



Performance of modified one-stage Phoredox reactor with hydraulic up-flow in biological removal of phosphorus from municipal wastewater

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ABSTRACT

Nowadays, eutrophication is considered as one of the disturbing environmental phenomena, which its main cause is the discharge of nutrients into receiving waters. The main problematic chemicals in this regard are nitrogen and phosphorus. Considering the undesirable effects of these two nutrients on the receiving waters, the application of a biological process with high removal efficiency, such as modified Phoredox, is essential to ensure the removal of nitrogen and phosphorus. In this context, a pilot plant (made of Plexiglas) with wall thickness of 0.5 cm and dimensions of 100 × 20 × 20) along with four sample valves and a dual valve were provided and utilized in order to allow the entrance of flow and the discharge of the reactor for the purpose of flexibility in operation. With regard to the structure of modified one-stage Phoredox reactor, in this study, 20% of the total volume of the reactor was dedicated to the anaerobic region which was embedded on the base of the reactor with the help of a porous network by assuming an up-flow. Investigating the data obtained in the present research revealed that the modified one-stage Phoredox reactor was able to provide the highest removal of chemical oxygen demand (COD) (95.5%) at the organic loading rate of 400 mg/L, inlet phosphorus concentration of 10 mg/L, hydraulic retention time (HRT) of 8 h, and media filling rate of 60%, while the biochemical oxygen demand (BOD)₅ removal efficiency by studied system was 94.9%. The remaining COD in this optimized phase was 15.04 mg/L. Moreover, the highest total phosphorus (TP) removal by this system was obtained to be 96.5 at organic loading rate of 500 mg/L and the inlet TP of about 15 mg/L, the HRT of 8 h and filling rate of 60% filling. The remaining TP in this optimized phase was obtained 0.54 mg/L which was extremely lower than the standard limit specified by the Department of Environment for discharging the sewage into the environment. This low rate indicates the effective performance of the modified one-stage Phoredox reactor to achieve environmental standards.

Keywords: Phoredox; Phosphorus; Biofilm; Nutrient; Biological treatment

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