Algae-Based Sol-Gel Technology: A Novel Approach to the Bioremediation of Wastewater

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Availability of fresh water sources is reducing rapidly due to accelerated population growth and billions die to waterborne diseases annually because of poorly treated wastewater supplied to households in trying to bridge the gap of fresh/reliable water source unavailability. Conventional water purification methods are adding to water contaminants due to chemical additives used and poor treatment methods. This project tests the hypothesis that the immobilization of algae in a sol-gel technology filtering system can purify heavy-metal wastewater for safer reuse and aims to replace conventional chemical wastewater treatment methods with more efficient, inexpensive, sustainable and eco friendly solutions to ensure increased access to safely managed water services. Different types of contaminated/wastewater were introduced in a miniature silica-based sol-gel technology system, with algae absorbers entrapped in the sol-gel network's porous interior. The effluent was filtered in a low-cost sand filter experiment then exposed to electromagnetic radiation in a simple kitchen microwave. The resultant water was tested for clarity, pH, heavy-metal content, bacterial content and hardness compared to tap water. The test yielded clearer, softer water of lower contaminant content (heavy-metal and bacterial content included) and pH closer to neutral. This study showed that the system gives wastewater properties closer to pure water in comparison with Harare tap water, making the method more reliable for wastewater recycling. Therefore, it can be concluded that the immobilization of algae in a sol-gel network effectively facilitates the adsorption of contaminants in wastewater, making it a potential primary-secondary wastewater treatment step.

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