



OpenAlgae

Processing Technologies

Algae Processing Technologies: Fueling Industry Growth

Biomass 2011

Gaylord, Maryland

27 July 2011

**Hoyt Thomas
President and CEO**

**If the algae industry isn't
suffering from a case of
separation anxiety,
it should be.**

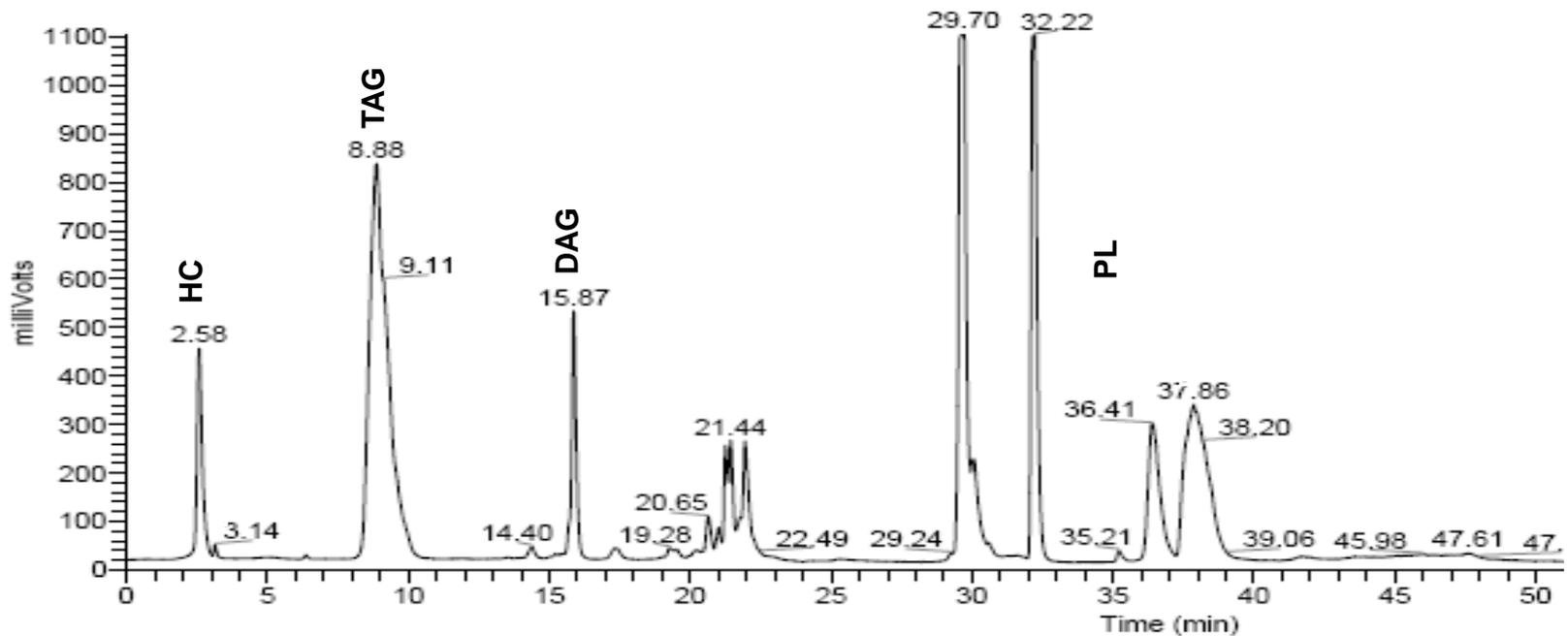
Separation Anxiety?

Algae from water – and recycle the water

Oil from algae and water – without solvent to preserve biomass

... and, how do we define “oil?”

Oil *and* Biomass – no solvent



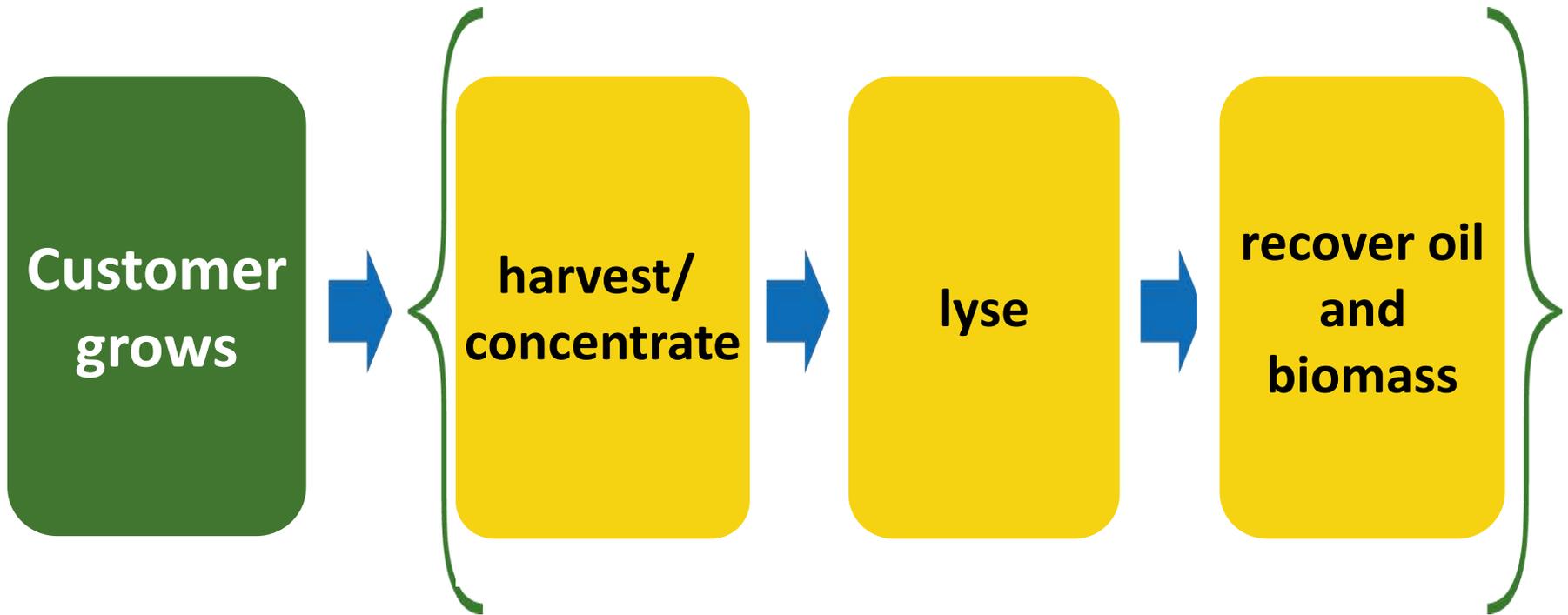
**Neutral lipids
RECOVERED**

**Polar lipids
IN BIOMASS**

Mobile Algae Processing Unit



Separation Technologies



Concentration – Objectives

Preserve water quality

Maximize water recycling

Yield pumpable
concentrate

Seek low cost, scalable,
proven technologies

**harvest/
concentrate**

Concentration – Solution

Adapted from
wastewater

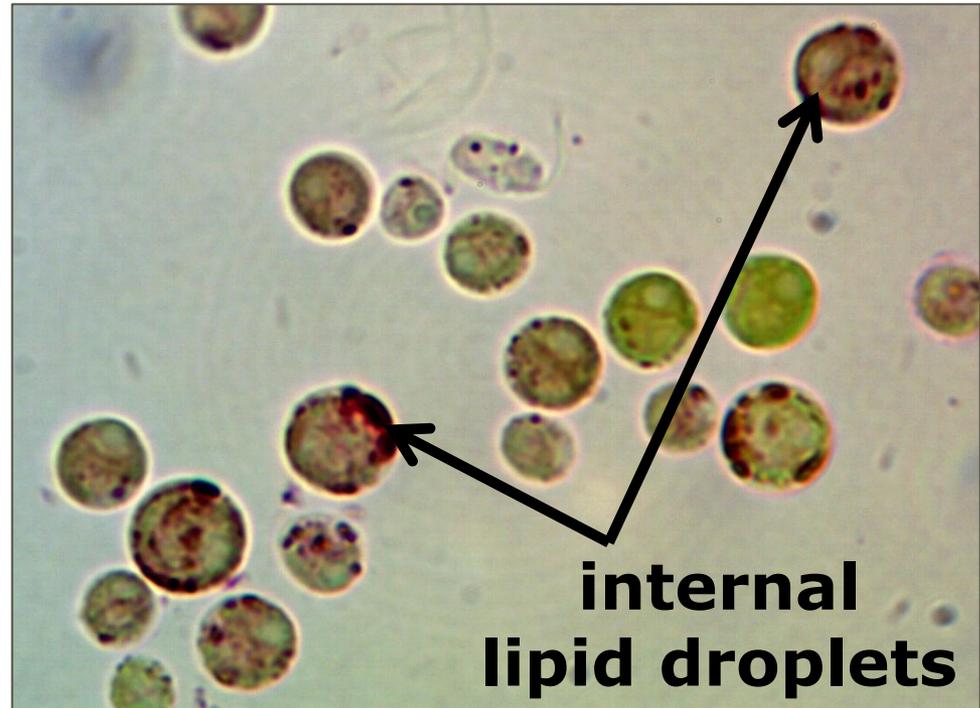
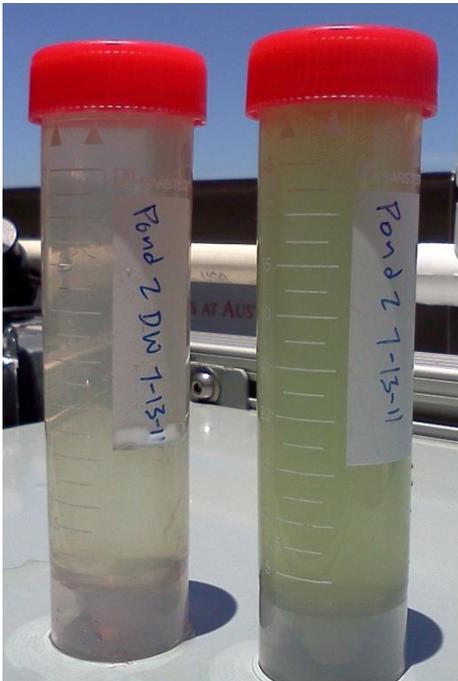
pH sweep yields up
to 100-fold
concentration

15,000 gallons of
dilute algae per day



Concentration – Experience

Whole algae



Lysing – Objectives

Process wet algae,
5% – 15% solids

Eliminate solvent, break
cells

Find pulse shapes and
amplitudes to compromise
cells, liberate neutral oil

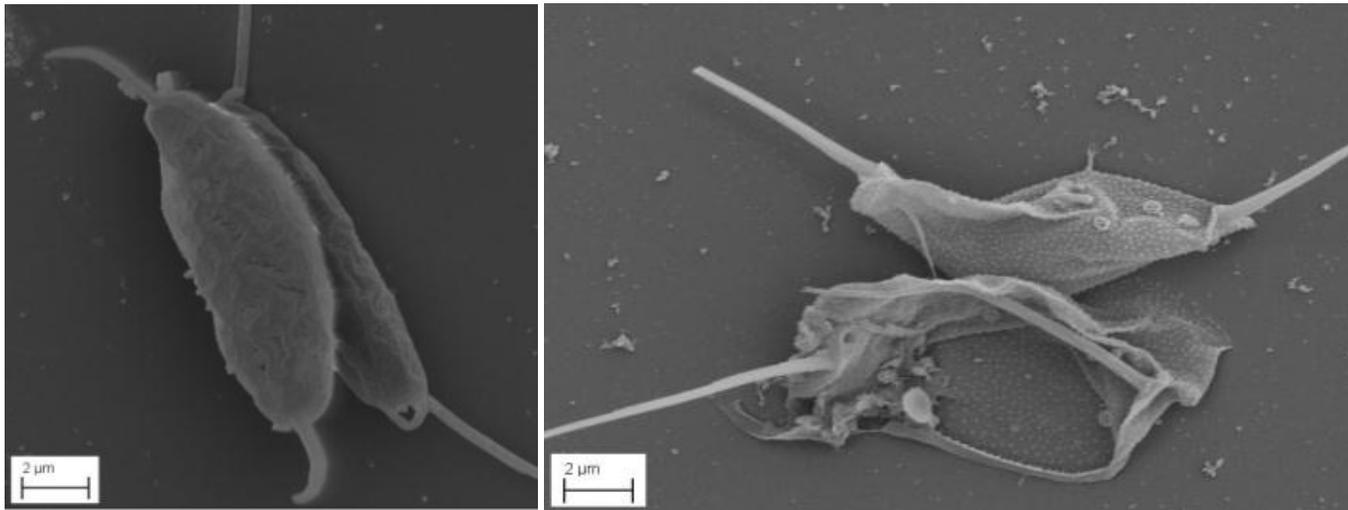
lyse

Lysing – Solution

Electromechanical lysing of slurry

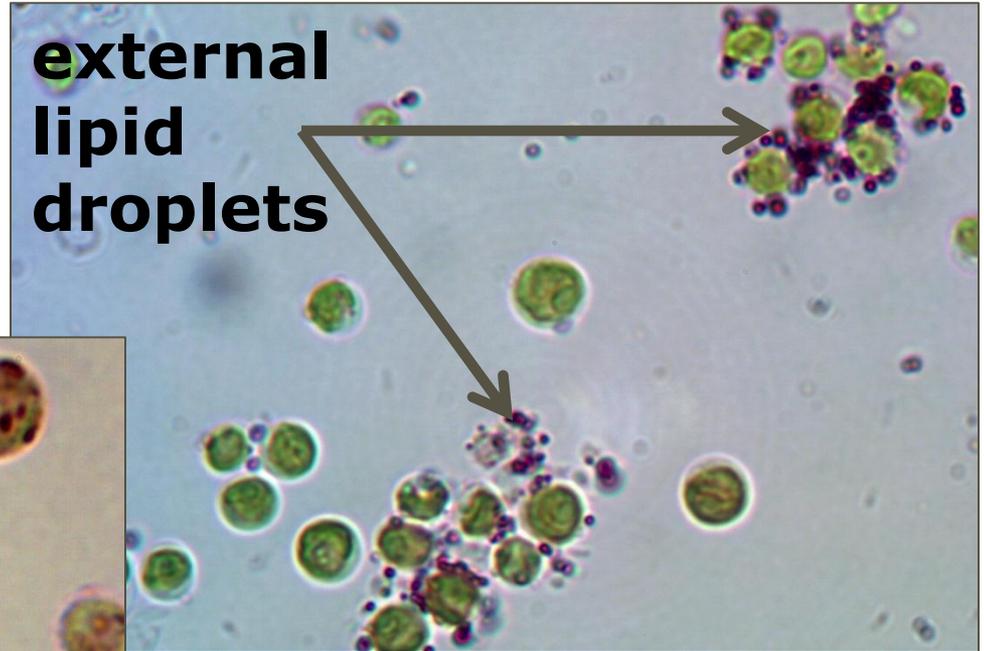
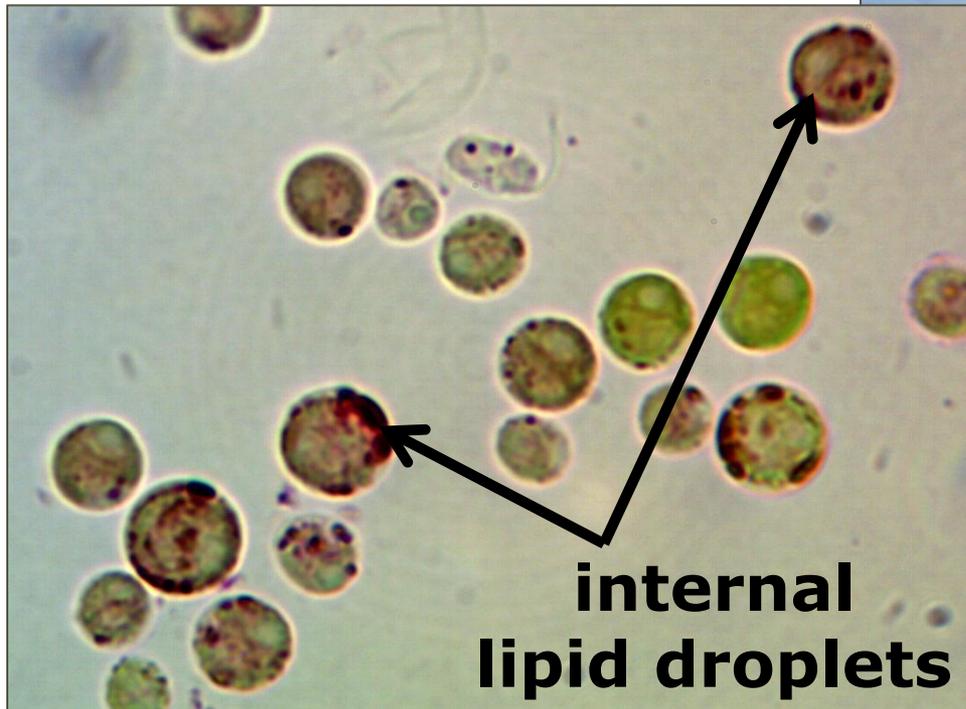
Continuously process at 2 g/m

Power consumption proportional to salt concentration



Lysing – Experience

Whole algae



Lysed algae

Oil Recovery – Objectives

Process continuously, high throughput

Break oil/water emulsions and remove oils adhering to cells

Identify low-cost oil/water separation among proven technologies

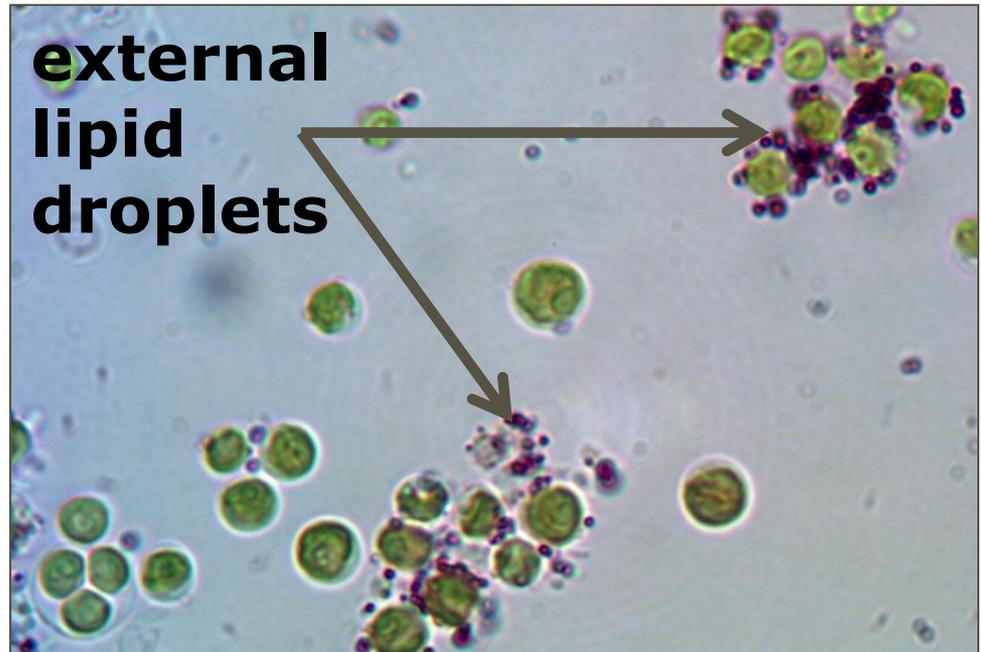
**recover oil
and
biomass**

Oil Recovery – Solution

Novel, scalable process

Re-purposes membrane

Recovers oil at commercial scale without solvent



Lysed algae

Oil Recovery – Experience

Mobile unit membrane at 2 g/m

Pure product can be recovered without solvent or distillation

95% of oil routinely recovered



Demise of Hexane Extraction?

Solvent-less lysing and oil recovery
achieve wet algae oil extraction

“Pristine” de-oiled algal biomass and
algae oil

Current operating cost of lysing and
oil recovery is ~\$5/ton of biomass

Fueling algae industry growth

Completing first continuous-process unit

Testing at City of Austin's Hornsby Bend

Additional testing planned

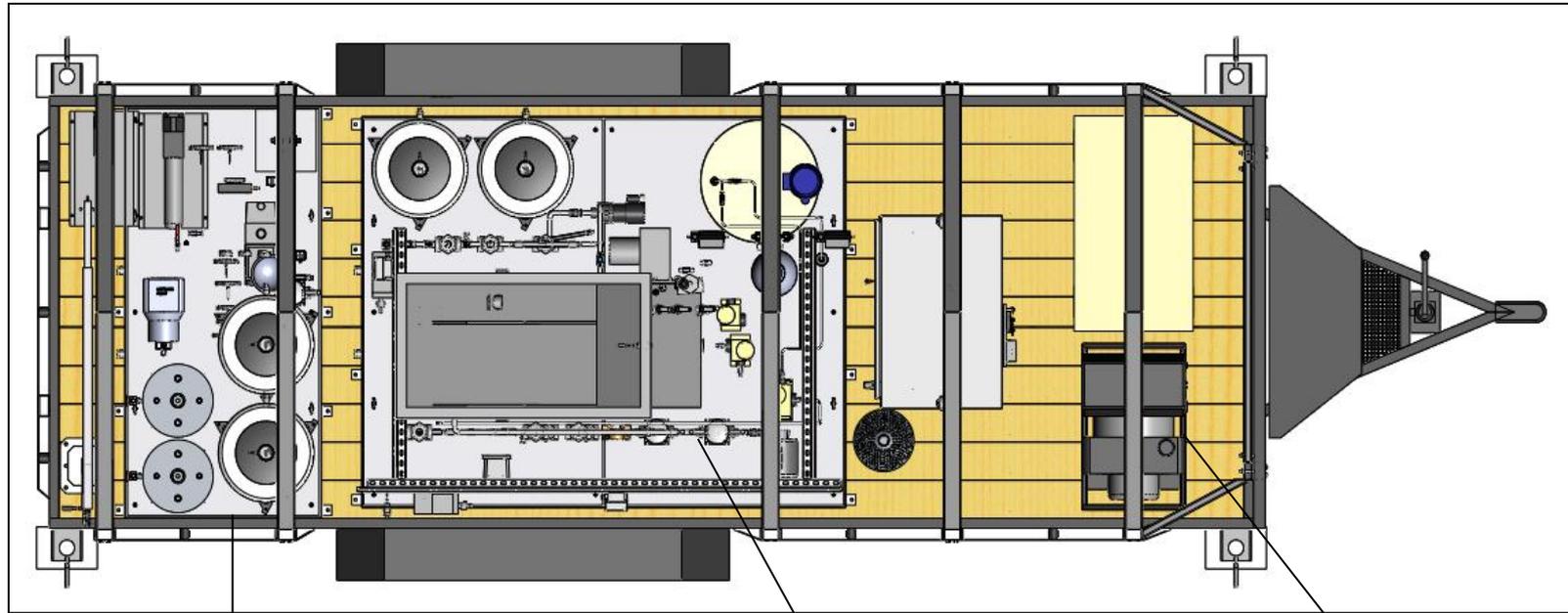
Future units in design



Mobile Algae Processing Unit



Adaptable, Modular



Oil Recovery

skid

Concentration

skid

Lysing

chamber &
power supply

Separation Anxiety – Solved

Scalable, low-cost method to concentrate algae and recycle water

Continuous processing of pumpable concentrate – eliminate drying and batch processing

Continuously recover oil without chemical solvent

Lower costs, preserve biomass



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Contacts

Hoyt Thomas

hthomas@openalgae.com

713.922.5295

Peter Kipp, PhD

pbkipp@openalgae.com

713.540.9436