CHEMICAL ENGINEERING TRANSACTIONS Volume 25, 2011
Editors Jiří Jaromír Klemeš, Petar Sabev Varbanov, Hon Loong Lam
Copyright © 2011, AIDIC Servizi S.r.l., ISBN 978-88-95608-16-7 ISSN 1974-9791
DOI: 10.3303/CET1125045

Submerged Membrane Bioreactors for Wastewater Treatment. Multi-Objective Optimization

Pompilia Buzatu*, Vasile Lavric

University Politehnica of Bucharest, Chemical Engineering Department
RO-011061, Polizu 1-7, Bucharest, Romania, p_buzatu@chim.upb.ro

In this paper we first optimized the operating parameters of a submerged membrane bioreactor for wastewater treatment using a dual-objective function: the global conversion of ammonia plus ammonium nitrogen and the weighted productivity of the system. Given the dichotomy of these two objectives, a Pareto front was obtained and the results analyzed. Consequently, a new operating strategy was proposed and optimized, namely the discontinuous mode until the microorganisms reach a convenient concentration in the bioreactor, followed by the original semi-continuous operating mode. In order to optimize this new operating strategy, the first objective function becomes the minimum between the global conversions of ammonia plus ammonium nitrogen and the soluble biodegradable substrate.
The point of the front having the productivity and conversion closest to those of a previously tested operating strategy was chosen to solve the mathematical model describing the system in order to compare the strategies.

1. Introduction

Submerged membrane bioreactors (SMBRs) are the in-situ combination of a suspended growth bioreactor with a membrane process, where the membrane primarily replaces the clarifier, which ensures high biomass concentrations in the conventional systems. Used in wastewater treatment, SMBRs lead to a number of advantages as compared with the aforementioned conventional technologies (Arevalo et al., 2009; Dialynas and Diamadopoulos, 2009; Meng et al., 2009; Teck et al., 2009).
Only a few attempts were made for optimizing SMBRs operating in wastewater treatment. Schoeberl et al. (2005) studied the influence of suction and backwash times, and aeration intensity on fouling, using a complete factorial experiment. Zarragoitia et al. (2009) tried to separately optimize the transmembrane pressure, the permeate volume and the energy consumption of a SMBR.
In this context, our study aims at contributing to the SMBR optimization field using mathematical modelling and simulation in white experiments, while searching for the appropriate objective functions to improve the operating strategy of this system.

Please cite this article as: Buzatu P. and Lavric V., 2011, Submerged membrane bioreactors for wastewater treatment. multi-objective optimization, Chemical Engineering Transactions, 25, 267-272
DOI: 10.3303/CET1125045