In the Aerobic zone community the following will form:

1. Algaes

(Elikaryotic photoautotrophs)

2. cyanobacteria

(prokaryotic photoautotrophs)

3. Heterotrophs

(vibrios)

(pseudomonades) ~~(CH2O)x + O2 → CO2+~~ $\underline{(CH_2O)_x + O_2 \rightarrow CO_2^{+}}$

Depending on the range of available inputs and locally viable species, this zone may be further broken up into separate tanks to increase total biomass output or to focus on any readily harvestable outputs that can be directly sold as products or used as precursors in downstream manufacturing processes in such markets as cosmetics and pharmaceuticals.

Although energy output is the primary goal of the system, overall system profitability is the ultimate guide to output optimization. This is the same path that the oil industry has followed in the evolution of refining. Large quantities of commodity fuels are produced with the overall income stream being supplemented by the production of small amounts of high-value products, such as lubricants.

The goal of this, and all other sections, is to determine the optimal feed rates of nutrients and the matching disposal rates of waste and useful products that can maintain growth at “bloom” rates without a population crash. Zone sizes are determined by the need to match the various input and output streams as well as the inter-zonal communication needed to support overall consortial stability.

Microaerophilic zone community, is deprived of the direct injection of oxygen, the following is formed:

1. Prokaryptic chemoautotrophs

a. Nitrifiers

(nitrosomonos) $NH_4^+ \rightarrow NO_2^+$

(nitrobacter) $NO_4^+ \rightarrow NO_2$

b. Sulfur oxidizers

(thiobacillus) ~~$S_2^- \rightarrow SO_4^{2-}$~~ $S^{2-} \rightarrow SO_4^{2-}$

c. Methane oxidizers

(methylococcus) $CH_4 + O_2 \rightarrow CO_2$

Below this is the Oxidizing Zone, which propagates:

1. Methane oxidizers

2. Heterotrophs

Denitrifiers

(pseudomonads) $NO_2^- \rightarrow N_2$

Sulfate reducers

(desulfombrio) ~~$SO4_2^- \rightarrow S_2^-$~~ $SO_4^{2-} \rightarrow S^{2-}$

3. Iron oxidizers

~~$Fe_2^+ \rightarrow Fe_3^+$~~ $Fe^{2+} \rightarrow Fe^{3+}$

This is followed by Redox Microtransition Zone, which forms:

1. anaerobic photoanitotrophs

red-green sulfur bacteria

2. heterotrotrophs

anaerobic chemoautotrophs

Final section of the biomass synthesis section of the biocolumn is Reducing Zone which supports:

1. fermenters (vibrios)

~~$(CH_2O)x \rightarrow CO_2 + (C + R)$~~ $(CH_2O)_x \rightarrow CO_2 + (C + R)$

2. heterotrotrophs

Sulfur reducers (desulfovibrio)

~~$SO_4^{2-} \rightarrow S_2^-$~~ $SO_4^{2-} \rightarrow S^{2-}$

3. methogens (methonococcus)

$CO_2 + H_2 \rightarrow C$

4. iron reducers

~~$Fe_3^+ \rightarrow Fe_2^+$~~ $Fe^{3+} \rightarrow Fe^{2+}$

In all cases, a zone may be subdivided into a series of separately controlled and fed tanks to match the various growth rates, life spans, product harvesting, nutrient feeding and waste disposal requirements needed to maintain maximum biomass output.

After harvesting directly salable products from each section, where possible, the balance of the system output will be gaseous, liquid and solid. The gaseous component is biogas, a combination of methane and carbon dioxide. It also may include trace amounts of hydrogen sulfide which is recirculated to become sulfates elsewhere in the system.

This components of biogas are either separated, being recirculated or sold, or are converted to syngas, which can be made into a wide range of commercial products such as Fischer-Tropsch Liquids (FTL), alcohols and hydrogen. Modular subsystems, sized to match the output of the biocolumn system, are used to provide some, or all, of the biocolumn process heat requirement.

The liquid portion of the output consists of the various directly harvested products, i.e., oily species, biofilms, polysaccharides and water. The majority of the water comes from the concentration of the indigestible solids that are subsequently hydrothermally liquefied into synthetic crude oil. In an embodiment of the invention gasifiers are used to promote gasification.

Figure 3 shows interconnections and transport of products and inputs in various zones of biocolumn of present invention. Photons (1), air or oxygen (2), carbon dioxide (3), carbon and/or compounds (4), nitrogen and/or compounds (5), waste

What is claimed is:

1. A system for generating fuel stocks ~~in a fabricated biocolumn~~ comprising a plurality of assembled zones, ~~each zone is~~ fabricated by stacking, or laterally arranging, prefabricated modules,

wherein said prefabricated modules form a biocolumn, said biocolumn comprised of an aerobic zone, a microaerophilic zone, an oxidizing zone, a redox microtransition zone, and a reducing zone;

~~inputting a nutrient, a renewable energy source, photon energy and a carbon source into said zones and outputting fuel stock and by products from zones;~~

wherein each zone is connected with the preceding and subsequent zones to allow communication, exchange of nutrients, and symbiotic consumption between species from different zones; and

wherein one or more of a nutrient, a renewable energy source, photon energy or a carbon source can be added into a zone and one or more of a fuel stock or by-product can be removed.

~~wherein the zones are interconnected so that by-products from each zone can be separated, recirculated, sold and converted to products.~~

2. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1, wherein each module can further be divided into submodules.

~~3. The system for generating fuel stocks in a fabricated biocolumn according to claim 2, wherein submodules are assembled to fabricate a module.~~

3 ~~4~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1, wherein photon energy is obtained from one or more submerged light emitting diode (LED) lights.

4 ~~5~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1, wherein said renewable energy source is ~~a~~ geothermal energy, ~~a~~ solar thermal energy, ~~a~~ photovoltaic energy, ~~an~~

external waste heat, ~~a~~ heat ~~of~~ from internal reactions or combination~~s~~ thereof.

5 ~~6~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1, wherein said nutrient is ~~selected from the group consisting of~~ a geothermal fluid, an organic waste slurry biomass, a coal, a hydrocarbon or ~~and~~ combination~~s~~ thereof.

6 ~~7~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1 or 5 ~~6~~ wherein said nutrient is water containing.

7 ~~8~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim 1, wherein said carbon source is ~~selected from the group consisting of~~ atmospheric air, a carbon dioxide source, an organic waste, a coal, a hydrocarbon~~s~~, a geothermal fluid, an internal product of ~~said~~ consortium growth, propagation and reaction~~, and~~ or combination~~s~~ thereof.

~~9. The system for generating fuel stocks in a fabricated biocolumn according to claim 1, wherein said modules are interconnected to function as a complete biocolumn.~~

8 ~~10~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim ~~4~~ 3, wherein ~~LEDs~~ said one or more submerged light emitting diode (LED) lights operate~~ing~~ below ~~at a fraction of~~ the normal intensity of sunlight and deliver only narrow bands of light with the frequencies that the resident algae are capable of accepting ~~(approximately one-sixth) at just the level at which~~ so that algae growth plateaus~~, before additional light intensity is wasted or actually inhibits additional growth, are used~~.

9 ~~11~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim ~~4~~ 3, wherein ~~LEDs~~ said one or more submerged light emitting diode (LED) lights ~~that~~ are pulsed to allow ~~the proximate~~ algae to

recover from the acceptance of a photon ~~and be ready to receive another are used~~.

10 ~~12~~. The system for generating fuel stocks ~~in a fabricated biocolumn~~ according to claim ~~4~~ 3, wherein light emitting diode (LED) light ~~LED~~ fixtures ~~that~~ are mounted on distributing tubes that provide nutrient input ~~in such a manner as~~ to sweep the LED lenses and prevent growth buildup ~~that would~~ from blocking the light~~, are used~~.

11. (New) A method for fabricating a biocolumn comprising the steps of:
    a) providing a plurality of individual modules, wherein each module includes at least one inlet and at least one outlet;
    b) assembling said plurality of modules together by stacking or laterally arranging them with one another;
    c) creating a biomass by adding to each of said modules a solution containing one or more of an algae, cyanobacteria, heterotroph, nitrifier, sulfur oxidizer, methane oxidizer, denitrifier, sulfate reducer, iron oxidizer, anaerobic photoanitotroph, anaerobic chemoautotroph, ferementor, methogen or iron reducer;
    d) adding at least one of a source of nutrient, a source of heat or a source of light to each of said modules;
    e) connecting said modules to one another using said at least one inlet and said at least one outlet;
    f) allowing said biomass to metabolize one or more sources of carbon;
    g) removing one or more salable materials from one or more modules.

12. (New) The method of claim 11 wherein each module can further be divided into submodules, each having at least one inlet and at least one outlet.

13. (New) The method of claim 11 wherein said light source is one or more submerged light emitting diode (LED) lights.

14. (New) The method of claim 11 wherein said nutrient is a geothermal fluid, an organic waste slurry biomass, a coal, a hydrocarbon or a combination thereof.