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# Low Temperature Biological Treatment of Chemical Oxygen Demand for Agricultural Water Reuse Application Using Robust Biocatalysts

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**Abstract :** The agriculture industry is especially vulnerable to forecasted water shortages. In the fresh and fresh-cut produce sector, conventional flume-based washing with recirculation exhibits high water demand. This leads to a large water footprint and possible cross-contamination of pathogens. These can be alleviated through advanced water reuse processes, such as membrane technologies including reverse osmosis (RO). Water reuse technologies effectively remove dissolved constituents but can easily foul without pre-treatment. Biological treatment is effective for the removal of organic compounds responsible for fouling, but not at the low temperatures encountered at most produce processing facilities. This study showed that the Microvi MicroNiche Engineering (MNE) technology effectively removes organic compounds (> 80%) at low temperatures (6-8 °C) from wash water. The MNE technology uses synthetic microorganism-material composites with negligible solids production, making it advantageously situated as an effective bio-pretreatment for RO. A preliminary technoeconomic analysis showed 60-80% savings in operation and maintenance costs (OPEX) when using the Microvi MNE technology for organics removal. This study and the accompanying economic analysis indicated that the proposed technology process will substantially reduce the cost barrier for adopting water reuse practices, thereby contributing to increased food safety and furthering sustainable water reuse processes across the agricultural industry.

**Keywords :** biological pre-treatment, innovative technology, vegetable processing, water reuse, agriculture, reverse osmosis, MNE biocatalysts
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