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Effectiveness of Sequencing Batch Biofilm Reactor Technology to Treat Domestic Wastewater in Basrah City

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ABSTRACT

The efficiency of a Sequencing Batch Biofilm Reactor (SBBR) for domestic wastewater treatment in Basrah was assessed. The experiments were carried out via a laboratory-scale SBBR cylindrical vessel used for this study, with geometric volume of 26 L, having an internal diameter of 15 cm, a height of 40 cm, and a working volume of 13 L. After a one-month start-up cycle for biofilm growth on the fibrous filler, the SBBR research test period lasted two months. The SBBR was run for three weeks to ensure that the biological treatment systems were mature and those steady-state requirements were reached, throughout the starting-up phase of operation, the removal efficiency for COD, NH_3-N, TN, and TP were 95%, 89%, 85%, and 93% respectively. The impact of aeration time on the SBBR efficiency was also tested by removal of COD, ammonia, total nitrogen TN, and total phosphorous TP under different levels of dissolved oxygen DO (2.0 – 6.8) mg\L. The SBBR method proved to be an effective method for treating domestic wastewater in Basrah city. The COD, NH_3-N, TN, and TP concentrations in the effluent were 42, 6.7, 9.0, and 1.0 mg/L, respectively, with the removal efficiency rates of 90.32 %, 86.24 %, 84.75 %, and 84.38 %. When comparing the SBBR effluent value to the WHO, European, Iraqi, and Chinese discharge standards, it was observed that the COD concentration (42 mg/L) met these standards. while ammonia (6.7 mg/L), TN (9.0 mg/L), and TP (1.0 mg/L) met the WHO, European, and Chinese standard only.

Keywords: SBBR, domestic wastewater, COD, NH_3-N, TN, TP.

INTRODUCTION

In order to comply with the effluent requirements before discharge to water streams, stricter effluent specifications necessitate more efficient wastewater treatment [Güçlü and Dursun, 2010].

SBBR is a biological system for treating wastewater that utilizes microorganisms (usually attached to plastic carriers). It is based on the sequencing batch reactor (SBR). SBBR has been widely studied and applied as a modern biological wastewater treatment method due to its many benefits, including more biomass but less sludge, easy and simple operating, and efficient sewage treatment [Gieseke et al., 2002].

SBBR has a number of advantages over a sequencing batch reactor (SBR), represented by more biomass and higher removal performance, lesser sludge and sludge conglomeration, higher volumetric loads, and improved process stability against shock loadings [Ding et al., 2011]. SBBR has many advantages over conventional biofilm systems and suspended activated sludge systems. It incorporates the characteristics of activated sludges and biofilm processes, allowing the device to withstand a sudden shock load [Zhang et al., 2006]. Simultaneously, the biofilm carriers create a dissolved oxygen concentration gradient from the surface to the inside, allowing direct denitrification to occur in both anaerobic and anoxic ecosystems [Fu et al., 2010]. Effective removal of many contaminants has been achieved using the SBBR process, and a most essential feature is it can conform to the variation in the village sewage; moreover, it is simple to install and maintain [Di Iaconi et al., 2004].