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ORIGINAL ARTICLE

Conforming to Agricultural Water Reuse Criteria: Wastewater Recovery by Electrooxidation Integrated with Nanofiltration/ Reverse Osmosis

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Abstract

In this study, two membrane configurations were investigated for water recovery in order to determine the potential for quality irrigation water production from alkaloid industry wastewater. In the first configuration, electrooxidation (EO) was used as a pretreatment before the NF90/BW30 units. In the second configuration, a single-pass, two-stage system consisting of NF4 and NF90/BW30 membranes was applied by replacing the EO unit with NF4. The initial and final fluxes in the single-pass two-stage system with NF4 and NF90 were calculated as 10.2 $Lm^{-2}h^{-1}$ and 5.4 $Lm^{-2}h^{-1}$, respectively. Initial fluxes for the NF4 + BW30 and EO + BW30 combinations were 9.4 $Lm^{-2}h^{-1}$ and 3.2 $Lm^{-2}h^{-1}$, respectively. Increasing the current density from 256 to 768 A/m^2 caused the specific energy consumption (SEC) to increase from 10.26 to 15.84 kWh/kg COD. Scanning Electron Microscopy (SEM) and energy dispersive X-ray spectroscopy (EDX) were used for membrane autopsies. Compliance with the criteria for agricultural reuse of recovered water was evaluated based on four key parameters: salinity, pathogens, nutrients, and heavy metals. The combination of electrooxidation and membrane treatments enabled simultaneous disinfection, reduction of salinity and heavy metals to comparable agricultural water reuse criteria.

Highlights

- Electrooxidation and pressure-driven membranes were integrated for water reclamation.
- Salinity, pathogens, nutrients, and heavy metals were analyzed for reuse conformity.
- NF4 and BW30 membranes provided better reclaimed water quality.
- Complete disinfection, and reduction of salinity and heavy metals were obtained by RO.

Keywords Wastewater reuse · Irrigation water · Industrial wastewater treatment · Electrooxidation · Membrane filtration

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