THE IMPACT OF TREATED WASTEWATER ON MANGANESE CONCENTRATION IN BASIL PLANTS

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INTRODUCTION

The textile industry generates large volumes of wastewater, which often contains pollutants, including heavy metals like manganese (Mn). Traditional treatment methods struggle to adequately remove these contaminants, posing environmental risks. Hybrid membrane processes, combining ultrafiltration (UF) and reverse osmosis (RO), offer a promising solution for treating textile wastewater (TWW). This study explores the potential reuse of retentate from such a process, focusing on the Mn concentration in basil plants irrigated with different water sources. By assessing Mn uptake, we aim to evaluate the feasibility of using concentrated retentate as a sustainable irrigation option.

OBJECTIVE

The objective of this study is to investigate the potential reuse of retentate from a hybrid membrane process, involving ultrafiltration and reverse osmosis, in the treatment of textile wastewater.

MATERIALS AND METHODS

Basil plants were irrigated with tap water, untreated textile wastewater, RO retentate (utilization 35%), and a 50:50 mix of RO retentate and tap water. Four planting pots were used for each type of water, with each pot irrigated with 75 mL of water daily for 21 days. The pots were illuminated with a Bestva LED Light lamp, model GW-DMD200, 2000 W, for 16 hours daily. The temperature and relative humidity were 24.2 ± 0.8 °C and 47.2 ± 2.3%, respectively measured using a Trotec BL30 climate data logger (Germany). For plant material analysis, a dryer, analytical balance (0.0001 g), microwave oven, decomposition block, scrubber, Kjeltec distillation unit, UV-VIS spectrophotometer, flame photometer, and atomic absorption spectrometer were used. The analysis followed the Official Methods of Analysis of AOAC INTERNATIONAL, 22nd Edition, Volume 1, Oxford University Press, 2023. Vanta, Olympus, 2019.

RESULTS

The results showed that the Mn concentration in the plant material, based on dry weight, was 15.6% for plants irrigated with retentate, 23.4% for plants irrigated with TWW, 32.6% for plants irrigated with drinking water, and 30.5% for plants irrigated with the 50:50 mix of RO retentate and tap water. Additionally, a lower yield was observed in plants irrigated with retentate (Figure 3) and 50% retentate (Figure 4) compared to those irrigated with tap water (Figure 1) and TWW (Figure 2).

Figure 1. Basil plants irrigated with tap water.

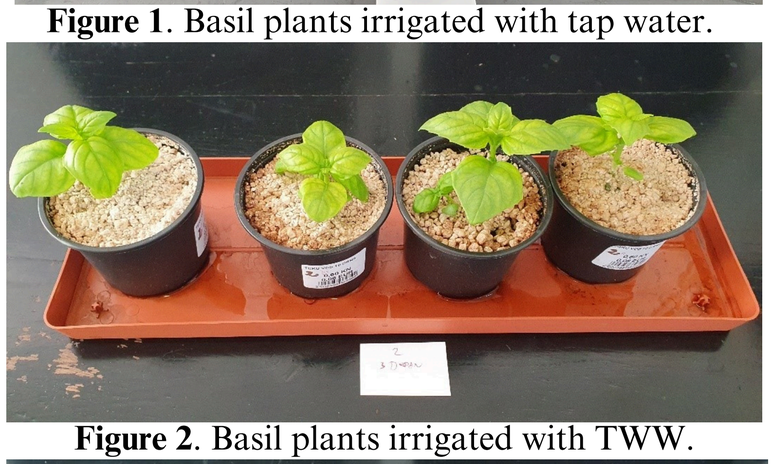

Figure 2. Basil plants irrigated with TWW.

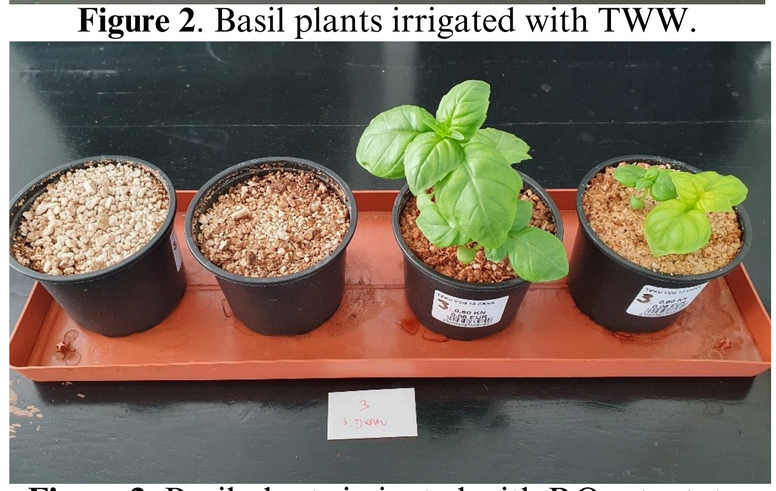

Figure 3. Basil plants irrigated with RO retentate.

Figure 4. Basil plants irrigated with 50% retentate mixture.

CONCLUSION

These results indicate that the reuse of 50% concentrated retentate in this study may be effective in managing Mn concentrations. The findings also revealed a higher Mn content in tap water compared to wastewater, which raises significant concerns. However, employing hybrid membrane processes could help in lowering Mn levels in both tap water and wastewater.

This publication is supported by: The NATO Science for Peace and Security Programme