

Bio-Crude Oil from wastewater Algae



Oxidation ponds showing HRAP location.

Five hectares of the Christchurch wastewater treatment plant (WWTP) oxidation ponds have been converted into the world's first large-scale wastewater treatment high rate algal pond (HRAP) system with CO₂ addition to demonstrate enhanced algal production and tertiary-level treatment. The system of four 1.25 ha HRAP treats 2000 m³ per day of primary effluent from the WWTP and scrubs CO₂ from up to 500 m³ per hour of exhaust gas from the treatment plant biogas driven electricity generators. Algae is harvested from the HRAP effluent by simple gravity settling for conversion to bio-crude oil by Solray Energy.

The Christchurch Wastewater Treatment Plant demonstration is the culmination of over 10 years research on wastewater treatment HRAP by NIWA.

This joint NIWA, Solray and CCC project will determine the energy efficiency and economics of production, harvest and conversion of wastewater treatment HRAP algae to bio-crude oil at large-scale. The key steps in the process are illustrated below:

Primary Treatment (solids removal)



Solids are separated from the raw wastewater by primary treatment e.g., gravity settling in a clarifier at Christchurch WWTP.

High Rate Algal Ponds

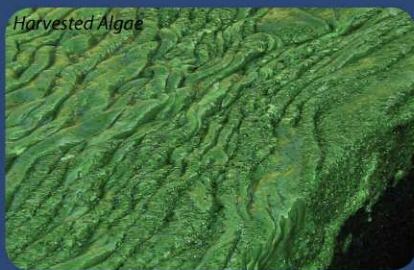
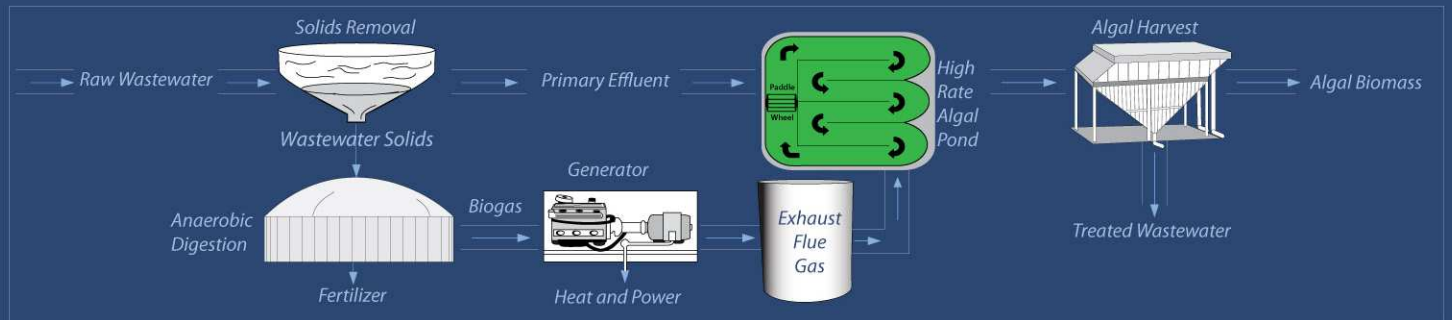


HRAP are shallow, gently mixed, raceway ponds which promote algal photosynthesis. The gentle mixing exposes wastewater to sunlight (for algal growth) and solar-UV (for natural disinfection). HRAP are particularly useful for wastewater treatment because they provide more efficient nutrient removal and disinfection than oxidation ponds, and are much more cost-effective than energy intensive mechanical wastewater treatment systems.

Algal Harvest



An advantage of HRAPs is that they produce colonial algae that tend to aggregate (bioflocculate), enabling the algal biomass to be cost-effectively harvested using simple gravity settling technology.



Benefits of the High Rate Algal Pond wastewater treatment system:

- Cost-effective (and energy efficient) tertiary-level wastewater treatment.
- Algal production potentially 10 times that of terrestrial biomass crops.
- HRAPs produce colonial algae which can be harvested cheaply and simply.
- Algal production and harvesting are funded by wastewater treatment costs.
- Algae can be used for biofuel conversion.
- Recovered nutrients can be recycled as fertilizer.
- GHG abatement by offset fossil fuel use through: low energy wastewater treatment & fertilizer recovery.

"The bio-crude oil from wastewater algae system is a technology for the future – it enables renewable fuel production whilst achieving low cost wastewater treatment, nutrient recovery and GHG abatement."



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