

Promoting Further Energy Saving of Membrane Bioreactor (MBR)

(Research of FY 2017-2021)

1. Purpose

This study aims to:

- Develop a next-generation MBR process which is operatable with equivalent to or less power consumption than the conventional nutrients removal processes
- Establish evaluation procedures of MBRs for their performance including energy efficiency, required levels of treatment performance, and cost estimation procedures

In this paper, next-generation MBR means MBR that has a higher energy efficiency than the energy-saving goal of 0.4kWh/m³ set at the fourth public proposal joint research.

2. Outcomes of this year

(1) Demonstration of energy-saving MBR: newly proposed joint research, has started, develops/demonstrates an immersed MBR system that reduces energy consumption by adopting energy-saving PVDF flat membrane units and controlling aeration volume.

(2) Trend survey on MBR development: researchers collected and classified articles relating to the development/improvement of MBR targeting overseas papers. In particular, we extracted 150 articles from academic journals, including Water Research, Water Science and Technology, Journal of Membrane Science, or reports published on seminar proceedings such as IWA-MTC or IWA-RMTC, issued for five and half years by September 2018. The extract

data was tallied by their purpose and measures to grasp the general trends in the development of MBR.

- For development/improvement, 150 examples were classified into five categories. They are: (a) cost reduction/energy saving, (b) improvement in the treatment capability of the membrane, (c) improvement in the treated water quality, (d) improvement in maintainability, (e) others. As a result, 59% of articles set their purpose as (b) improvement in the treatment capability of the membrane, and 20% set (a) cost reduction/energy saving (figure 1.)
- Most of the examples (90%) scope the reduction of electric power consumption for "cost reduction/energy saving." It demonstrates energy saving is always a critical issue of MBR. While the energy-saving attempts of 69% target membrane treatment unit, some cases aiming to the entire MBR system account for 23%, which is a significant proportion.
- For the treatment capability of the membrane, 80% of articles aim to control fouling. For fouling control, some new approaches such as using quorum-quenching/sensing (11%) or electric field(9%) are found in addition to the conventional methods like the enhancement of aeration washing (15%), material improvement of the membrane (11%), and the property improvement of activated sludge(7%).

(3) The evaluation for the energy-saving performance of next-generation MBR: Researchers summarized 11 samples that estimated/evaluated energy-saving performance and introduction cost and started organizing information to develop the standard procedure on the evaluation of MBR for its expenses and energy-saving performance.

3. FUTURE PLANS

Joint research will continue the development/demonstration of new MBR enhanced energy-saving performance, and establish the evaluation procedure of MBR for its costs and energy-saving performance.

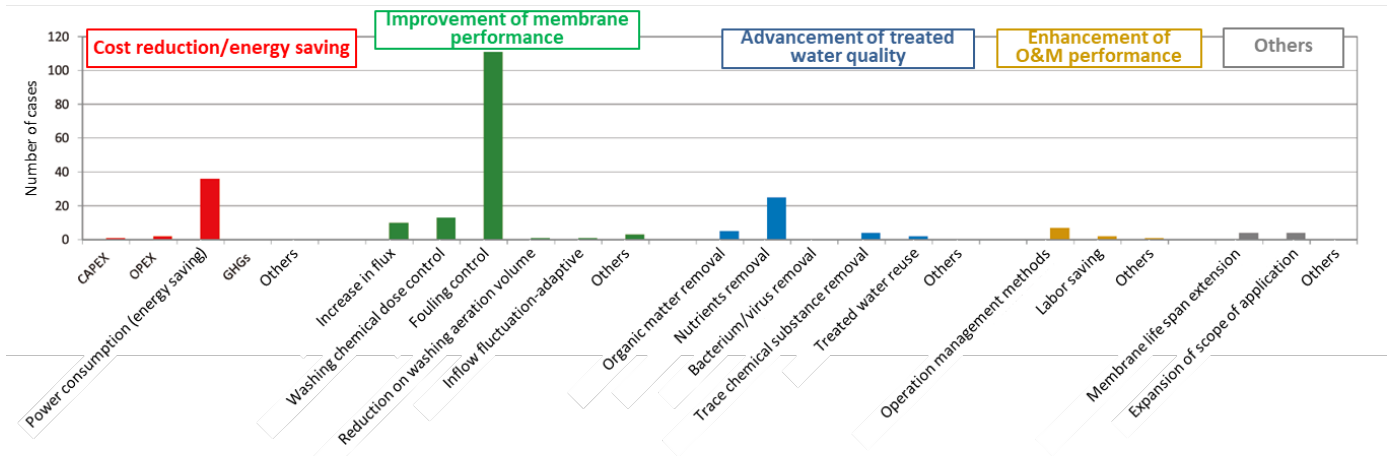


Figure 1: Aggregate results by purposes for MBR development/improvement in international journals (multiple answers)

Keywords: Membrane bioreactor, MBR, Energy saving