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Effect of Retention Time on Kitchen Wastewater Treatment Using Mixed Algal-Bacterial Consortia

Authors : Keerthi Katam, Abhinav B. Tirunaghari, Vinod Vadithya, Toshiyuki Shimizu, Satoshi Soda, Debraj Bhattacharyya

Abstract : Researchers worldwide are increasingly focusing on the removal of carbon and nutrient from wastewater using algal-bacterial hybrid systems. Algae produce oxygen during photosynthesis, which is taken up by heterotrophic bacteria for mineralizing organic carbon to carbon dioxide. This phenomenon reduces the net mechanical aeration requirement of aerobic biological wastewater treatment processes. Consequently, the treatment cost is also reduced. Microalgae also participate in the treatment process by taking up nutrient (N, P) from wastewater. Algal biomass, if harvested, can generate value-added by-products. The aim of the present study was to compare the performance of two systems - System A (mixed microalgae and bacteria) and System B (diatoms and bacteria) in treating kitchen wastewater (KWW). The test reactors were operated at five different solid retention times (SRTs) -2, 4, 6, 8, and 10-days in draw-and-fill mode. The KWW was collected daily from the dining hall-kitchen area of the Indian Institute of Technology Hyderabad. The influent and effluent samples were analyzed for total organic carbon (TOC), total nitrogen (TN) using TOC-L analyzer. A colorimetric method was used to analyze anionic surfactant. Phosphorus (P) and chlorophyll were measured by following standard methods. The TOC, TN, and P of KWW were in the range of 113.5 to 740 mg/L, 2 to 22.8 mg/L, and 1 to 4.5 mg/L, respectively. Both the systems gave similar results with 85% of TOC removal and 60% of TN removal at 10-d SRT. However, the anionic surfactant removal in System A was 99% and 60% in System B. The chlorophyll concentration increased with an increase in SRT in both the systems. At 2-d SRT, no chlorophyll was observed in System B, whereas 0.5 mg/L was observed in System A. At 10-d SRT, the chlorophyll concentration in System A was 7.5 mg/L, whereas it was 4.5 mg/L in System B. Although both the systems showed similar performance in treatment, the increase in chlorophyll concentration suggests that System A demonstrated a better algal-bacterial symbiotic relationship in treating KWW than System B.

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