HIGH QUALITY TREATED WASTEWATER FOR IRRIGATION PURPOSES USING AN OPTIMIZED AERATION PROCESS IN MEMBRANE BIOREACTORS

18 March 2020

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Overview

Motivation

Problem statement

Experimental setup

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Conclusions
Water scenario in Qatar

Scarcity of renewable water resource\textsuperscript{[2]}

Major sources of water in Qatar\textsuperscript{[1]}

\begin{itemize}
\item 2\%
\item 68\%
\item 30\%
\end{itemize}
There are 3 major sewage treatment plants in Qatar.

Their combined capacity is 690,000 m³/day.

Primarily used for agriculture and landscaping.

Also used in other sectors.
Fertilizing solution

High nutrient concentration makes TSE suitable for irrigation [3].

Excess nutrient concentration can have adverse effect on soil [4].

The nutrient concentration in TSE must be controlled.

The fertilizing solution should meet the standard set by FAO [5].
Available technologies

Diagram showing the process of wastewater treatment and draw solute recovery.
Membrane bio-reactor

Membrane bio reactor combines the traditional activated sludge process and membrane processes.

The activated sludge in the reactor decomposes the organic foulants and the membrane filters them out.

In membrane bio reactor, continuous aeration is provided for the biomass.

Membrane fouling is the major challenge in membrane bio reactors.
Evaluation of the effect of **aeration rate**, **aeration type** and **biomass concentration** on membrane flux.
Experimental setup
Experimental result

- Time (min)
- MLSS Concentration (10g/l)
- Normalized permeate flux (%)

- Cont. 1.5LPM (10g/l)
- Cont. 0.5LPM (10g/l) (2)
- Cont. 1.0LPM (10g/l) Avg

- Average Flux (LMH)
- 1.5 LPM: 51.28
- 1.0 LPM: 40.74
- 0.5 LPM: 38.36
Experimental result

![Graph showing experimental results with normalized permeate flux (%) on the y-axis and time (min) on the x-axis. The graph compares different conditions: Cont. 0.5LPM (5g/l), Pulsed 1.0LPM (5g/l), Cont. 1.0LPM (5g/l), Pulsed 1.5LPM (5g/l), Cont. 1.5LPM (5g/l), Pulsed 0.5LPM (10g/l) Avg, Pulsed 1.0LPM (10g/l) Avg, Cont. 1.0LPM (10g/l) Avg, Pulsed 1.5LPM (10g/l) Avg, and Cont. 1.5LPM (10g/l) Avg.]
Experimental result

- Flowrate 1.5 LPM

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<th>Cont. 1.5LPM (10g/l)</th>
<th>Pulsed 1.5LPM (5g/l)</th>
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- Continuous Aeration (g)  
- Pulsed Aeration (g)
Student learning outcome and Future work

Through this project, we:

- Learned how to carry out detailed literature review on a specific topic.
- Learned the importance water reclamation in sustaining our society.
- Learned how to work as a team of achieve difficult objectives.
- Learned how to write a scientific report.

In future, the following tasks can be done:

- Dielectrophoretic (DEP) force inducing membranes can be used.
- Pulsed voltage can be applied in DEP membranes to reduce the energy consumption.
- Different type of membrane can be used.
Conclusions

- Reclaiming wastewater and using it for agriculture will improve water security in Qatar.
- Membrane bioreactors can be used for reclaiming the wastewater.
- Fouling of membrane must be reduced to make this technology viable.
- By using 5gm/L biomass, at 1.5 L/min pulsed aeration, highest average flux of 63.32 LMH was obtained.
Acknowledgement

This project was made possible by UREP (grant # UREP22-007-2-003) from the Qatar National Research Fund (a member of The Qatar Foundation). We would also like to thank the public works authority of Qatar (Ashghal) for their support and for their supply of the biomass samples.
Thanks for your attention
References


