Improving the Effectivity of Nitrate Removal in Biosand Filters Using N. oculata

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Biosand filters are an effective way for rural or less-developed communities to purify water from local water sources. However, limited research has been done on how the addition of microorganisms, specifically the microalgae Nannochloropsis oculata, into the biolayer could improve filtration efficiency. In this project, N. oculata was introduced into the biolayer of a biosand filter constructed out of recycled and easily accessible materials; it was hypothesized that introducing of a new species of microalgae to the biolayer would ameliorate filtration efficiency, specifically of nitrates, from local source water. Water collected from the Penjajawoc Stream was treated with an altered filter (with N. oculata) and a control filter (without N. oculata). Nitrate concentrations pre- and post-treatment were measured; N. oculata cell density was measured over time. Results showed that the altered filter consistently reduced nitrate levels more effectively than the control, with an overall 60% reduction in nitrate concentration. This difference was found to be statistically significant ($n = 25$, $p < 0.01$). Moreover, evidence suggested that the population of N. oculata in the biolayer remained stable over time, suggesting sustainable filtration efficiency. Notably, the altered filter reached stability more rapidly than traditional biosand filters, which typically take 30 days to stabilize. Overall, these findings suggest that N. oculata augments nitrate removal in biosand filters, offering a more sustainable and affordable solution for improved water quality. This research is especially relevant as human populations grow and access to safe drinking water becomes increasingly critical in rural or developing areas.

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