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Recycling Wastewater as Fertiliser for Basil Growth in Indoor Farming

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Abstract

Water scarcity has emerged as a serious issue worldwide due to the growth of the global population. At the same time, generated wastewater volume has increased with the development of population, economy, and urbanization. To combat water shortage, one potential solution is the reclamation and utilization of wastewater in agriculture. Notably, wastewater contains valuable nutrients such as nitrogen, phosphorus, potassium, and essential metals. Thus, wastewater may be used as a substitute for synthetic fertilizer in agriculture, simultaneously conserving water resources and mitigating environmental concerns associated with synthetic fertilizer production. Therefore, to investigate the potential of using wastewater as a fertiliser, a pot experiment was conducted with basil (*Ocimum basilicum L.*) growing to recover nutrients from various wastewater streams. Ten basil seeds were sown in each round pot (D: 15 x H13.9 cm) containing zeolite-based substrate. Nutrient-free composition of the substrate allows for precise management of nutrient levels and simulates conditions found in hydroponic systems. The special characteristics of the zeolite-based substrate can also provide valuable insights into the potential utilization of wastewater as a fertilizer in both traditional and hydroponic farming approaches. A total of 16 pots was set up with four replicates of four different water streams including tap water as control, optimal liquid fertilizer, treated wastewater that was discharged from the wastewater treatment facility, and partially treated wastewater (after mechanical treatment). The pots were placed in a controlled indoor environment with temperature (18-20 °C) and humidity (40-50%) regulation. Irrigation occurred every two days over an eight-week period. Parameters such as plant height, number of leaves per plant, fresh weight, chlorophyll content, nutrient content in substrate, roots and the shoots of the plants, and metal concentrations are measured post-harvest. Collected data are analysed using the statistical software R. Differences in growth parameters and nutrient concentrations among treatments are analysed by performing the analysis of variance (ANOVA) and Duncan’s post-hoc test. This study aims to provide insights into the potential of wastewater reuse as an alternative to synthetic fertilizer for growing herbs in indoor farming. By exploring the use of wastewater as a nutrient source, this research addresses the pressing need for alternative fertilization methods that simultaneously promote resource efficiency and environmental

sustainability in the field of agriculture and indoor farming. The findings will contribute to developing sustainable agricultural practices, conserving water resources, optimizing fertilizer usage, and mitigating environmental pollution uniquely in parallel.

Keywords: wastewater reuse, indoor farming, nutrient recycling, alternative fertiliser, sustainable agriculture