates; wood, coconut husk and copper sulfate-infused wood. Each container was inoculated with identical media and quantities of Methylocystis rosea (ATCC® BAA-1196™), a very robust methanotroph, charged with methane in air mixture and sealed. Each vapor space was analyzed daily for methane. The containers were refilled from the same gas source and trials repeated as methane concentrations decreased. Data was reported and compared for each alternative and tested for significance. Cost estimations for animal specific applications were also developed. Conclusions from this study: (1) Biofilters will treat CAFO methane emissions (2) Trace amounts of copper enhances the effectiveness of the biofilter (3) Coconut biofilter substrate with high natural copper content are 50% more efficient than ash wood (4) Biofilters artificially enhanced with inorganic copper will significantly reduce their size and cost As biofilters to control current air constituents are installed, methanotrophic bacteria and a dilute copper solution could be added for minimal additional cost to eliminate methane emissions as well.

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