

Abstract

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Application of Biowin™ Modeling to Enhance Operational Performance of Wastewater Treatment Using Attached Media: A Case Study

Upgrading of existing Wastewater Treatment Plants (WWTPs) has become indispensable especially in developing countries. The high growth rates, limited financial resources and land availability require stringent treated effluent quality in order to protect water resources. Hybrid systems could be considered as a suitable alternative. Balaks wastewater treatment plant (BWWTP), with an average designed capacity of 600,000 m³/d, located in Egypt provides the material of this study. It is a conventional activated sludge treatment system which is expected to receive massive quantities of wastewater that would surpass its peak design capacity and consequently would fail to meet the allowable effluent limits. Subsequently, this research has focused on modeling and testing the use of either moving bed bio film reactor (MBBR) integrated fixed film activated sludge (IFAS) in three different locations with respect to the installed surface aerators. BioWin, a software simulating program, was used to compare the performance of both systems. Results indicated that MBBR with polyethylene media acting as Bio film carrier possessed greater potential to be used as an ideal and efficient option for different flow rates (Q_{inf}.2013, Q_{av} 2037 and Q_{Peak} 2037). The MBBR removal efficiencies (RR) of COD, BOD₅ and TSS, in winter were 91.62%, 87.92% and 99.67%, respectively, while in summer, corresponding RR were 90.53%, 89.70% and 99.83%, respectively compared to IFAS system which achieved RRs of 91.62%, 88.26% and 98.34% in winter and 90.53%, 90.13% and 98.77% in summer. MBBR also achieved excellent removal of Ammonia in winter with residual value of 0.38mgN/l while in summer it was 0.99mgN/l, compared to IFAS system., in winter it was 19 mgN/l, while in summer it was 0.49 mg N/l. Concerning the number of aerators needed for maintaining a DO concentration of 2 mg/l, the results showed that in winter two aerators with hp 75 were sufficient, while in summer just one aerator was sufficient for the MBBR process. However, the number of aerators needed for IFAS process was 23 aerators in winter and 33 aerators in summer. The values of HRT in IFAS process achieved better results than MBBR. On the contrary the SRT achieved better results in MBBR than in IFAS. In conclusion, MBBR could be a preferable option for this study since a minimum number of aerators would be required and the media used is locally manufactured, thus the operating cost could be narrowed.