# DESIGN AND COMPARISON OF DIN REMOVAL RATES BETWEEN FIVE 'LOW-TECH' FIXED FILM BIOLOGICAL REACTORS TREATING AQUACULTURE WASTEWATER ON COCONUT ISLAND

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## ABSTRACT

Over the past century, the human needs for the Earth's resources have increased and the consequences of these actions are becoming more apparent as ecological diversity and functionality are in decline. An approach to better service our continuance and future generations' livelihoods is being explored by implementing natural systems technologies. Ecological engineering is a mechanism that can provide simple, 'low-tech' design and infrastructure while encouraging the growth and development of nature's complexity as the primary operating system. Ecologically engineered fixed film biological reactors were designed and implemented to remediate freshwater, aquaculture wastewater on Coconut Island, Oahu. The biological reactors principally operate by utilizing the inherent, multifaceted biochemical development of biofilm ecologies. The primary objective of this research was to design 'low-tech' systems that compared naturally occurring media commonly found on Pacific Islands for their use in fixed film biological reactor technology to remove dissolved inorganic nitrogen from the wastewater. The media researched for the comparison study included: coral rubble, lava rock (pumice), bluestone (hydropressurized basalt), coconut fiber, and a synthetic geotextile material. The fixed film filters were connected to one freshwater aquaculture tank containing Mozambique tilapia (Oreochromis mossambicus). Both the influent (fish tank) and the effluents from the five filters were analyzed for total suspended solids, ammonium, nitrate/nitrite, and phosphate concentrations. A replicate system was also designed on a small scale to test for data reproducibility and

was compared to the Coconut Island system. Overall, ammonium and total suspended solids reduction was marked in all the systems. Therefore in order to compare the media, the removal rate of ammonium + nitrate/nitrite (DIN) was calculated for all the systems and statistical analysis was conducted to determine differences between DIN removal rate efficiencies.