Co-treatment of Septic Tank Effluent and Landfill Leachate in a Submerged Membrane Bioreactor

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Abstract
This study was firstly aimed at investigating the performance of a laboratory scale submerged membrane bioreactor (MBR) for septic tank effluent treatment and subsequently the influence of landfill leachate addition on the system performance was also investigated. Finally, sponge pellets were introduced into MBR tank to conduct a hybrid MBR system for treatment of septic tank effluent/ landfill leachate mixed liquid. A long-term operation of 308 days was divided into 8 stages to examine the HRT, S/L volume ratio and sponge pellets addition influences on parameters related to total chemical oxygen demand (TCOD) removal, nitrification, denitrification, color removal, metal removal and membrane cleaning. The results indicated that TCOD removals for the runs without leachate addition (septic tank effluent only) were higher than 90% and more than 80% of ammonia nitrogen was converted. However, it is apparent that the addition of landfill leachate would worse the removal of TCOD. The result of sponge-MBR showed that the TCOD removal was 79% and with an average TN removal of 51% for treatment of septic tank effluent/landfill leachate mixed liquid. However, the conversation of ammonia nitrogen was down to 31%. The introduction of sponge pellet could significantly improve the permeability of MBR system for treatment of septic tank effluent/landfill leachate mixed liquid. It also revealed that the sponge pellet was with a strong capability to enhance the color removal in MBR system. The results showed that the removal efficiencies of metal Mg, Ca, Cr, Fe, Mn, Ni and Ba are 24.2%, 36.3 %, 68.8 %, 86.2 %, 75.3 %, 40.5 %, 53.3 %, respectively. Results of EDX spectra indicated that Zn can pass through the membrane and accumulate on the inner surface.

Keywords
Membrane bioreactor; septic tank effluent; landfill leachate; sponge; metal removal

INTRODUCTION

The membrane bioreactor (MBR) has been receiving a lot of attention in wastewater treatment and water reuse, as membrane filtration promises a complete solid–liquid separation which can prevent the failure of biological systems due to biomass loss and/or bulking and consequently maintains a high number of mixed liquor suspended solids (MLSS) in the reactor (Yamamoto et al. 1989; Chang et al. 2008; Muller et al. 1995; Rosenberger et al. 2000; Chiemchaisri et al. 1992). In principle, membrane bioreactors have no theoretical limitation to the operational biomass concentration, and some researchers reported that bacterial growth could be minimized by operating these systems under long SRT with limiting sludge withdrawal which could lead to the high solid concentrations (15–25 g SS L^{-1}) (Wagner and Rosenwinkel, 2000; Rosenberger et al. 2002; Pollice et al. 2004; Laera et al. 2005; Cicek et al. 2001).