# Methanotrophic Bioremediation for the Degradation of Chlorinated Hydrocarbons

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The main objective of this applied science project is to demonstrate the viability of a novel, low-cost methanotrophic biotrickling filter with the ability to co-metabolise methane as well as heavy metals and chlorinated hydrocarbons in oceanic environments contaminated with industrial waste run off. While methanotrophic bioremediation has been adapted for in-situ degradation in fresh water, there has never been an ex-situ remediation system adapted for aquatic environments. The biotrickling filter was modelled as an idealized Plug Flow Reactor and a set of Ordinary Differential Equations (ODEs) parameterized with the dimensions of our system, described pressure, temperature, and substrate concentrations over time. Another set of ODEs, describing the Monod Growth Kinetics, solved using Euler’s method, described the methane degradation rate over time. Using pmora-pmof primers (Iwamoto, Tomotada, et al.) to isolate the pMMO enzyme present in all Methanotrophs, PCR and Gel-electrophoresis showed the presence of a large methanotrophic community. Multiple microscopic characterizations, as well as gram stains, indicated the small .2 micron, gram-negative morphology of type II methanotrophs. Our biotrickling filter has a degradation rate of 20856 ppm / hour under 1 atm. Running the system continuously one year our system has the capability our system has the ability of degraded 25.2 kg $CH4$. Considering that the global warming potential of methane is roughly around 23 times larger than $C02$, our system degrades an equivalent of 575 kilograms or roughly 0.673 US Tons per year. Our dynamic and modular biotrickling filter proves the feasibility of methanotrophic bioremediation for the degradation of oceanic methane and chlorinated hydrocarbons.