Perlemax – patented - award winning - technologies to improve productivity and save energy.

Will Zimmerman and his collaborators invented the fluidic oscillator generated microbubbles in 2005.

Produced with 2-3 orders magnitude - ***less*** - energy density and capital cost, microbubbles add efficiencies to gas, mass, momentum, and heat transport.

Will and coworkers also invented plasma microreactors with very low power consumption in 2007.

Together, 90 + utilisations have been identified across a host of industries.

The Perlemax pipeline driven by Will and his team continues to invent new technology / techniques such as "microflotation separation" that achieves greater algal dewatering (>98%) than conventional dissolved air flotation or DAF using only a fraction (~1%) of the capital and energy cost.

Perlemax is dedicated to taking these truly unique technological developments to create / improve energy efficiencies and processes in across an array of applications.

Contact us for the latest updates

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PERLEMAX

Applications of Energy Efficient Microbubbles: Perlemax

Winner of the 2010 Royal Society Brian Mercer Innovation Award

Microbubble fluidic oscillator

Fluidic oscillator is one approach that promises minimal power losses and low power consumption with desirable bubble size properties and nearly uniform spacing to oppose coalescence.

Advantages:

- 18% less electricity;
- 3-4 fold better aeration rates;
- very low shear mixing.

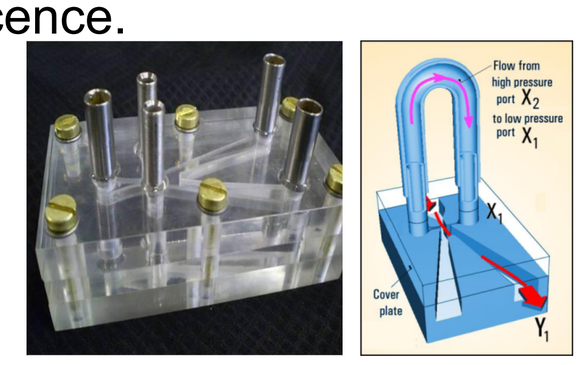
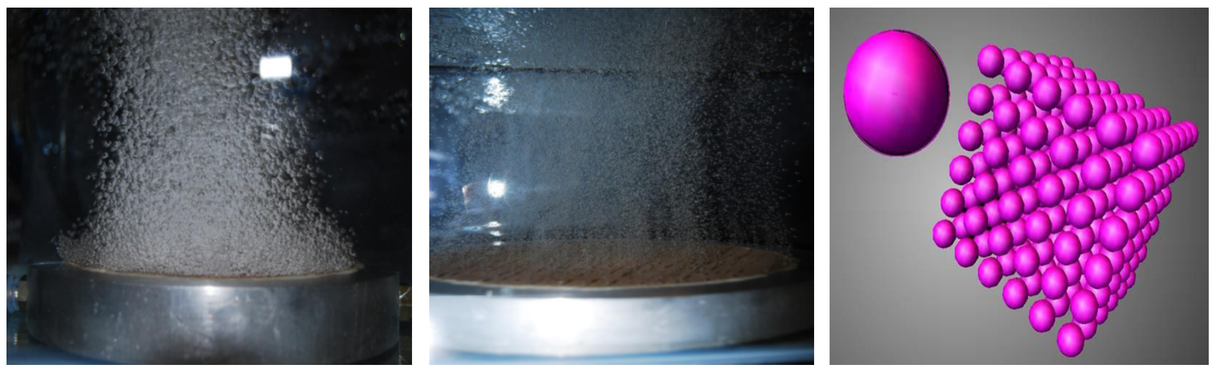


Fig. 1: Fluidic oscillator



a *b* *c*

Fig. 2: Microbubbles with membrane only (a) and with membrane and oscillator (b). Comparative size of bubbles (c).

Microbubbles' gas, mass, momentum, and heat transport at the interface of microbubbles is influenced by the interfacial surface area: smaller bubbles lead to greater transfer.

Ozone

Our low power ozone plasma microreactor can be inserted into the microporous diffusers to arrange for ozone dosing on demand for sterilization or other uses.

- Low power - a ten-fold reduction over conventional ozone generators.
- High conversion. The selectivity is double that of conventional reactors.
- Strong irradiation in UV.
- "killing zone" of ~300 nm.
- Operation at atmospheric pressure, at room temperature,and at low voltage.

Fig. 5: Setups for low power ozone plasma microreactor

Microflotation

Microflotation applies the traditional physical chemistry of dissolved air flotation – dosing with flocculants and coagulants to form microbubble flocs of algae for harvesting and dewatering. This is the single most important problem precluding economic algal biofuel production. We have achieved 99% separation performance with 2-3 orders of magnitude lower energy cost.

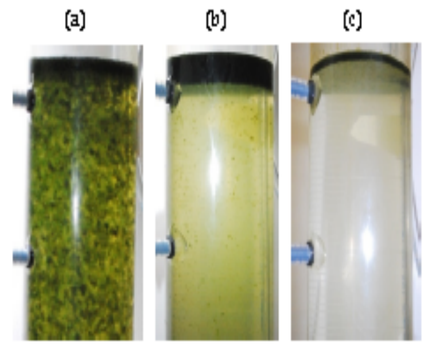


Fig. 3: Microflotation stages of clarification: (a) Flocculated algae; (b) blanket formation; (c) completed separation.

Algae recovery efficiency as a function of pH increased as coagulant concentration increased (Fig. 4).

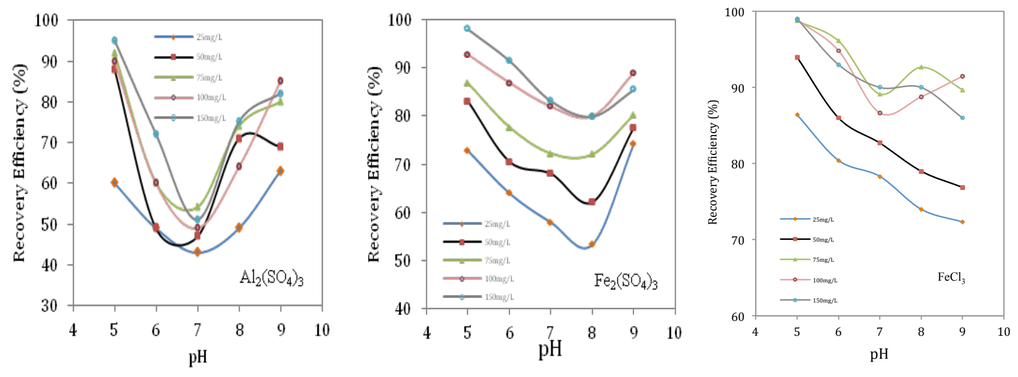


Fig. 4: Plots of algae recovery efficiency as a function of pH at different coagulant concentrations.

Algal growth in an air lift loop bioreactor

- Microbubbles dissolve CO_2 faster and therefore increase algal growth.
- Microbubbles extract the inhibitor O_2 produced by the algae from the liquid.
- Algal culture had supra-exponential growth (Fig 7.).
- Bioenergy could become a more attractive option in the recycling of the high concentration of CO_2 emissions.

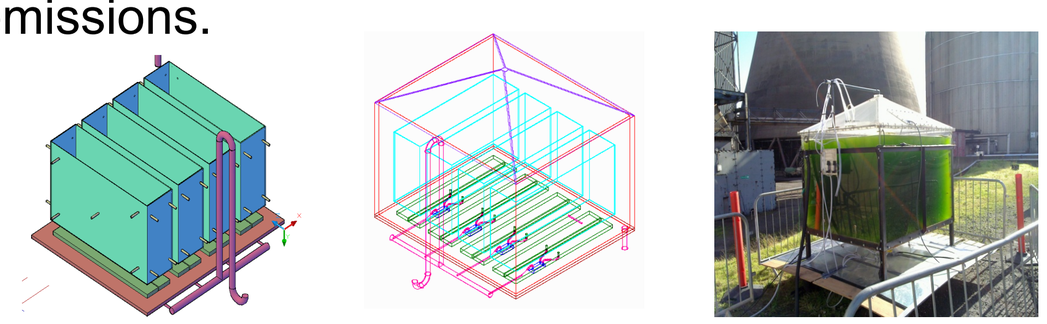


Fig. 6: Air lift loop bioreactor

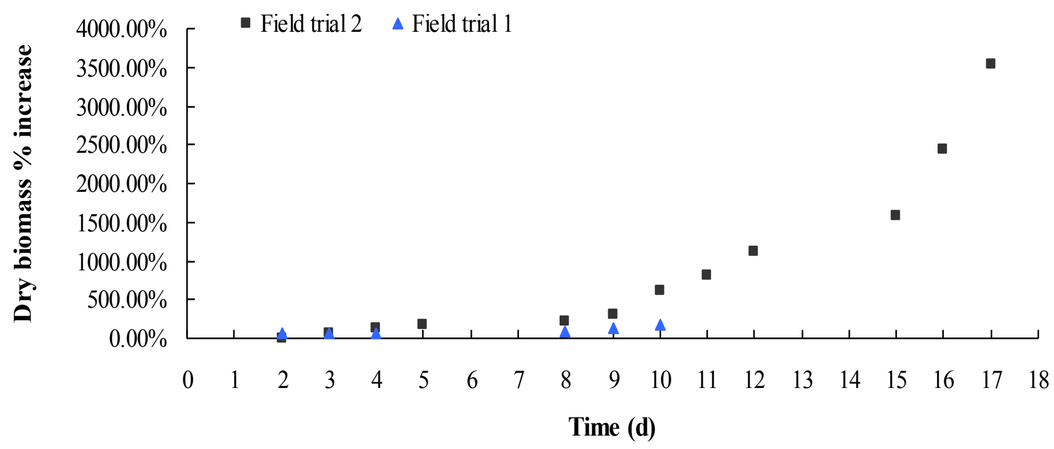


Fig. 7: Algal biomass / bioenergy production

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