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Organic matter recovery from municipal wastewater by using dynamic membrane separation process

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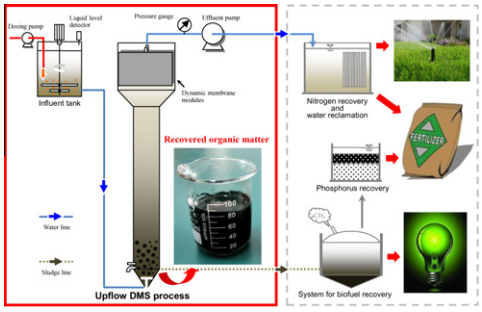
HIGHLIGHTS

- Dynamic membrane separation (DMS) process was used for organic matter recovery.
- 81.6% of organic matter could be recovered by operating the DMS at 60 L/(m^2 h).
- The recovered organic matter had a high C/N ratio compared to activated sludge.
- The dynamic membrane was efficient to retain particles and macro-molecules.

GRAPHICAL ABSTRACT



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ABSTRACT

An upflow dynamic membrane separation (DMS) process was developed for organic matter recovery from low-strength municipal wastewater. During the operation of 300 days, 81.6% of organic matter recovery rate on average was achieved at a high membrane flux of 60 L/(m^2 h). Chemical analyses and batch assays revealed that the recovered organic matter (ROM) had larger carbon to nitrogen mass ratio (C/N) and higher fermentation potential compared to the waste activated sludge. The transformation of the organic matter occurred in the DMS process, which was related to the polyferric sulfate (PFS) coagulation, anaerobic metabolism and membrane retention. The recovery of soluble organic matter was facilitated by the coagulation, and the transformation was observed in the sludge zone due to the anaerobic metabolism. Although the dynamic membrane was less efficient to remove the small molecules, it allowed a sound retention of particulate fractions and biopolymers, enabling a relatively high ROM recovery in the DMS process. Furthermore, the net operation expenditure for the novel wastewater treatment paradigm employing the DMS process was about 0.24 kW h/m^3, much lower than that (1.10 kW h/m^3) for the conventional membrane bioreactor treatment technology. These results indicated that the upflow DMS process was a promising approach for sustainable wastewater treatment.

1. Introduction

The conventional activated sludge (CAS) process, which has been developed for almost 100 years since its invention and currently is still a widely-used method for municipal and industrial wastewater treatment, is now open to question [1]. In CAS processes, influent organic matter is likely oxidized in parallel with the aerobic respiration, which consumes a large quantity of oxygen and results in the greenhouse gas (GHG) emissions. It has been reported that half of the energy needs for a typical CAS plant are used to supply air for the aeration basins [2], and this might account for

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