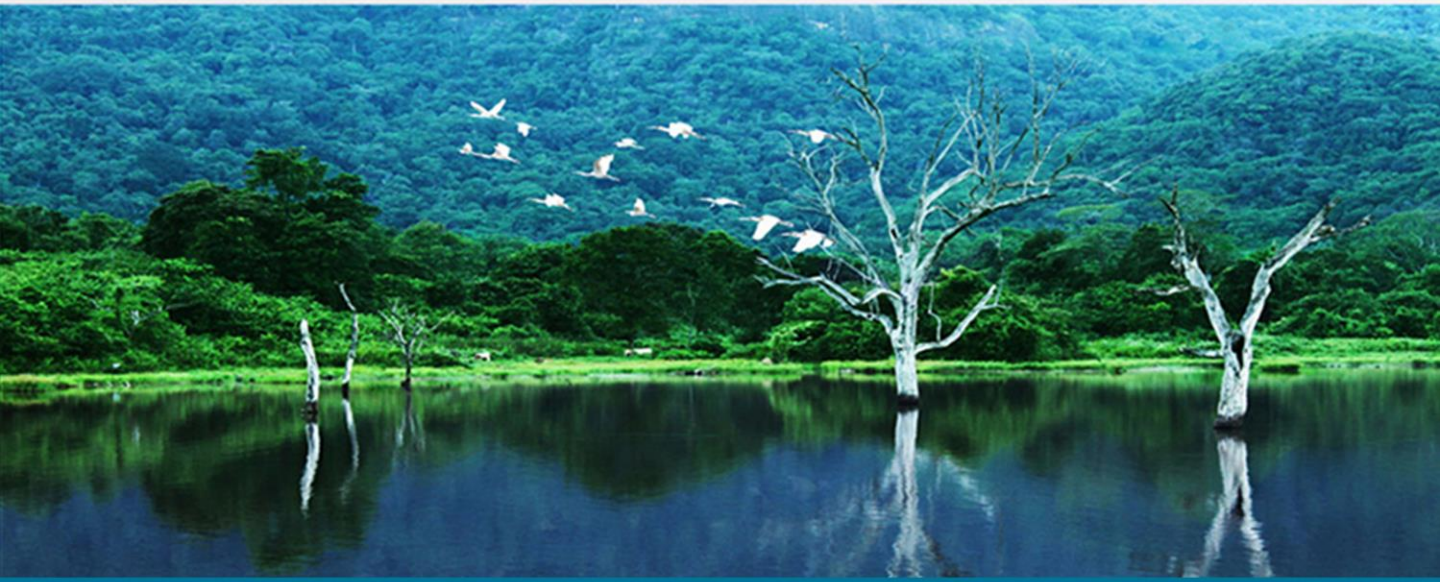
PROCEEDINGS

INTERNATIONAL SYMPOSIUM ON WATER QUALITY AND HUMAN HEALTH

2024

CHALLENGES AHEAD



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All begins with water

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PR23

MEMBRANE-DRIVEN WATER DESALINATION AND REMOVAL OF TOTAL DISSOLVED SOLIDS FROM DRY ZONE WATERS IN SRI LANKA

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Over three million individuals, mainly residing in the North and North-Central Provinces of Sri Lanka, face water stress due to the lack of access to safe drinking water within their home areas. Unfortunately, most of the water sources in the dry zone have excess fluoride levels, high hardness, excess salinity and high levels of total dissolved solids (TDS) which render the water unfit for consumption. TDS is a secondary contaminant in drinking water with permissible limits of 300 mg L^{-1}. Water desalination is the first step in improving the palatability of such water, and various methods have been used to achieve the desired salinity levels in drinking water. In the current study, a reverse osmosis (RO) desalination system with an optimized membrane configuration was used to remove excess salinity without the use of external chemicals. This system employs ultrafiltration, and nanofiltration followed by reverse osmosis membranes in a special topology. This allows the selective removal of excess salinity and TDS while retaining essential nutrients, such as calcium, magnesium, potassium and other beneficial minerals. The nanofiltration step removes larger contaminants, such as organic matter, heavy metals and certain salts; but crucially preserves vital minerals with smaller ionic radii in the permeate stream. For experimental purposes, a seawater sample diluted with deionized water was used as the feed water. After being filtered using an ultrafiltration unit, TDS and electrical conductivity of the seawater decreased from 1360 mg L^{-1} and 2630 µS cm^{-1} to 1210 mg L^{-1} and 2430 µS cm^{-1}, respectively. The concentrate generated from the nanomembrane was used as the feed water for the RO membrane. The nano and RO membrane permeates were combined to achieve the desired water quality. To assess the performance, TDS, electrical conductivity and pH of both the feed and permeated water were measured, along with the flow rate of both the permeate and concentrated water using a multiparameter with a calibrated probe for over 30 days. The average concentration in the feed was 1190 mg L^{-1}, whereas the average concentration in the permeate was 40 mg L^{-1}. A 96% average rejection rate was observed for this period. The results of the study suggested that the filtration system was effective in removing a significant percentage of dissolved solids from the feed. Therefore, it could be concluded that the reverse osmosis system, at the laboratory level, exhibits high rejection rates for water desalination, and hence it could be a potential method for providing safe drinking water in the dry zone of Sri Lanka.

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Keywords: Membrane topology, Nanofiltration, Reverse osmosis, Water desalination

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