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Synergy between Membranes and Microbial Fuel Cells

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DOE Workshop on Hydrogen, Hydrocarbons, and Bioproduct Precursors from Wastewaters
March 18-19, Washington DC

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Why linking "filtration-type membranes" to MFCs?

- Effective separation of biomass from the final effluent;
- High-quality effluent for direct discharge or reuse;
- Assist electricity generation or other bioproducts.

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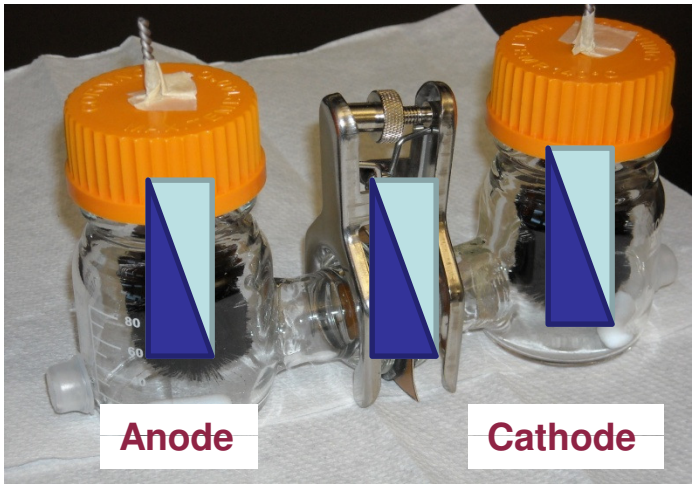
How to link "membranes" to MFCs?

Internal



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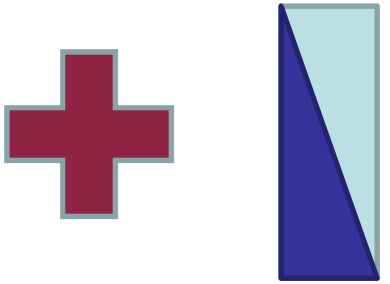

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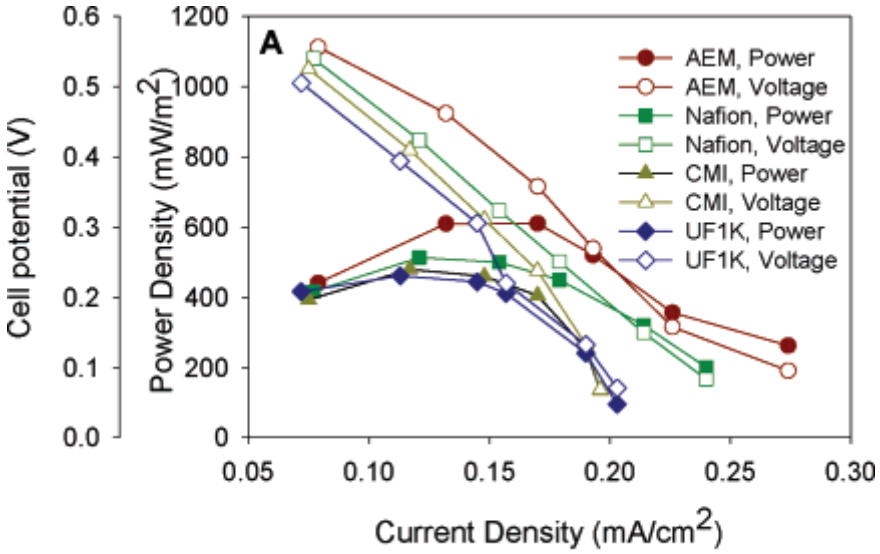
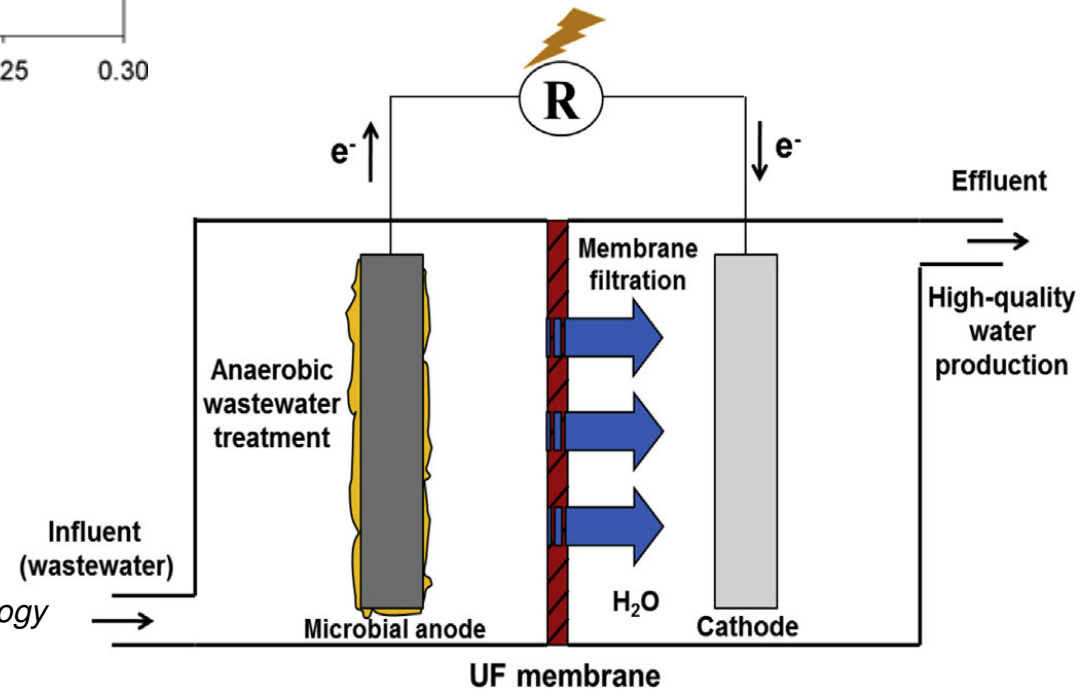
Membrane as separators in MFCs



No water flux

Water flux



Kim et al. (2007) Environmental Science &Technology
Kim at al. (2015) Journal of Power Sources

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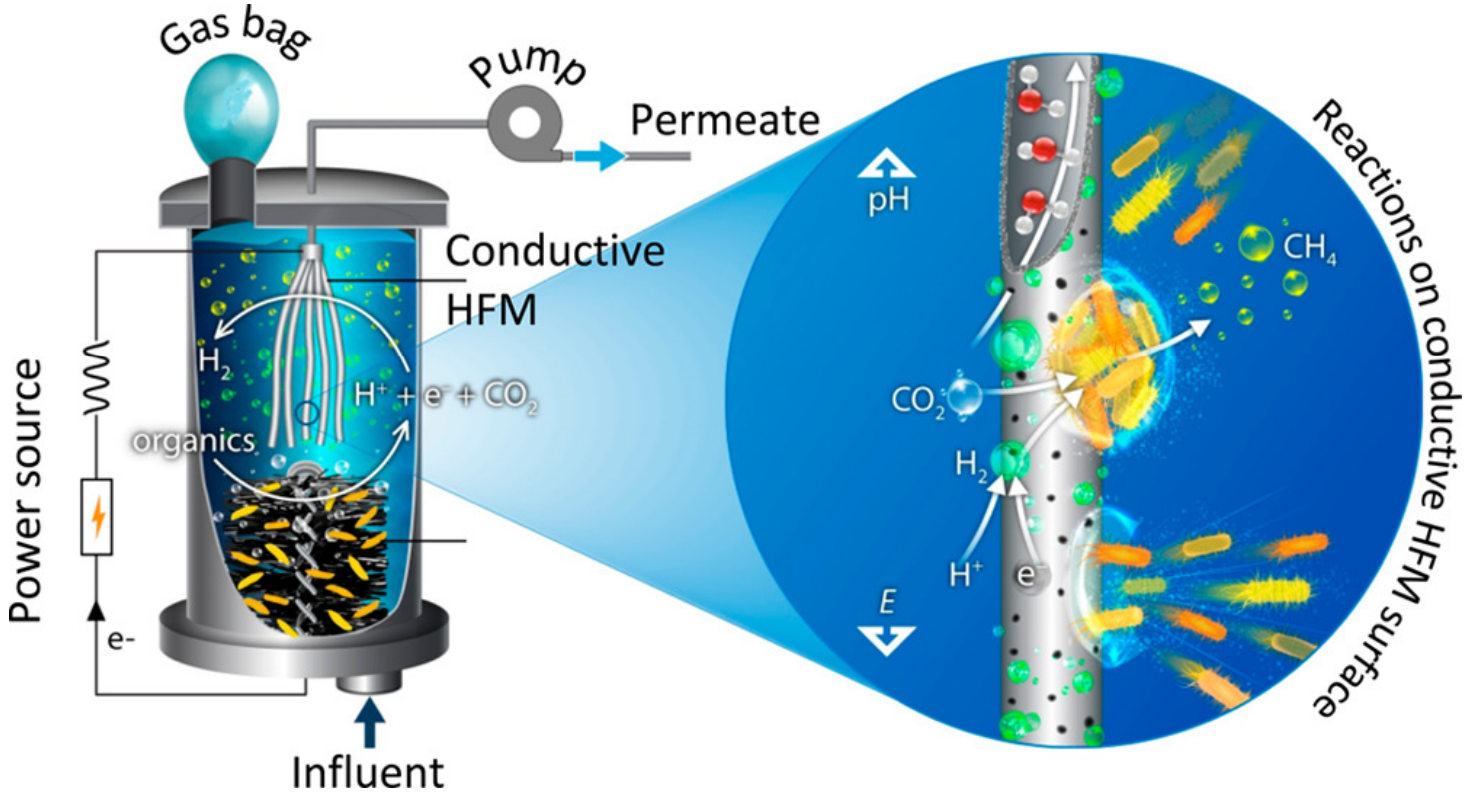
Membrane as separators in an MEC



Katuri et al. (2014) Environmental Science &Technology

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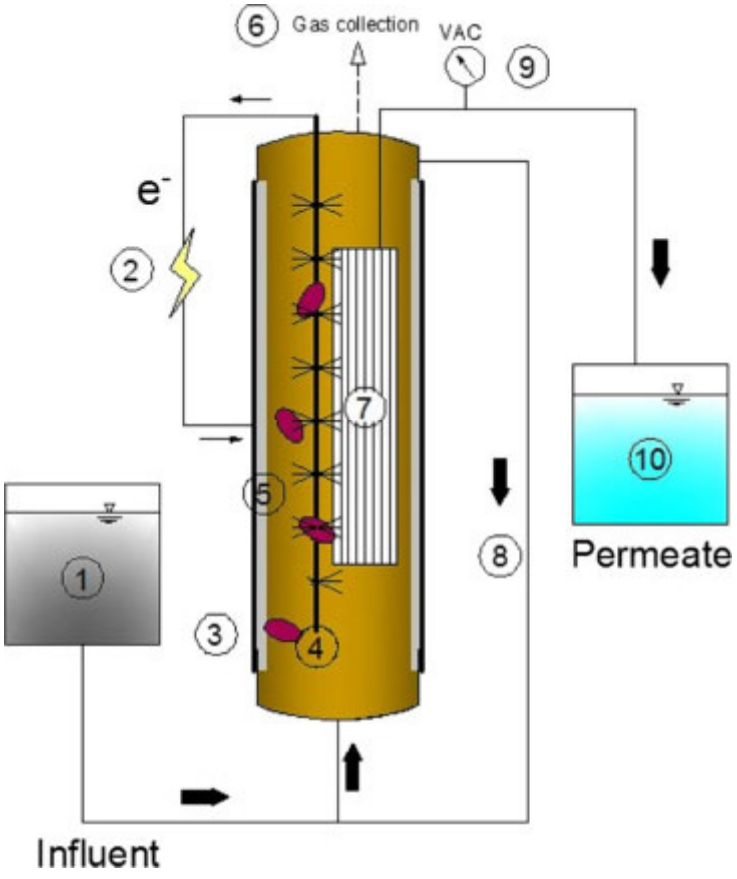
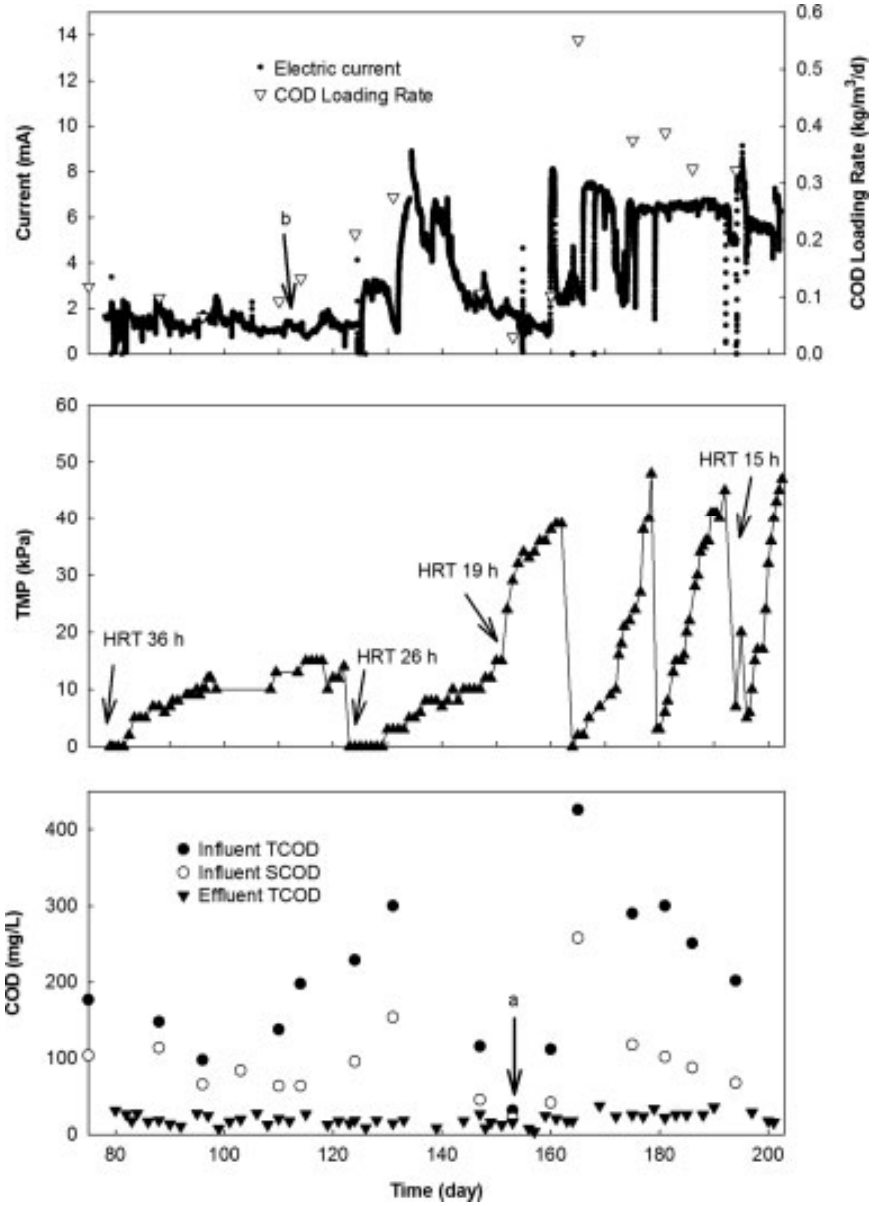
Membrane in MFC anode





Ge et al. (2013) Journal of Chemical Technology & Biotechnology

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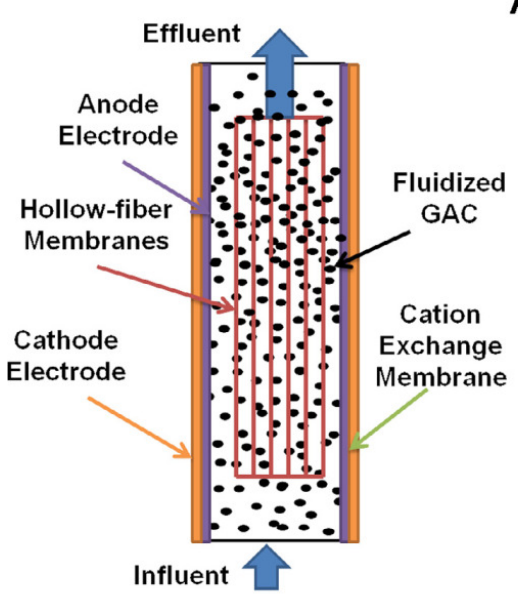
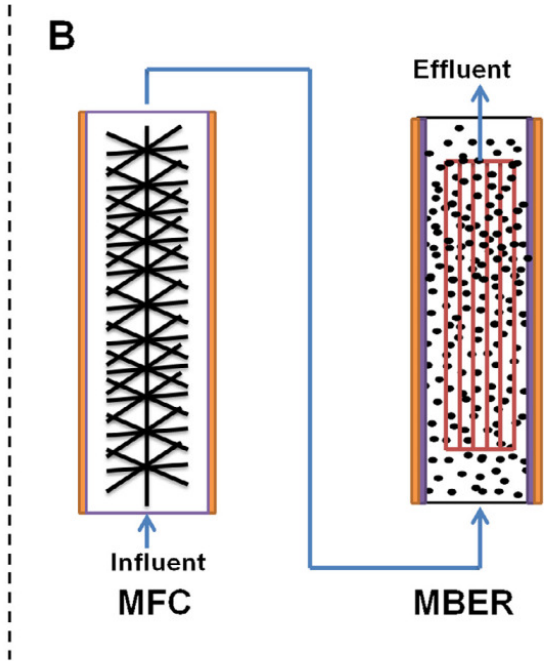
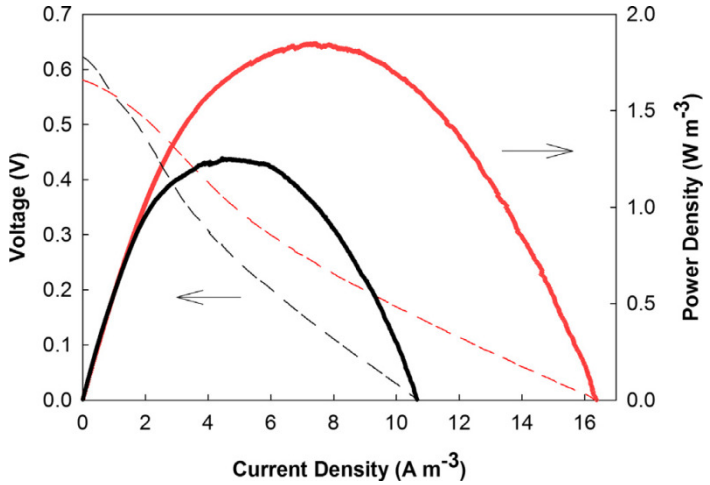
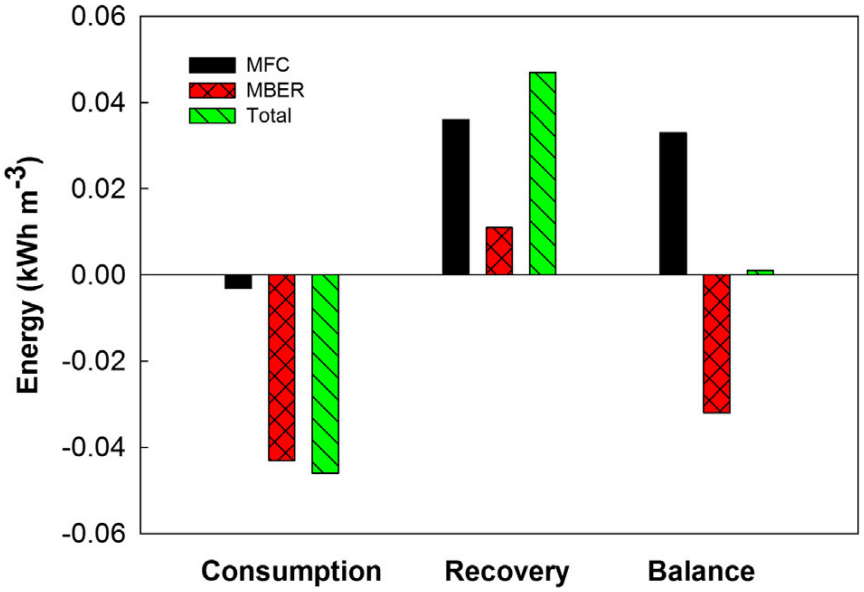
Membrane in MFC anode (fluidized GAC)









Li et al. (2014) Bioresource Technology

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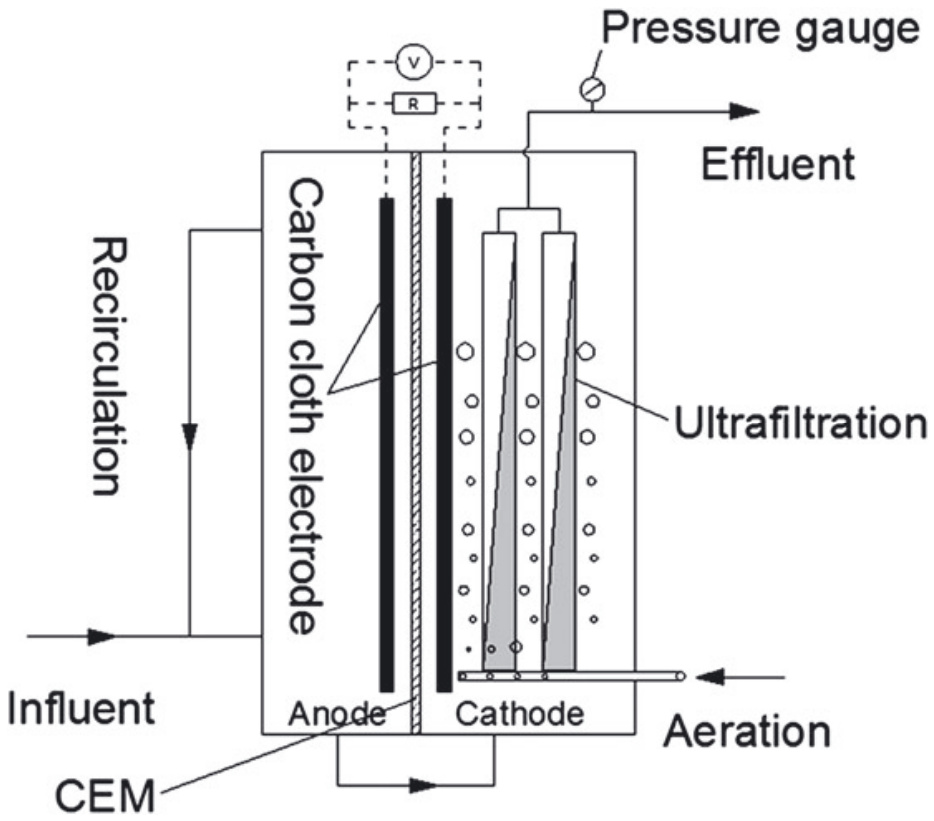
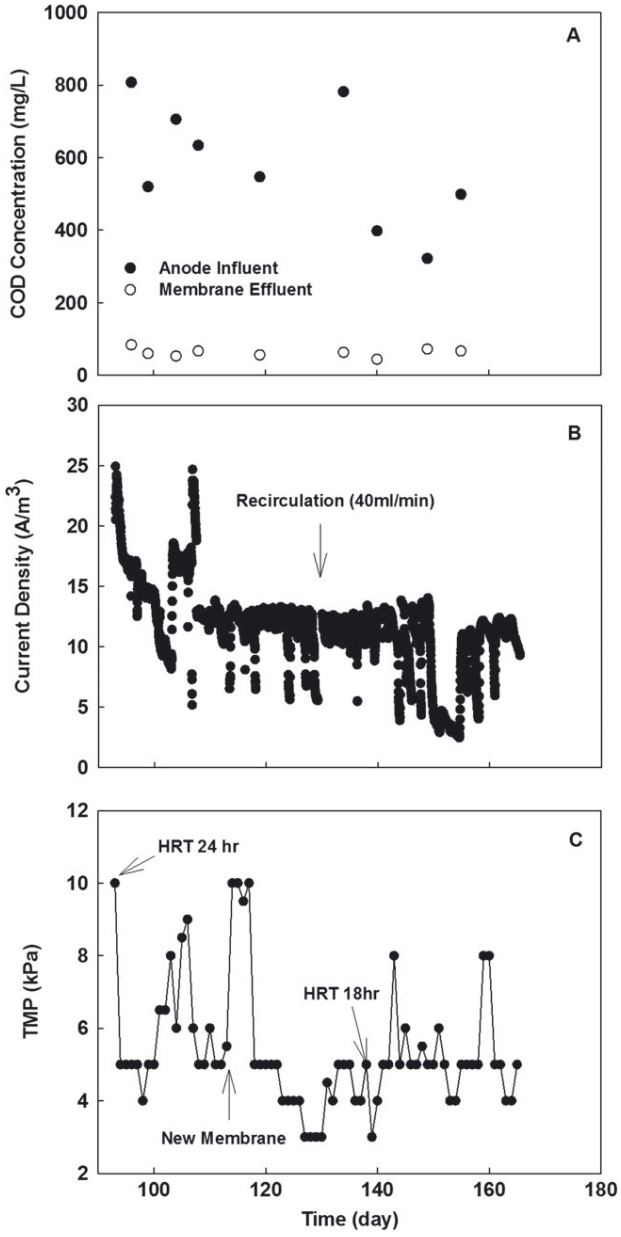
Membrane in MFC cathode





Li et al. (2014) Journal of Chemical Technology & Biotechnology

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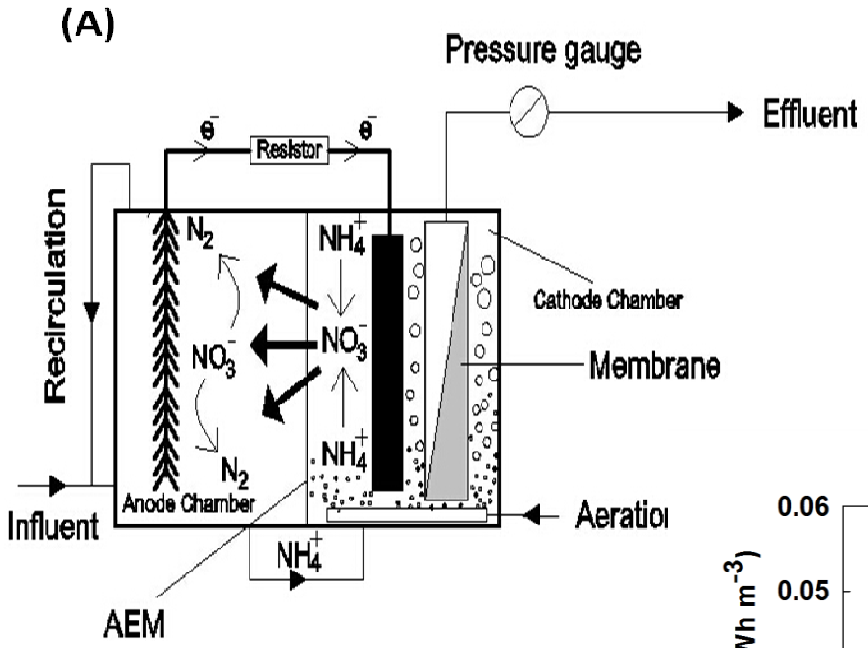
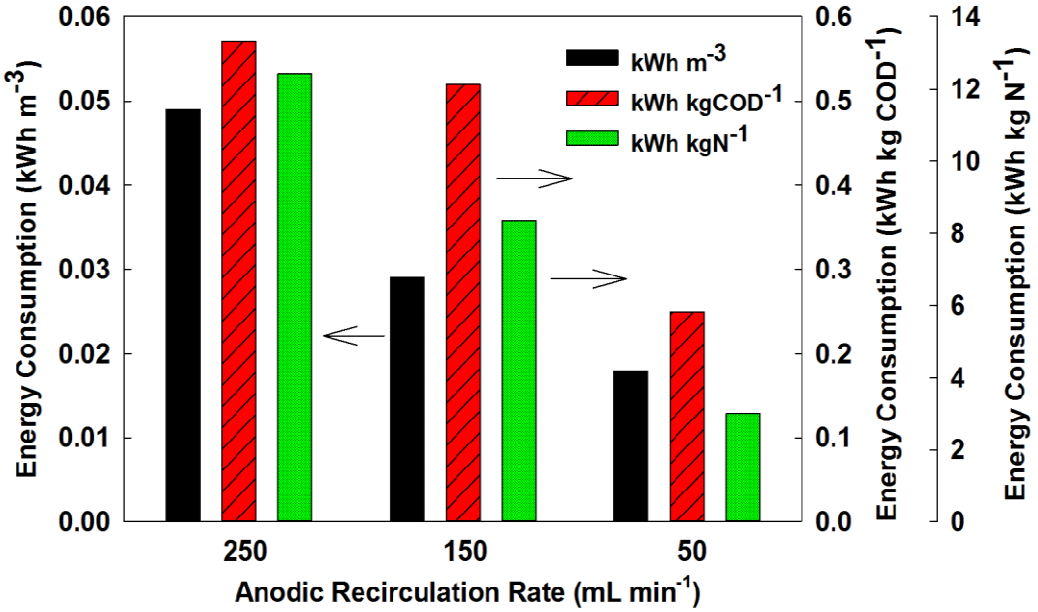
Membrane in MFC cathode



Using AEM to improve nitrogen (nitrate) removal



Li et al. (2015) Environmental Science: Water Research & Technology

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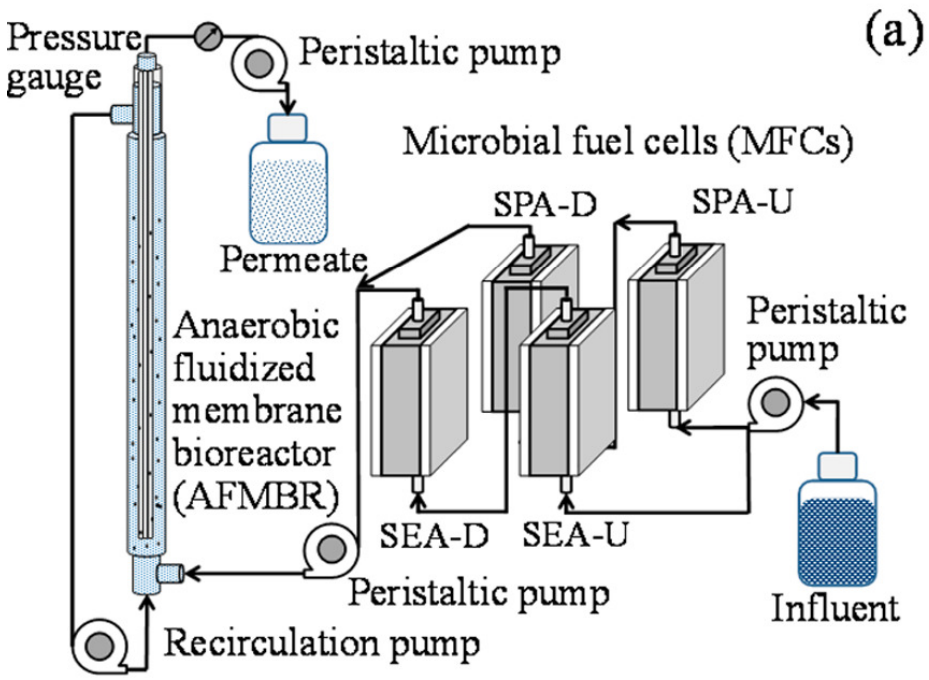
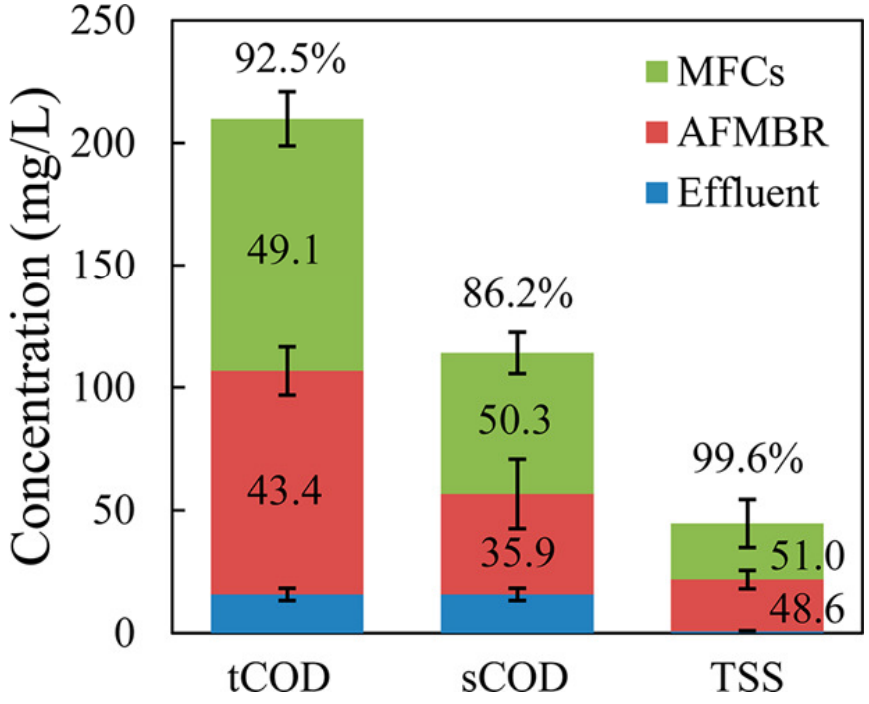
External linkage





Ren et al. (2014) Environmental Science & Technology

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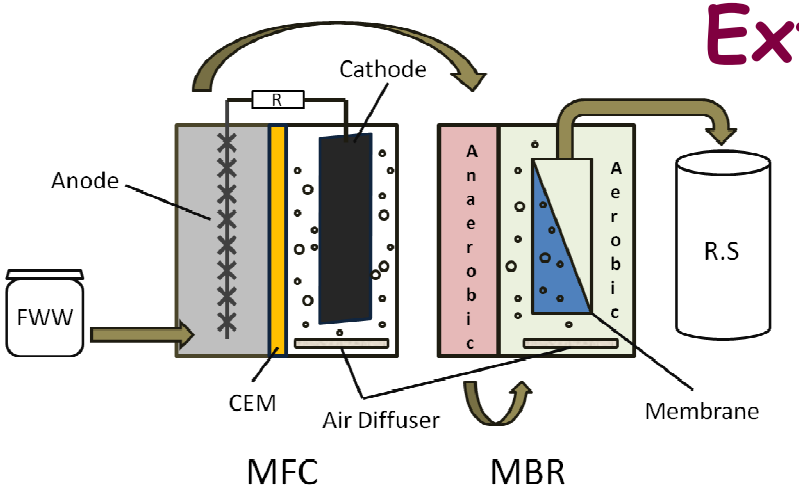
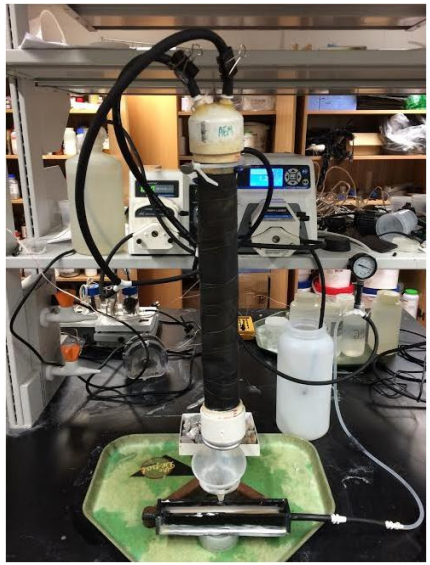
External linkage





Unpublished information.

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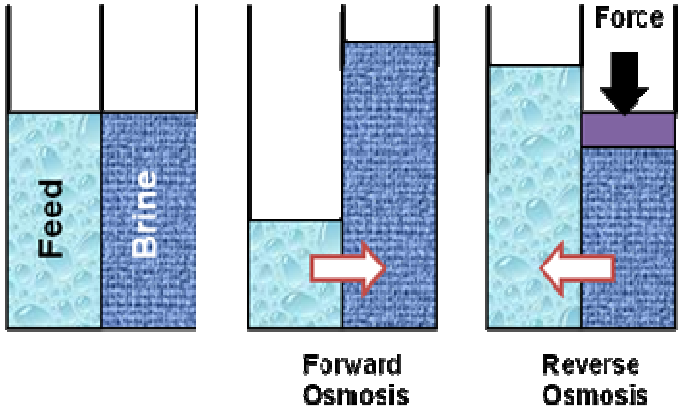
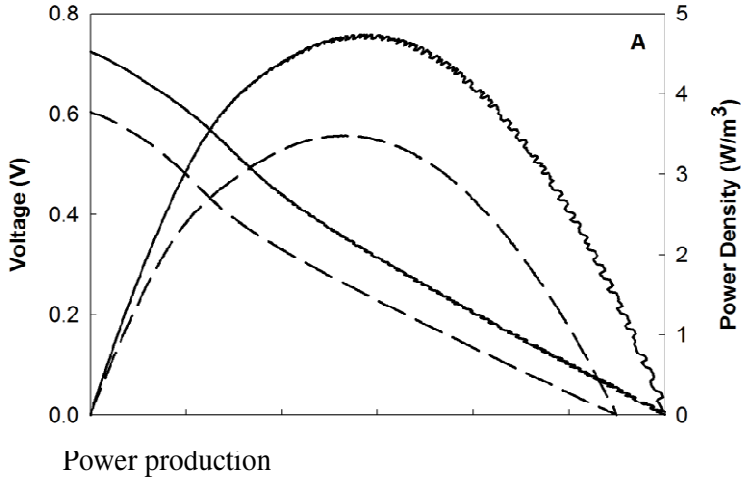
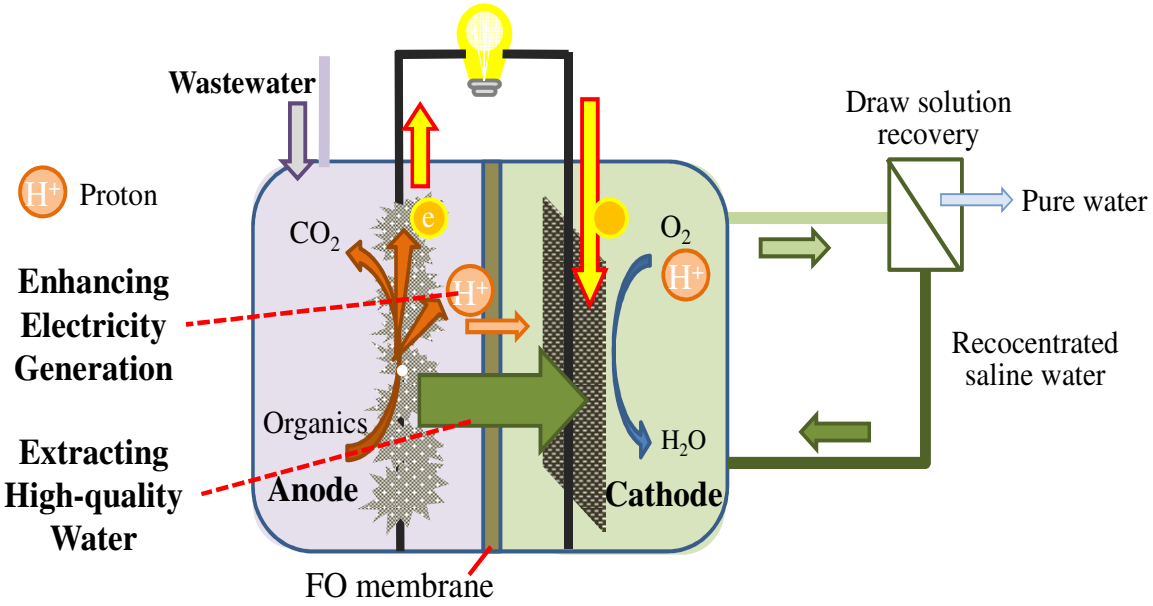
Another type of membrane – forward osmosis (FO)





Power production



OsMFC

Lu et al. (2015) Water
Zhang et al. (2011) Environmental Science & Technology.

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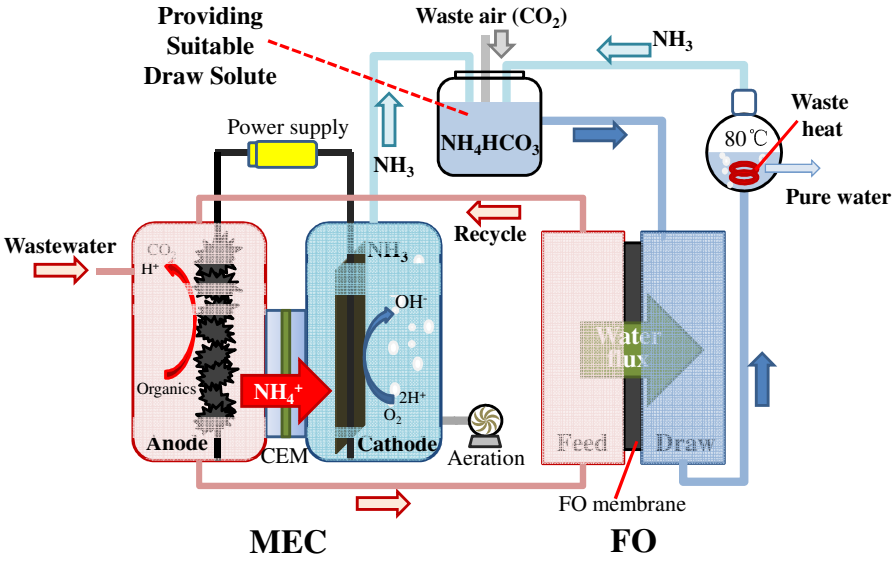
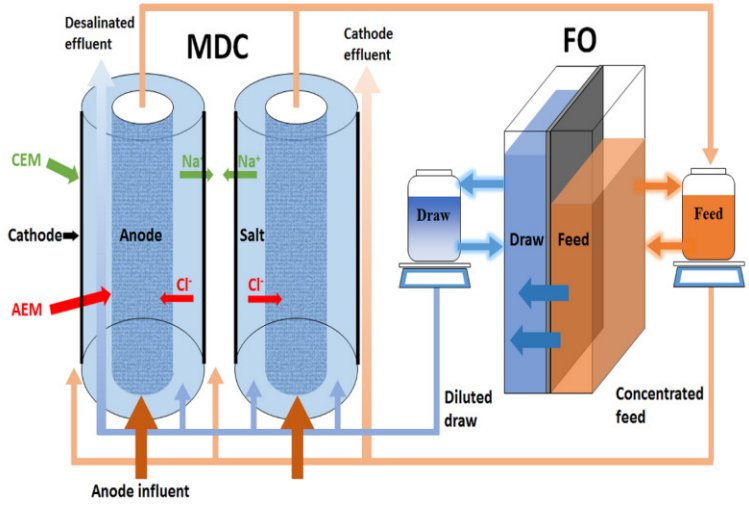
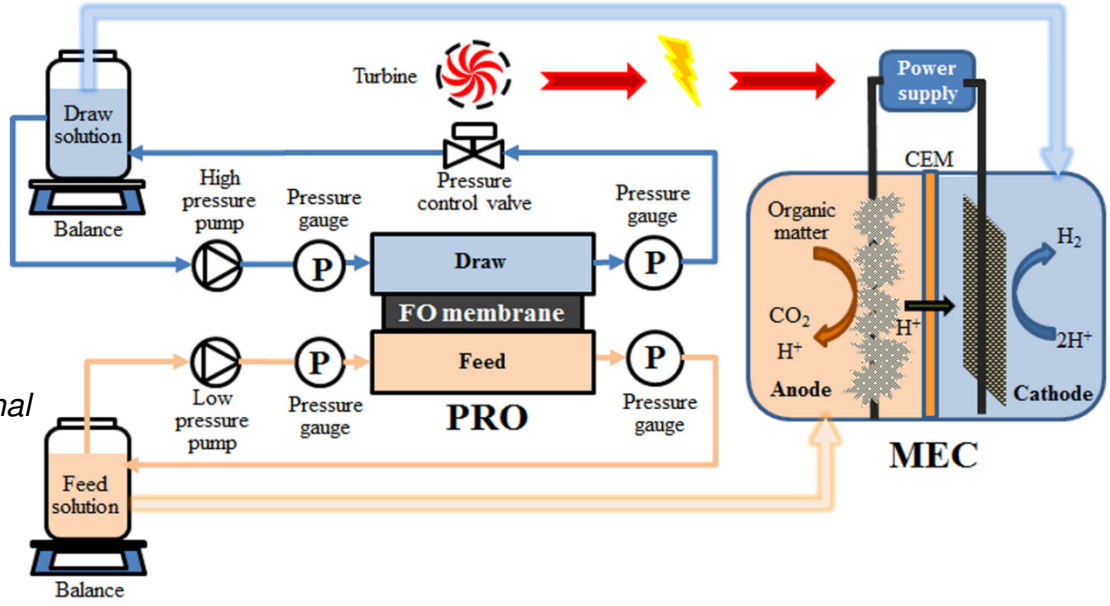
Osmotic BES







Yuan et al. (2015) Chemical Engineering Journal
Qin and He (2014) Environmental Science & Technology Letters
Yuan et al. (2015) Environmental Science & Technology. Under review

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Implications

- Strong synergy between membranes and MFCs;
- Internal vs. external integration; functions, capital investment, operating cost, and maintenance;
- Forward osmosis is also of strong interest.

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Thank you!