Abstract

Biofilm systems have extensively used for biological treatment of domestic and industrial wastewater. Recently, moving bed biofilm reactor (MBBR) was developed, which combined the principle of suspended activated sludge and biofilm technology with an advantage of retaining biomass on carrier. Sludge recycling system was unnecessary in MBBR system which made the process more cost effective. Carriers are floated and mixed in the MBBR through aeration with rising air bubbles or mechanical force that made no dead space in the reactor. MBBR system also had a better recovery capability from system shock and had potential to replace the old treat system due to less building cost and high efficacy.

A real wastewater was obtained from a secondary-fiber papermaking plant in Taiwan. A Kaldnes MBBR system was used for reducing COD in the papermaking wastewater. The temperature of the influent was respectively controlled at ambient temperature, 40 ^{o}C, 50 ^{o}C and 60 ^{o}C. Efficiency of COD removal from the wastewater by this Kaldnes MBBR system was measured. A thermophilic strain BL11 was added into the system to be the target microorganism for establishing the analysis of microbial community by using molecular approach. Polymerase chain reaction-denaturing gradient gel electrophoresis (PCR-DGGE) was used to analyze the microbial community structure of the biofilm. After starting MBBR system

(10% of carrier filling fraction without chemical addition), total COD removal efficiency increased from 71% at ambient temperature to 90% at 60 ^{o}C. Soluble COD removal efficiency was 37% at ambient temperature and 55% at 60 ^{o}C, while the average effluent COD at 60 ^{o}C met the discharged limit (<180.0 mg/L).

Chromosomal DNA of the bacterial community in the bioflim was extracted by using traditional phenol-chloroform method and two commercial DNA extraction kits. The results showed that the traditional phenol-chloroform method followed by a DNA purifying step with isopropanol was superior to the commercial kits on extracting DNA from the biofilm. The result of PCR-DGGE showed the strain BL11 was successfully immobilized onto carrier, but disappeared when operation temperature reached 60 ^{o}C. For future application, the removal efficiency may be improved with higher carrier filling fraction which retains more biomass in the system.

PCR-DGGE analysis can be used to monitor the development of biofilm on the carrier.

Keywords: Papermaking wastewater, Moving bed biofilm reactors (MBBR), Kaldnes, DGGE, Thermophilic

Contents

List of Tables

List of Figures