Bioremediation of swine wastewater using microbial fuel cell aimed to minimize volatile organic compounds

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Livestock farming is a dynamically growing sector in agriculture around the world. Pig farms represent mechanized systems having concentrated and localized operations. Annually, each of these systems generates high concentration wastewaters containing organic compounds, ammonia, phosphates, odorous gases, suspended solids, and pathogens. Nowadays, the most significant source of serious problems stemming from livestock production is the environmental contamination of soil, water and air. Common methods of treating swine wastewater (SW) include aerobic oxidation ponds, lagoons, anaerobic digestion and constructed wetlands. Microbial fuel cells (MFCs) represent a promising eco-friendly technology for swine wastewater (SW) bioremediation.

Laboratory-scale MFCs inoculated with native microbial community of SW or industrial granular brewery sludge (IGBS) were fed swine wastewater in a semi-continuous mode. MFC performance was studied under different operational modes, such as pH and strength of feed, hydraulic retention time (HRT) and external resistance. The results of this study showed that electrogenic and degradative activities of SW-treating MFCs depended on inoculum source, pH, initial COD level and HRT but not on external resistance. The consistently higher current production by the SW-inoculated MFC illustrates an importance of initial microbial colonization on subsequent MFC performance. Acidification of SW improved COD and VFA removal by both types of MFCs. Doubling the HRT of the high-strength SW-fed MFCs improved the removal of COD and, for the SW-inoculated MFC, VFAs from the SW. Maximum Coulombic efficiency occurred at a lower feed strength than did maximum power density. Based on performance results obtained swine wastewater treatment by MFCs have the potential to address environmental contamination associated with swine livestock production.