RESEARCH ON WASTEWATER TREATMENT BY EXPANDED GRANULAR SLUDGE BED (EGSB) REACTOR USING POLYVINYL ALCOHOL (PVA) CARRIER

Vu Dinh Khang and Nguyen Tan Phong
Faculty of Environment, Ho Chi Minh City University of Technology
268 Ly Thuong Kiet Street, District 10, Ho Chi Minh City, Vietnam

ABSTRACT

The expanded granular sludge bed reactor (EGSB) has more advantage than UASB. The ratio of height to width of EGSB is 4 to 10, so that it has more time to contacting between wastewater and granular sludge. Additionally, with the high velocity, granular sludge is expanded and the hydraulic mixing is intensified giving granules more chances to contact with wastewater. This lab-scale was operated under mesophilic (30-35°C) condition and with the low strength wastewater (0.8-1g COD/L) for over 120 days. The effluent recirculation water to feed water was set 100%-200%. Poly Vinyl Alcohol (PVA) carrier has porous structure, so that it has the appropriate structure to immobilize and expand anaerobic microorganism. After 2 months star up and contacting to construct granular sludge, PVA color was changed from white to dark brown and deep brown. The lab-scale was operated at five organic loading rates (OLR) from 4 and increased stepwise up to 18 kg COD/m³/day by reducing the hydraulic retention time. The COD and TSS removal efficiency of EGSB reactor with PVA carrier can reach to 92% and over 90 %, respectively.

KEYWORDS: Poly Vinyl Alcohol, Anaerobic process, EGSB reactor, Granular sludge, Biological carrier.

1 INTRODUCTION

The anaerobic treatment has been rapidly developed since the late 1960s. Lettinga told that anaerobic treatment process makes mineral compounds such as ammonium, phosphate, or sulfide and needs additional post treatment for a sustainable environmental protection can be met. Anaerobic treatment has a lot of advantages such as low energy consumption, low production of waste biological solids, storage ability unfed for many months, low nutrients and chemicals requirements, great removal at even high loading rate, pathogen removal, improving dewaterbility and producing energy gases. Seung J. Lim, (2009). Anaerobic biofilm processes, such as up-flow anaerobic sludge blanket (UASB), fluidized bed and fixed bed, are widely accepted as a proven technology for the methanogenic treatment of organic wastewater. The main advantage of this system is the high-rate treatment of wastewater, related to the good retention of anaerobic bacteria by formation of biofilm or granular sludge, Lettinga 1995 & Speece (1996). However, most of organic wastewater is discharged at a moderate temperature and with a low or medium organic strength, Rebec et al., 1999; Angenent et al., (2001). EGSB (Expanded Granular Sludge Bed) reactor was developed to improve the wastewater-biofilm contact via expanding the sludge bed and increase hydraulic mixing by effluent recirculation system As a result, the EGSB reactor show sufficient process performance for treatment of low strength wastewater (ethanol and volatile fatty acid containing wastewater) with 0.8-1.0 g COD/L. Kato et al., (1994, 1997); Rebec, (1998). In this study, this anaerobic process was operated under mesophilic (30-35°C) condition. The effluent recirculation was used to increase contact