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Microbial Electrochemical Remediation System: Integrating Wastewater Treatment with Simultaneous Power Generation

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Abstract : Pollution of estrogenic compounds has caught the attention of researchers as the slight increase of estrogens in the water bodies has a significant impact on the aquatic system. They belong to a class of endocrine disrupting compounds (EDCs) and are able to mimic hormones or interfere with the action of endogenous hormones. The microbial electrochemical remediation system (MERS) is employed here for exploiting an electrophototrophic bacterium for evaluating the capacity of biodegradation of ethinylestradiol hormone (EE2) under anaerobic conditions with power generation. MERS using electrophototrophic bacterium offers a tailored solution of wastewater treatment in a developing country like India which has a huge solar potential. It is a clean energy generating technology as they require only sunlight, water, nutrients, and carbon dioxide to operate. Its main feature that makes it superior over other technologies is that the main fuel for this MERS is sunlight which is indefinitely present. When grown in light with organic compounds, these photosynthetic bacteria generate ATP by cyclic photophosphorylation and use carbon compounds to make cell biomass (photoheterotrophic growth). These cells showed EE2 degradation and were able to generate hydrogen as part of the process of nitrogen fixation. The two designs of MERS were studied, and a maximum of 88.45% decrease in EE2 was seen in a total period of 14 days in the better design. This research provides a better insight into microbial electricity generation and self-sustaining wastewater treatment facilities. Such new models of waste treatment aiming waste to energy generation needs to be followed and implemented for building a resource efficient and sustainable economy.

Keywords : endocrine disrupting compounds, ethinylestradiol, microbial electrochemical remediation systems, wastewater treatment
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