World Academy of Science, Engineering and Technology
International Journal of Environmental and Ecological Engineering
Vol:14, No:01, 2020

Chemical Oxygen Demand Fractionation of Primary Wastewater Effluent for Process Optimization and Modelling

Authors : Thandeka Y. S. Jwara, Paul Musonge

Abstract : Traditionally, the complexity associated with implementing and controlling biological nutrient removal (BNR) in wastewater works (WWW) has been primarily in terms of balancing competing requirements for nitrogen and phosphorus removal, particularly with respect to the use of influent chemical oxygen demand (COD) as a carbon source for the microorganisms. Successful BNR optimization and modelling using WEST (Worldwide Engine for Simulation and Training) depend largely on the accurate fractionation of the influent COD. The different COD fractions have differing effects on the BNR process, and therefore, the influent characteristics need to be well understood. This study presents the fractionation results of primary wastewater effluent COD at one of South Africa's wastewater works treating 65ML/day of mixed industrial and domestic effluent. The method used for COD fractionation was the oxygen uptake rate/respirometry method. The breakdown of the results of the analysis is as follows: 70.5% biodegradable COD (bCOD) and 29.5% of non-biodegradable COD (iCOD) in terms of the total COD. Further fractionation led to a readily biodegradable soluble fraction (SS) of 75%, a slowly degradable particulate fraction (XS) of 24%, a particulate non-biodegradable fraction (XI) of 50.8% and a non-biodegradable soluble fraction (SI) of 49.2%. The fractionation results demonstrate that the primary effluent has good COD characteristics, as shown by the high level of the bCOD fraction with Ss being higher than Xs. This means that the microorganisms have sufficient substrate for the BNR process and that these components can now serve as inputs to the WEST Model for the plant under study.

Keywords : chemical oxygen demand, COD fractionation, wastewater modelling, wastewater optimization
Conference Title : ICBWTP 2020 : International Conference on Biological Wastewater Treatment Processes
Conference Location : Dubai, United Arab Emirates
Conference Dates : January 30-31, 2020