Utilization of Gel and Fiber Extracts From Opuntia ficus-indica Cactus as an Innovative and Sustainable Approach for Water Purification: An Eco-Friendly Solution for Reducing Turbidity and Enhancing pH Balance in Water Treatment Processes

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Water pollution is a global problem which requires sound, cost-effective wastewater purification. This study evaluates the natural effectiveness of Opuntia ficus-indica (prickly pear cactus) as a bio-flocculant for water treatment compared to Jordanian and international drinking water (WHO, EPA). We used some fibres and gel extracted from the plant on stagnant kitchen wastewater in three ways: either on fibres only, or gel only, or a combination of both. The pH, turbidity, organic matter, and color of water samples were performed based on WHO drinking water quality parameters. The findings indicated that the most effective treatment was the fiber-gel mixture, which reduced turbidity to 8 NTU, complying with the Jordanian (=5 NTU) and WHO (=5 NTU) standards. The pH was 7.5 which was in the WHO limit 6.5–8.5. Fiber alone did not do much, gel alone did very well with reduction in turbidity but increase organic matter, so more refinement needed. The KMnO4 test of gel-treated samples confirmed the presence of organic matter, which is within EPA limit of natural organic matter. The study has shown that Opuntia ficus-indica is an environment-friendly substitute for chemical coagulants for water clarification as it is easy to obtain, biodegradable, and sustainable. The findings support global water safety initiatives, aligned with WHO, EPA, and UN Sustainable Development Goals (SDG 6 & 13), on the access to clean water and sustainability.

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