International Chemical Engineering and Material Symposium, SICHEM 2025, 6-7 November 2025, ISSN 2537-2254

ASSESSMENT OF WWTP PERFORMANCE FOR CHANGES IN INFLUENT, RECYCLE AND WASTE FLOW RATES

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Abstract: *The study presents the assessment of the Pumping Energy (PE), Effluent Quality (EQ) and GreenHouse Gas (GHG) emissions performance indices of the Waste Water Treatment Plant (WWTP) in different operating scenarios. These scenarios consist in changing influent flowrate, return sludge flow rate, internal recycle flow rate and waste sludge waste flow rate. The pumping energy is most affected by modifications to the return sludge flow rate. Effluent quality and GHG emissions are most affected by the influent flow rate changes.*

Key words: wastewater treatment modelling, performance indices, sensitivity to plant flow rates

Introduction: The wastewater treatment industry is facing growing challenges due to world population increase and urbanization. Several quality indices have been established in order to monitor plant performance. This sensitivity study monitors the influence of several operating variables, such as influent flowrate, return sludge flow rate, internal recycle flow rate and waste sludge waste flow rate, on the plant performance indices.

Experimental and/or Modelling: *Model*: The simulations were carried out using the modified Benchmark Simulation Model No. 1 (BSM1) [1], calibrated for the anaerobic-anoxic-oxic configuration of the municipal WWTP serving as case study. The monitored indices are Pumping Energy, Effluent Quality and GHG emissions [2]. *Simulation Scenarios*: The studied scenarios consisted in the step modifications of the main mentioned WWTP flow rates. Each of these flow rates were modified independently, being increased and decreased by ±5% steps, up to ±20%. Simulation results were collected and analyzed.

Results and discussions: From the whole set of simulations, results obtained for the increase of the return sludge flow rate are presented in Figure 1.

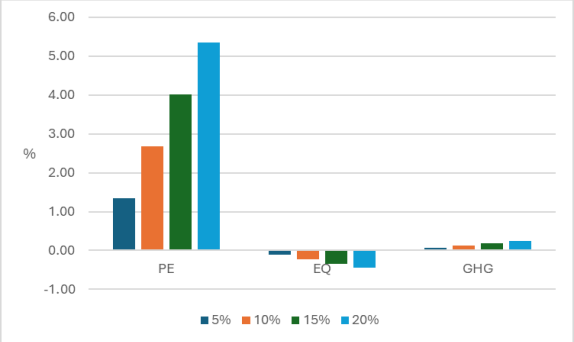

Figure. 1 Simulation results for increased return sludge flow rate, as percentage differences relative to the reference scenario

Table 1 showcases the performance indices results, as percentage differences relative to the reference scenario, for a 10% increase in influent flow rate, return sludge flow rate, internal recycle flow rate and waste sludge flow rate.

Table 1 Simulation results for a 10% increase in all studied flow rates, as percentage differences relative to the reference scenario

	Pumping Energy	Effluent quality	GHG Emissions
Increased Influent Flow Rate	0.00	3.97	2.43
Increased Return Sludge Flow Rate	2.68	-0.23	0.13
Increased Internal Recycle Flow Rate	0.16	-0.48	0.01
Increased Sludge Waste Flow Rate	0.01	-0.29	0.00

Conclusions: The pumping energy is most affected by modifications to the return sludge flow rate. Effluent quality and GHG emissions are most affected by the influent flow rate. The results of the study reveal which of the main flows rates associated to the WWTP operation have larger impact on the plant performance indices and offers a valuable insight for the design of the WWTP control and decision support system.

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Acknowledgements: This work was supported by a grant of the Ministry of Research, Innovation and Digitization, CNCS - UEFISCDI, project number PN-IV-P2-2.1-TE-2023-0666, within PNCDI IV.

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