RESEARCH ABSTRACT

ENVIRONMENT

Title: Reduction of *Salmonella* and Other Fecal Microbes in Swine Waste Treatment Systems - **NPB #99-112**

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ABSTRACT

The presence and control of human pathogens in waste from commercial swine farms has emerged as a public health and policy issue that impacts management practices for swine waste treatment. This project focused on quantifying the reductions of fecal microbes in commercial swine waste lagoons and constructed wetlands. Constructed wetlands are a promising alternative or additional treatment technique for flushed swine waste. Swine waste samples were analyzed for a suite of six microbial indicators (fecal coliforms, *Eschericia coli*, enterococci, *Clostridium perfringens* spores, somatic coliphages and male-specific coliphages) and *Salmonella* spp., a group of pathogenic bacteria. In untreated swine waste from flushed and pit-plug systems at four swine farms, the average concentration of *Salmonella* was measured to be 3800 MPN/100 mL. *Salmonella* were reduced by approximately 96% in primary anaerobic lagoons at these farms and by a further 97% in the secondary lagoons used at two of the farms. In general, fecal coliforms, *E. coli* and enterococci were reduced to a similar, but slightly greater, extent than *Salmonella* (≈ 97-98%) in each lagoon cell provided. *C. perfringens* spores, investigated as a potential model for the removal of helminth ova and protozoan parasite cysts and oocysts in swine waste, were less efficiently reduced in lagoons than the other enteric bacteria studied, being reduced by an average of 84% in primary lagoons and another 92% in secondary lagoons. Somatic coliphages and F+ coliphages, investigated as potential models for the removal of enteric viruses pathogenic to humans, were reduced to a similar extent as measured for fecal coliforms, *E. coli* and enterococci (≈ 97% in primary lagoons and a further 96% in secondary lagoons). In a field-scale surface flow (SF) constructed wetland operated as a secondary treatment system receiving anaerobic lagoon liquid, fecal coliforms, *E. coli* and enterococci were reduced by 98, 99 and 87%, respectively. *Salmonella* were reduced by 96% in this constructed wetlands system, and *C. perfringens* spores, somatic coliphages and male-specific coliphages by 97, 99, and 98%, respectively. In laboratory-scale SF and subsurface flow (SSF) wetland reactors, temperature and loading rate were shown to be significant variables affecting the performance of the reactors for reducing concentrations of enteric microbes and nutrients in swine lagoon liquid. At temperatures of 10, 20 and 30°C and total Kjeldahl nitrogen loading rates of 10, 25 and 40 kg/ha/d, the vegetated SSF reactor generally achieved higher microbial and nutrient reductions than either the vegetated SF reactor or the unvegetated SSF control reactor. The results of this study show that significant reductions of fecal microbes can occur in anerobic swine waste lagoons, but that high concentrations of these microbes remain in lagoon liquid. Alternative, or additional, treatment using constructed wetlands can achieve significant removal of pathogens and nutrients from swine waste if important design variables such as temperature and mass/hydraulic loading rates are considered.