Influence Factors on Membrane Fouling in Membrane Bioreactors

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In recent years, membrane bioreactors (MBRs) have allowed considerable progress to be made in the field of water treatment, allowing a distinction between solids retention time (SRT) and hydraulic retention time (HRT), resulting in reduced sludge volume and improved effluent quality. However, membrane fouling is a major obstacle to widespread use of this technology.The moving bed-membrane bioreactor (MBBR-MBR) has been developed as alternativeto activated sludge-based membrane bioreactor (MBR) process.The objective of this study is to characterize and compare the membrane fouling and bacterial communitiesbetween MBBR-MBR and MBR.

The results showed that all reactorshad high removal efficiency of ammonium and COD, despite very different fouling conditions. TheMBBR–MBR with media fill ratio of 26.7% had much lower total membrane resistance and no obviousfouling was detected during the whole operation. In contrast, MBR and MBBR–MBR with lower andhigher media fill experienced more significant fouling. Low fouling at optimum fill ratio may be due tothe higher percentage of small molecular size (<1 kDa) and lower percentage of large molecular size(>100 kDa) of EPS and SMP in the reactor. The composition of EPS and SMP affected fouling due to differentO–H bonds in hydroxyl functional groups, and less polysaccharides and lipids.

The result of microbial communities indicated that the microbes of MBBR-MBR can achieve the highest diversity at shorter time, and the reactors had a better ability to resist the shock temperature than the MBR. The bacterial community compositions in two MBRs were significantly different. *Betaproteobacteria* was the predominant group in MBBR-MBR but *Gammaproteobacteria* was the main group in MBR. *Bacteroidetes* was the subdominant group in MBR but it only occupied small proportion in MBBR-MBR. Some uncultured bacterium clones were the dominant species in MBBR-MBR, and *Nitrospira* was the main bacterium in MBR.

Keywords: Membrane bioreactor; Moving bed biofilm reactor; Extracellular polymeric substances; Soluble microbial products; Membrane fouling