[ID-P#157] Cytotoxic, Mutagenic and Genotoxic Impact of Dewatered Sludge Treated with Microbial Fuel Cell (MFC) using In Vitro Systems

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Background: The rapid increase in activated sludge from wastewater treatment plants is a major environmental concern, highlighting the need for sustainable waste treatment methods. Microbial fuel cell (MFC), a bio-electrochemical system shows potential for sludge treatment and renewable energy production. However, concerns about environmental and health risks such as DNA damage and cancer have arisen. Thus, this study aims to assess the cytotoxic, mutagenic and genotoxic effects of MFC- treated dewatered sludge.

Methods: MFC samples consisted of Bacillus subtilis (BS), Bacillus cereus (BC), Bacillus tropicus (BT) and combinations of BS+BC, BS+BT, BS+BC+BT, each tested at six concentrations (1mg/ml, 0.5mg/ ml, 0.25mg/ml, 0.125mg/ml, 0.0625mg/ml, 0.0313mg/ml). Cytotoxicity was assessed using MTT assay on human foreskin fibroblast Hs27 cells. For mutagenicity, a Bacterial Reverse Mutation (AMES) test was performed, employing Salmonella typhimurium strains TA98 and TA100 to detect frameshift and base-pair mutations. Meanwhile, genotoxicity was tested by examining the presence of micronuclei (MN) in the cytoplasm of human spleen lymphoblast TK6 cells.

Results: Analysis of cell viability (%) showed that all MFC samples (BS, BC, BT, BS+BC, BS+BT, BS+BC+BT) slightly increased cell viability compared to controls (xT: untreated non-autoclaved sludge, T0: untreated autoclaved sludge), which contained no bacteria. In the mutagenicity test, the BT sample led to an elevated number of colonies in both strains compared to the negative control. Additionally, the bacterial combinations (BS+BC, BS+BT, BS+BC+BT) resulted in higher colony counts than the control, while BS and BC had fewer colonies. However, for genotoxicity test, no significant MN induction was observed for all samples.

Conclusion: Based on these tests, MFC samples did not induce cytotoxic and genotoxic. Nevertheless, mutagenic effects were observed, particularly in samples treated with bacterial combinations. Therefore, MFC technology shows safety potential for dewatered sludge treatments and using single bacteria may reduce mutagenic risk.