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Modification of bacterial cell membrane to accelerate decolorization of textile wastewater effluent using microbial fuel cells: role of gamma radiation, salinity and endogenous biosurfactant induction

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Modification of bacterial cell membrane to accelerate decolorization of textile waste water effluent using Microbial Fuel Cell: role of gamma radiation, salinity and endogenous biosurfactant induction

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Abstract

A combined approach was investigated to accelerate Microbial Fuel Cell (MFC) performance and textile wastewater decolorization through modifying bacterial membrane. The aim was to increase both bacterial adhesion on anode and electron mediator release. Ten Gram-positive exoelectrogenic bacteria were isolated from the anodic biofilm after decolorization of real textile waste water in mediator-less MFC. The isolates were identified and characterized, to understand the nature of the bacteria involved. According to the battery of tests performed, three factors gamma radiation, salinity and induction of endogenous biosurfactant were involved membrane modification. Dielectric measurement, a non-invasive technique, was used to measure the cell membrane permeability and cell surface charge. Plackett-Burman experimental design was carried out to determine the key contributor among the three studied factors. Exposing the cells to 1 KGy gamma radiation led to 7.84- and 1.71- fold increase in total surface-charge and cell-permeability, respectively. Scanning Electron Microscope (SEM) images and surface-bound protein concentrations for the samples indicated that biofilm formation increased under the same conditions. These results have been reflected on the power density profiles and decolorization of textile wastewater. Modification of bacterial membrane prior to MFC operation can be considered highly effective as a pre-treatment tool that accelerates MFC performance.