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Hybrid electrochemical microfiltration treatment of reverse osmosis concentrate: A mechanistic study on the effects of electrode materials

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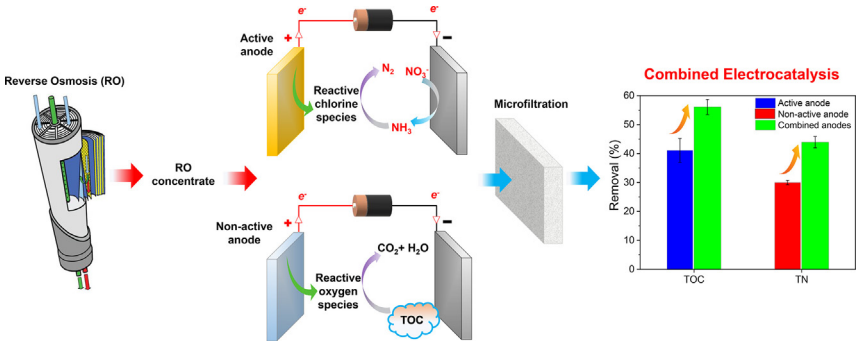
GRAPHICAL ABSTRACT



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ABSTRACT

The reverse osmosis (RO) technology is promising as a key process for water reuse, but the RO brine (concentrate) needs proper treatments for minimal liquid disposals. This study investigated the potential of hybrid electrochemical microfiltration for the treatment of the RO concentrate from a municipal wastewater reuse plant. Two anodes (active Ir-RuO_x and non-active Sb-SnO_2) and two cathodes (stainless steel and carbon felt) were employed and compared in terms of the contaminants removal. The electrochemical microfiltration treatment achieved a substantial removal of color, turbidity, chemical oxygen demand, and fluorophores. However, the removal of the total nitrogen and organic carbon was limited. Then, mechanistic studies on the used electrode materials for the electrocatalysis of the RO concentrate were further conducted. The electrocatalysis that used a non-active anode improved the mineralization of the organics, whereas the active anode enhanced the denitrification. The combined use of the two anodes enabled the enhancement of the overall removal efficiencies. In addition, the oxidants (reactive chlorine/oxygen species) responsible for the organics and the nitrogen removals were elucidated. Overall, it was revealed that the electrochemical microfiltration that utilizes proper electrode combinations is a promising option for enhancing the treatment of RO concentrates with minimal disposals.

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