

Sugar Industry Wastewater Treatment with The Combined Wetlands-Anaerobic-Filtration Pilot-scale Bioreactor

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Sugar industry wastewater dispose-off untreated discharge into the environment and causes water contamination. Conventional wastewater treatment methods are often expensive and resource-intensive, making them impractical in developing countries like Pakistan. Sustainable and low-cost wastewater treatment technologies are required to improve water quality while ensuring affordability and environmental sustainability. Different nature-based technologies, such as floating treatment wetlands (FTWs), constructed wetlands (CWs), anaerobic digester (AD) and sand filtration (SF) are being used to treat sewage and industrial wastewater. The purpose of this study was to combine FTWs, CWs, AD, and SF to develop a bioreactor for the effective treatment of wastewater from sugar industry. The tailor-made bioreactor efficiently removed chemical oxygen demand (COD), biochemical oxygen demand (BOD), total dissolved solids (TDS), nitrogen, phosphorus, chlorides, sulfates, lead, and cadmium to 84.7%, 84.1%, 71.6%, 79.5%, 74.6%, 99.9%, 41.5%, 53.3%, and 44.1%, respectively, from wastewater with a hydraulic retention time of 7 days. There was a complete removal of bacterial pathogens, E. coli and fecal coliforms, from wastewater. The kinetics model and correlation coefficient (R²) data demonstrated that the removal process is more influenced by chemisorption and microbial activities and contributed to the overall carbon neutrality objective by the sequestering atmospheric carbon into the plant biomass efficiently. It is a nature-based, low cost and sustainable approach to treat the sugar industry wastewater for its safe discharge in the environment.

Keywords: Removal; contamination; BOD; TDS; model