Lake Laguna Hyacinth & Blue-green algae Energy Calcs For Redstar's WtE Pyrolysis System

1 message

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Pasig River and the 20 other rivers leading to Lake Laguna make up the aquatic network of Metro Manila. These waterways are two thirds covered with hyacinth, including the 940 km2 Lake Laguna. This represents 850,000 mt of hyacinth and 750,000 mt of blue green algae or cyanobacteria. The hyacinth once dried will weigh 20% when the water is removed by Red Sun solar Infrared 1000°C kilns (that operate independently and dont subtract from the net energy yield at 0.5 US cent/ kWh), or 170,000 mt. The energy density is 17 MJ. Thus the energy yield is:

170,000 mt x 17 MJ/ kg x 1000 kg/ mt x 1 MWh/ 3,600 MJ x 60% efficiency running through cogen= 481,000 MWh

Lake Laguna Algae Blooms:

The algae blooms are so thick they cannot travel through the water company pipes that provide 10% of the drinking water for metro Manila. The algae is blue green algae, which is a prokaryote; and is also called cyanobacteria because of the toxins they produce. They are photosynthetic microscopic organisms that are technically bacteria. They produce oil from water and carbon dioxide with the help of light (and a few salts). This is shown by a recent study by the University of Bonn. Thus they are interesting as supplements of feed or fuel, especially since they do not require arable land, unlike oil plants such as rapeseed or oil palm. Thus, they do not compete with food crops, and combustion would only release the carbon dioxide that the cyanobacteria had previously extracted from the air during growth and oil production. The microorganism thus makes a contribution to climate change when they are harvested regularly (annually); otherwise they produce vast, unchecked amounts of methane as they fill-up lakes, rivers and bays, as will as whole oceans including the Arabian Sea and Gulf of Mexico (salt water microorganisms are mostly dinoflaggetes and protozoa). What happens is the algae dies after a week or two and sinks to the bottom of the water body and rots anaerobically, creating methane in the hundreds of millions of tons world- wide. This is a critical problem that Redstar designed the catalyst for, and is the first to profiting on this new WtE system on algae using conventional pyrolysis hydrocracking systems with a brand new low- cost catalyst that does not use or require very expensive precious metals like Ruthenium, palladium or Platinum that almost all other hydrogen systems do- including the 224 year old Faraday- invented electrophoresis that our competitors are using.

Now: Redstar has developed an exciting new breakthrough proprietary catalyst to gasify microalgae and hyacinth/ biomass into syngas and H2, while breaking the hard to break down double bonds in the lignins of biomass and hydrocracking and transforming most of the tars into useful syngas and H2 in a high-temperature standard pyrolysis system. The breakthrough includes both higher yields of H2 of up to 0.79 liters H2 per gram of dried algae from the biomass, while simultaneously increasing the yield in the water shift reaction that occurs in this 900°C Pyrolysis reaction.

Pyrolysis is simply holding back the oxygen in a sealed reactor to create partial burning and using superheated steam as all oil companies use in their hydrocracking operations. This is identical to the standard methane Hydrocracking to produce the 95 million tons of hydrogen we use today; also at 900°C; and, also creating the water shift reaction during a catalytic partial oxidation..

Water shift Reaction:

https://images.app.goo.gl/8DtRGxV7SSSNUSZ68

$CO2 + H20 = CO + H2O$ @ 298°K
- 41 MJ (meaning you must put energy in for the reaction to go forward- endothermic).

Also, for each 25 MW, 200,000 tons of CO2 are removed annually over conventional systems switching to algae and/ or biomass. Moreover; algae has a higher energy content at 20 to 25 MJ/ kg, as you can get up to 20% oil from many types of algae. And; with up to 25% of biochar byproduct in the pyrolysis system (low-temperature pyrolysis is used around the world to make charcoal), this can give a good secondary income of up to $500 USD per ton of biochar. Also mixed with manure and urine, a top- grade fertilizer can be co- marketed. In addition, supercritical steam can remove the need for drying. This, utilization of this process can substantially reduce the energy intensity of the conversion process, and in turn, enhance the environmental benefits.

Algae oil content - 20% wt% dry
Gasifier temp 800 to 900°C
Feed water content - 30 wt%
Steam to biomass ratio - 0.6 kg/ kg algae
Fuel air equivalence ratio 0.2
Lipid -CH 1.83 O 0.17 N 0.0031 P 0.006
Protein- CH 1.56 O 0.3 N0.26 S 0.006
Carb- CH 1.67 O 0.83
Nucleic Acids CH 1.23 O 0.74 N 0.4 P 0.11

Oil 20% protein 4.9% carb 25% nucleic acid 6%

Oil content 20% H2 107 g/ kg SO 610g CH4 0.8g CO2 549 g NH3 109 g

Green chemistry, simulated life cycle assessment of algae - duel fluidized bed gasifier
Poor Azide 2020 CO2 net = 40 g CO2/ MJ

Laguna Lake Algae Energy Content:

940 km2 x 100 ha/ km2 × 100 tons wet algae/ ha x 34% dry/ 1 ton wet algae x 20 MJ/ kg x 1000 kg/ 1 ton x 0.2778 kWh/ 1 MJ = 17,800,000 MWh x 50% efficiency = 8,88 million MWh/ Lake Laguna algae energy content