

Development and Scale-Up of a Horizontal Bioreactor for High-Density Cultivation of Microalgae

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Algae Cultivation Technologies

Open pond



- Low investment
- Low biomass density
- Low yield



**high water volume
to process**

Closed photobioreactor (PBR)

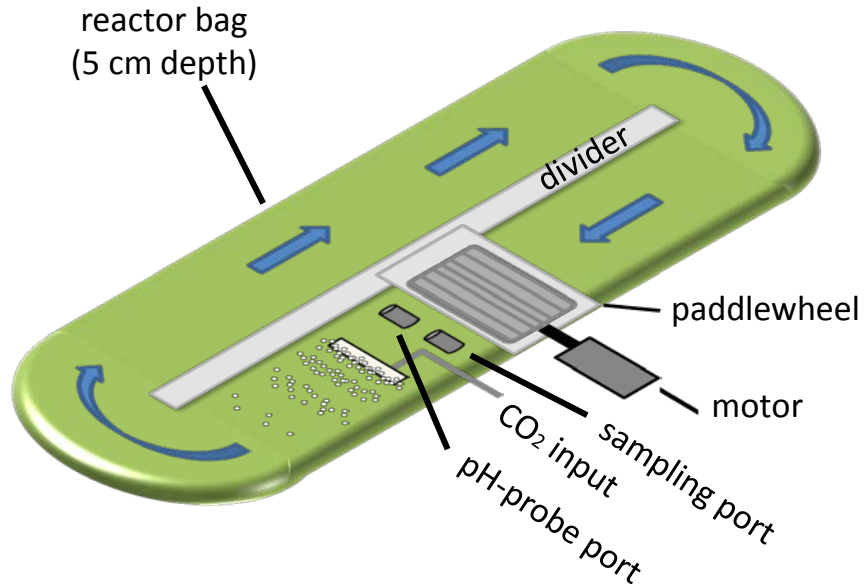


- High investment
- High biomass density
- High yield

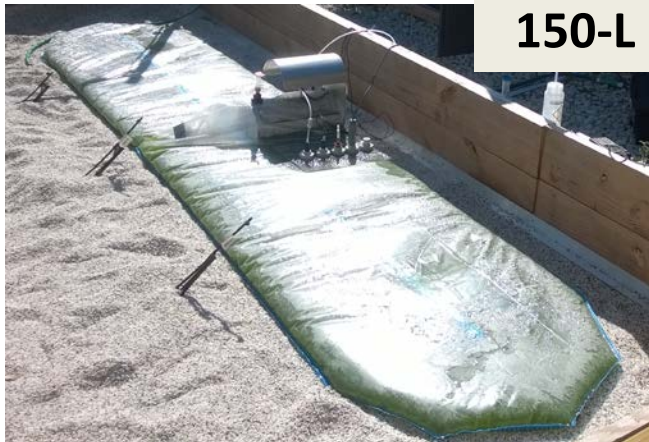


**high energy
consumption**

Innovative Approach: Horizontal Bioreactor (HBR)



- **Low capital cost**
- **High cell density & productivity**
- A fraction of water use ($< 1/4^{\text{th}}$)
- Lower cost of downstream processing
- Contamination barrier
- Floating or on the ground
- Readily scalable (modular)



150-L

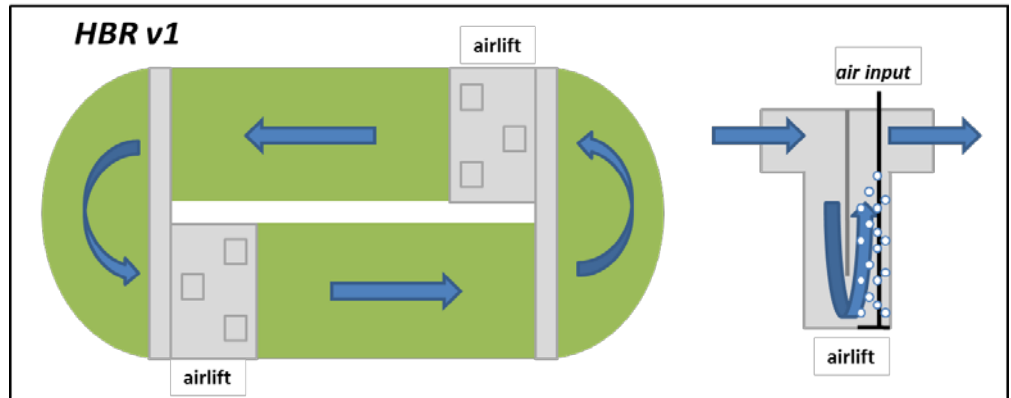


2000-L

HBR improvement

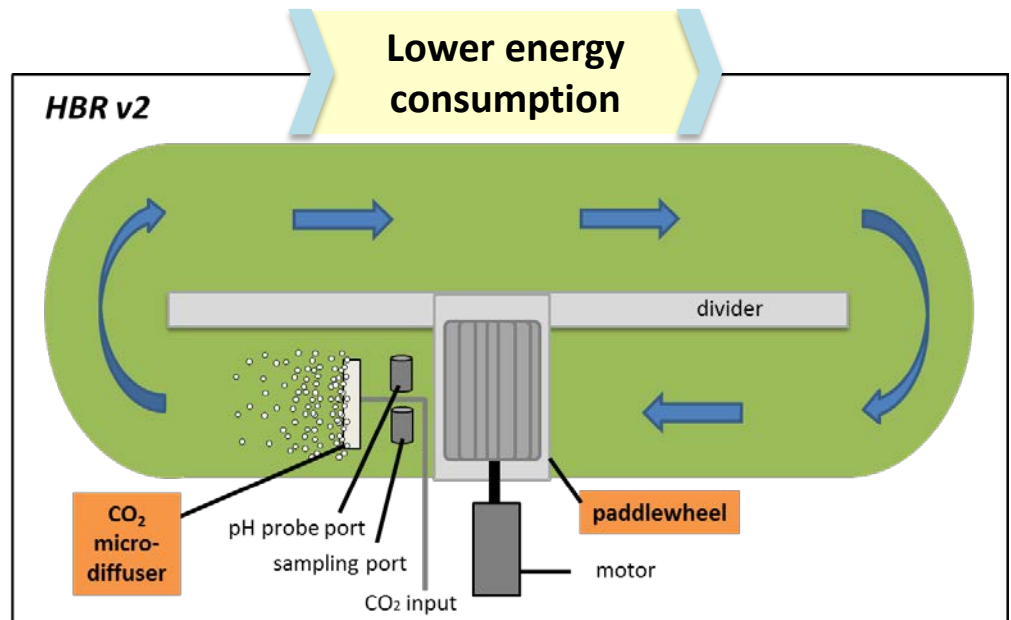
HBR version 1 (65-L prototype)

Mixing and CO₂ diffusion by two acrylic airlifts



HBR version 2 (150-L prototype)

- Mixing by 8-blade paddlewheel.
- High-efficiency CO₂ micro-diffusers



HBR demonstration and scale-up

Semi-continuous operation in progress

2000-L



2000-L HBR scale-up

Hydraulics testing:

- ✓ Average culture flow speed: **10.4 cm/s**
- ✓ Leak test: **Pass**
- ✓ Wind and rain test: **Pass**
- ✓ Integrity test: **Pass**

Monitoring systems:

1. — HBR T
2. — HBR pH
3. ■ Ambient T
4. ■ Ambient RH
5. ■ Solar radiation

