Technical specifications

Inoculation zone

- Low volume inocula: illuminated metalic shelves for different bottle sizes that include the option of bubbling CO₂ enriched air
- Pre-inoculum. Illuminated bubbled column of 0.1 m³, including the option to supply CO₂ enriched air and rotameters to regulate the gas flows

Preparation of cultivation media

- · 2 Plastic tanks (150 L) with agitation
- · Ultraviolet systems to avoid bacterial contamination
- Water is taken from the general water supply network. It is microfiltrated through membranes to avoid the entrance of solid particles and subsequently pumped into the columns or raceways

Bubbled columns

- 3 Modules consisting of 4 columns each. The modules are attached to a stainless steel structure. They can be operated individually or in series
- Each module includes rotameters for CO₂ and air
- Controlled illumination system
- · Each module includes temperature and pH probes
- Each column includes a valve to harvest the biomass manually and a pumping system that can be coupled to the columns or raceways systems for harvesting the biomass automatically

Raceway

- 2 Raceways of 0.5 m³
- Mixing provided by stainless steel paddles coupled to an engine of 10 W/m³ (average flow rate of 0.2-0.3 cm/s)

Harvesting and biomass dewatering

- . The culture broth from the photobioreactors is transferred to a 0.5 m³ harvesting tank
- Biomass is dewatered with a centrifuge that operates in continuous mode

Automated photobioreactors

· On-line control of the processes taking place in the photobioreactors through the software and computer. All the parameters from the probes (pH and temperature) and supply of gases can be controlled and automatized





Contact:

contact.energy@imdea.org tel. +34 91 737 11 20 fax +34 91 737 11 40

Avda. Ramón de la Sagra, 3 Parque Tecnológico de Móstoles E-28935 Móstoles, Madrid, Spain



institute MCEa energy

PMLab Photosynthetic Microorganisms Lab



Photosynthetic Microorganisms Lab (PMLab)

φφ

IMDEA Energy has a modern pilot plant for photosynthetic microorganism cultivation in photobioreactors. These cultivation systems allow the scale up from lab to pilot plant cultivation of microalgae and cyanobacteria. This pilot plant includes two types of photobioreactors: bubbled columns and raceways. The pilot plant has been designed to be highly versatile and flexible.

The total volume of the bubbled columns is 1 m³, divided in 13 columns. Each column is provided with rotameters to control air and CO_2 flows. Likewise, nutrient supply, temperature, pH and illumination can also be regulated. The pilot plant offers high versatility to cultivate a wide range of photosynthetic microorganisms grown at different operational conditions.

The 2 raceways reactors also present a total volume of 1 m^3 . These raceways can be controlled as described previously for the bubbled column type reactors. In this case, the raceways include stainless steel paddle wheels for mixing the culture broth.

The photobioreactors are fed with cultivation media prepared with water and nutrients in two reservoirs of 0.15 m³ each. The cultivating media are prepared with microfiltrated water from the general water supply network, to which the nutrients are added and mixed. Likewise, the pilot plant could be also fed with wastewater or any other liquid effluent.

The pilot plant also includes an area where inocula are prepared. This area includes low volumes reactors to cultivate microalgae and cyanobacteria microorganisms until the biomass is ready for scaling up. Additionally, the pilot plant contains a fast harvesting system. Once the biomass is grown to the desired level, it is pumped to another reservoir of 0.5 m³ and subsequently centrifuged in continuous mode.

Lines of work



φQ

Scale up of microalgae and cyanobacteria production under controlled conditions



Cultivation of photosynthetic microorganisms at optimal conditions (media composition, illumination, CO₂, etc.)



Isolation and cell wall characterisation

Biofuels production: bioethanol and biogas



Population dynamics



Biomass chemical characterisation



Nutrient recovery from liquid effluents: bioremediation

Services



- Cultivation of photosynthetic microorganisms at optimal conditions (media composition, illumination, CO₂, etc.)
- Comparison of microalgae and cyanobacteria production in various photobioreactor systems: raceways and bubbled columns
- · Wastewater bioremediation by means of photosynthetic microorganism nutrient uptake

 Population dynamics of the different microalgae and cyanobacteria strains developed under different operational conditions applied to the photobioreactors:

- · Feeding organic loading rate
- \cdot Changes in temperature
- pH changes
- \cdot Air and $\mathrm{CO}_{_2}\,\mathrm{supply}$
- Illumination
- Mixing

