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# Stability and bifurcation synthesis in a nonlinear chemostat model

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**Abstract**

This study focuses on a wastewater treatment problem. It explores the equilibria and their stability providing hence conditions for the local and global stability. Our aim is to provide a qualitative study of the stability with respect to three parameters: residence time $\tau$, rate of air/liquid oxygen transfer $K_La$ and the dissolved oxygen saturation coefficient $C_s$. The study analyzes all situations that may occur and establishes a synthesis of bifurcations with diagrams showing our results. The results reveal that the no-washout equilibrium can be reached without the need to increase the residence time, by means of an adequate choice of $K_La$ and $C_s$.

**AMS subject classification:**
**Keywords:** Dynamical system, Stability, Bifurcation, Wastewater treatment.

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