Redefining Algae Harvesting

“Integrated Harvesting Solutions”

Evodos B.V.
Herre Hoekstra
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Support our Algae customers with best in class products for mechanical separation at minimal energy consumption and without using chemicals or consumables.
Why customers choose Evodos

Clients harvest a top quality algae paste with a high Dry Weight percentage.

Even the smallest and most fragile algae are harvested successfully.

All algae cells are harvested intact and undamaged.

All valuable components inside the algae cells are retained.

Clients minimize the energy consumption in the downstream process.
Spiral Plate Technology
Spiral Plate Technology

Dynamic settlers available:
- Evodos type 10
- Evodos type 25
- Evodos type 50
Growing customer base

AlgaePARC Wageningen

TomAlgae

BioScan

Algae to omega

Beagle Biopra

Wageningen

ISPT

fuel4me

BIOFAT

Algae Testbed
Public-Private Partnership

ATP³

ALPAG
Algen-Parks

agroenergia

algal health

University of Helsinki

GalilAlgae

Jacobs University

UNIVERSITY OF BATH

Böggypower

Synaptic Research

PharmaVitae Corporation

Abşeron Bio-Technologii

MURADEL

CAL POLY

SR

U.S. Air Force

Symbiotic EnviroTek Inc.

ECN

cpi

MBD Energy Limited

GENERAL ATOMICS

necton

Embrapa
Evodos Algae Harvesting Strategy

Customer Requirements

- Good quality algae paste with intact cells
- Robust solutions, easy to use
- Bacterial removal from recycled water
- Mild drying processes
- Energy efficient processing of high volumes
- Scalable solutions

Evodos Integrated Solutions

- Harvesting solution + water recovery unit
- Scalable pre-concentration + harvesting solution for high volumes
- Harvesting solution + algae paste downstream processing
Integrated Harvesting Solution
small scale with water recovery

Production 0.5-3.5 l/hr

Water recycled
Bacteria removed 99,9999999 %

Algae Paste 200-300 gr/l
FUEL4ME Partners

1. Wageningen UR- Food & Biobased Research
2. Wageningen University
3. Ben-Gurion University of the Negev
4. Fotosintetica & Microbiologica S.r.l
5. Biotopic
6. Evodos B.V.
7. Cellulac
8. FeyeCon Development and Implementation B.V
9. Neste Oil Corporation
10. JOANNEUM RESEARCH Forschungsgesellschaft mbH
11. IDconsortium SL

www.evodos.eu
Objectives

- To develop a continuous one-step process in which the lipid productivity in microalgae cultures is maximized
- To translate the developed one-step process to outdoors
- 3 pilot plants (Italy, Netherlands and Israel) and 1 demonstration facility in Spain.
- Integrated Harvesting solution with water recovery unit at Demo site in Spain
Integrated Algae Harvesting Solution

Scalable high volume & low concentration 10 m³/hr units

Production 0.2-4 gr/l

Pre-concentration 10-40 gr/l

Harvesting 200-300 gr/l
Implementation

- Strain selection, algae growth and harvesting optimization
- Two 0.5 ha pilot-scale facilities located in Italy and Portugal.
- Integrated Harvesting solution with pre-concentration
- Scale-up preparation to a 10 ha demo facility.

Partners:
A4F AlgaeFuel SA (coordinator)
A & A F.LLI Parodi SPA
Ben Gurion University of Negev
Università Degli Studi de Firenze
Abengoa Bioenergía NT SA
Fotosintetica & microbiologica S.r.l.
AlgoSource Technologies IN S.r.l.
Hart Energy Publishing LP
Evodos BV
Promising pilot results with Pre-concentration

Pre concentration test with SiC membranes
BIOFAT, Pataias September 18th 2014

- LMH with back pulse
- "LMH/TMP with back pulse"
- "concentration factor"
- "Recovery %"
Promising initial results with Pre-concentration

- LMH 300
- Concentration factor up to 20
Integrated Algae Harvesting Solution

Scalable high volume & low concentration 10 m3/hr units

Production

Pre-concentration 10 - 40 gr/l

Harvesting

Standard 10 m3/hr integrated units available
Integrated Algae Harvesting Solution

Processes in combination with Evodos

Pre-concentration
10 - 20 gr/l

Dynamic settling
250 - 300 g/l

Drying
Biorefinery opportunity

- 13 partners
- 8 countries
- €10m: producing suites of compounds from Dunaliella to meet market requirements

Evodos Chosen Partner

*Developing a large-scale harvesting system for a CO₂ microalgae biorefinery with Dunaliella*
The D-Factory Concept

- **Evodos**
  - Raamsdonksveer
  - The Netherlands

- **NBT**
  - Eilat, Israel

- **NateCO2**
  - Wolnzach
  - Germany

- **Dynamic Extractions**
  - Slough, UK

- **Algal Raceways & PBRs**

- **Harvesting**

- **scCO2 Extraction**

- **HPCCC Separation**

- **HTS**

- **High Value Chemicals**

**Products**

- Nutraceuticals & Pharmaceuticals

**Algal Raceways & PBRs**

**Evodos**

**Harvesting**

**scCO2 Extraction**

**HPCCC Separation**

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**HTS**

**Products**

- Nutraceuticals & Pharmaceuticals
Dunaliella β-carotene retained

Dunaliella bardawil: No cell wall

> 90% Algae harvested intact

Dry solid content of > 22%

β-carotene content 5.6%
Global Algae Innovation
Hawaii
Evodos is the basis for integrated harvesting solutions:

1. Harvesting solution + water recovery system
2. Pre-concentration + harvesting solution
3. Harvesting solution + processing of algae paste

Evodos harvest a top quality Algae paste