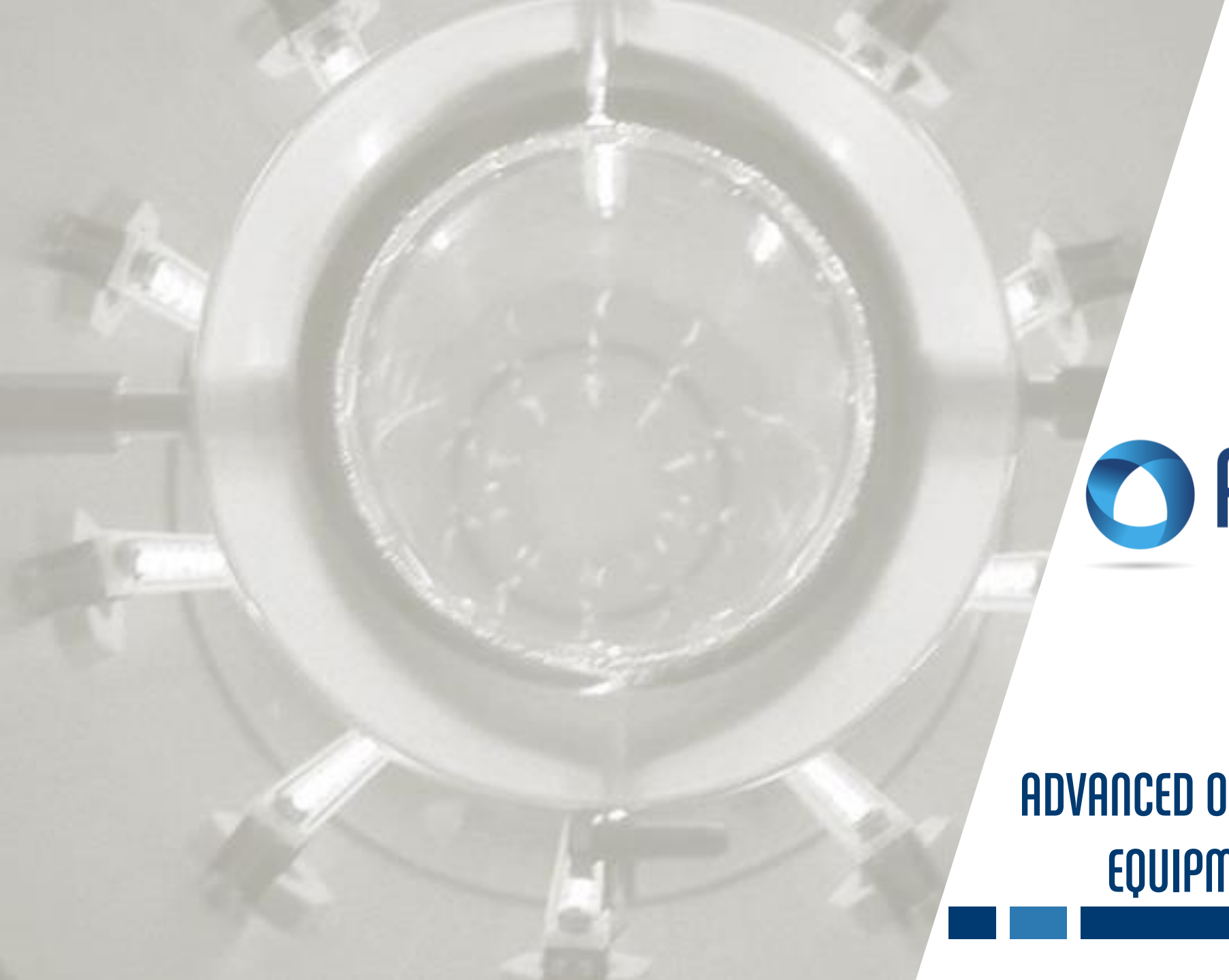


APRIA systems

ADVANCED OXIDATION EQUIPMENT

APRIA systems

We are a technology-based company that provides consulting and engineering services focused on the treatment, purification and valorization of liquid and gaseous streams through innovative technologies

Index

INTRODUCTION

Advanced oxidation processes (AOPs) are characterized by the in-situ generation of chemical species with a high oxidation power, mainly hydroxyl radicals.

We have extensive experience in the design, construction, and commissioning of **equipment based on one or several advanced oxidation processes** from laboratory to industrial scale.

Photochemical

- Photocatalysis
- Photo-Fenton
- UV/H_2O_2

Electrochemical

- Electro-oxidation
- Electro-Fenton

Photoelectrochemical

- Photoelectrocatalysis
- Photoelectro-Fenton

PHOTOCHEMICAL EQUIPMENT

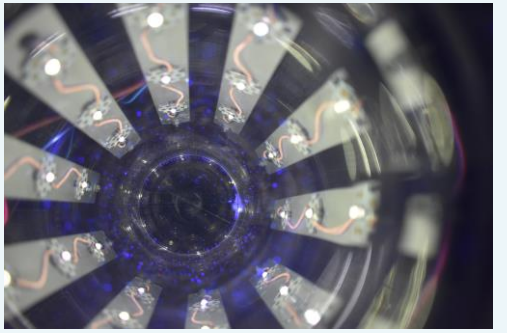
Introduction

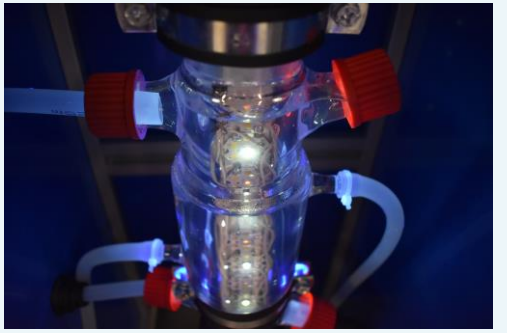
APRIA Systems applies cutting-edge **light emitting diode (LED) technology** in the photochemical equipment to promote treatments with a minimum energy consumption.

The amount of radiation emitted can be regulated and adjusted to the needs of the oxidation process under study.

The temperature of the LEDs is monitored and controlled through a forced air convection system, allowing for maximum efficiency and useful life of the LEDs.

We know that each client has their particular needs. Therefore, we offer a **wide range of alternatives to adjust our equipment to your needs**.





Available models

Photo

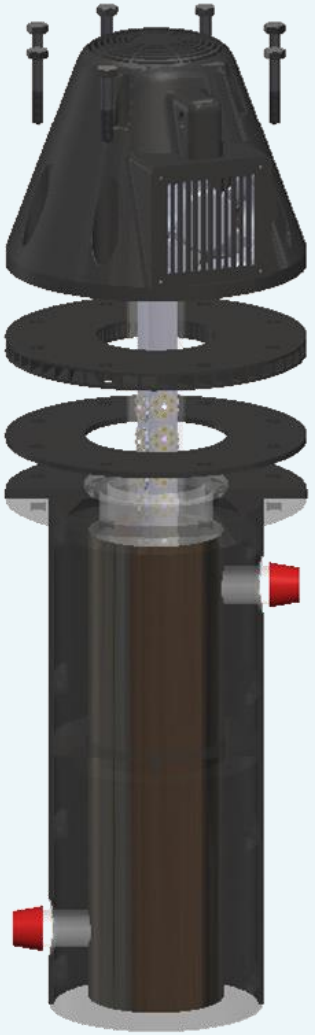
lab / bench / ind

LED (1) - (2) (3)

Maximum wavelength emission:
365 (365 nm), 450 (450 nm), etc.

Total irradiated power:
10 (10 W), 25 (25 W), 50 (50 W), etc.

Photoreactor configuration:
a (annular), c (cell), cb (collimated beam),
i (immersion), etc.



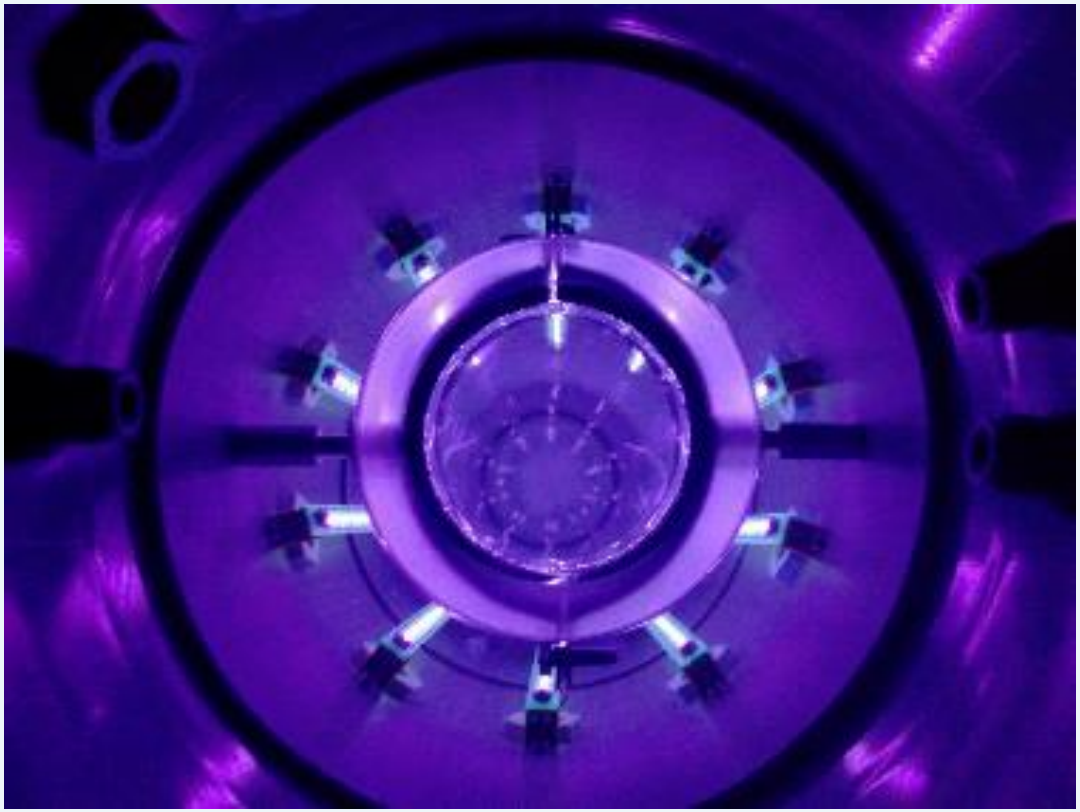
Available models

Technologies	Photocatalysis / Photo-Fenton / UV/H_2O_2
Technology of the light source	Light Emitting Diode (LED)
Configuration	Annular / Cell / CPC / Collimated beam / External radiation / Immersion
Volume of treatment / flow rate	Selectable
Operation mode	Alternating / Batch / Continuous
Radiation type	UV-A / UV-B / UV-C / visible / IR
Scale	Laboratory / Pilot / Industrial
Radiant flux	Adjustable through an electric console with PLC
Refrigeration system for the LED	Forced air convection
Reactor material	Borosilicate / Methacrylate / Quartz / Stainless steel
Sealing gaskets material	EPDM / TPU / Viton®
Connection type	Barb fitting / Quick plug
Optional features	Automatization / Online measurements (pH, O_2, etc.) / Jacketed reactor / Mirror finish / System for the recovery of the photocatalyst / Temperature control

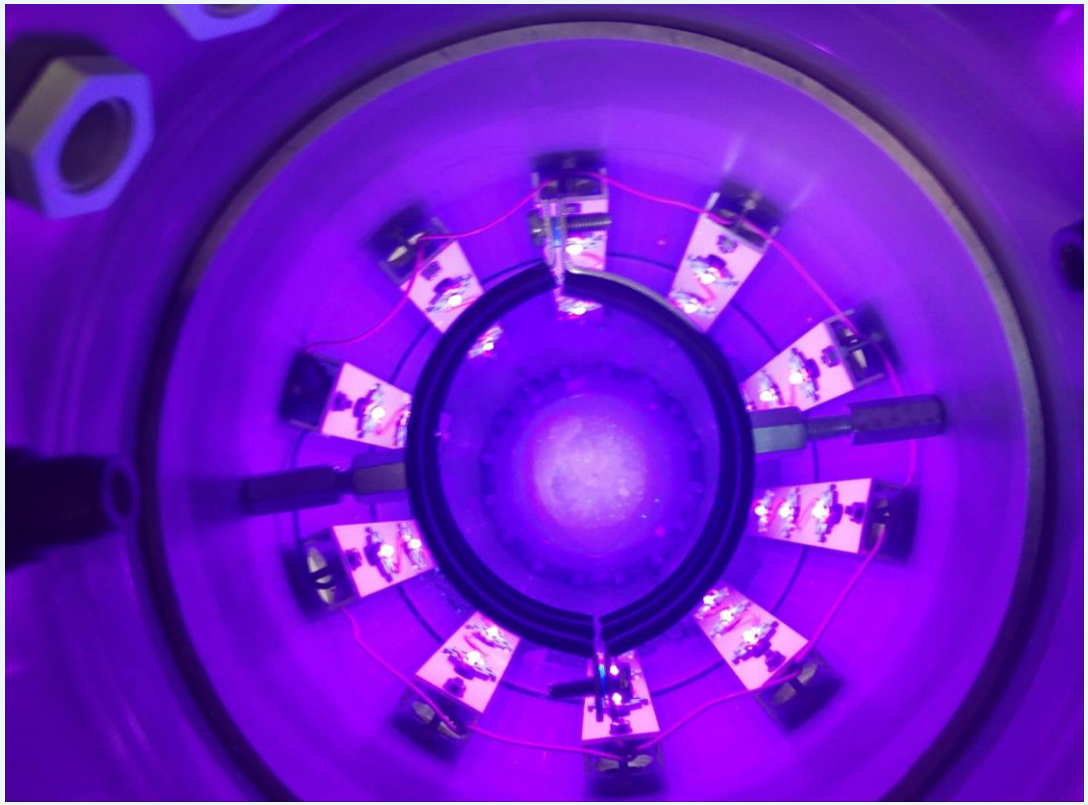
Photolab LED380-1er

Characteristics:

- Lab scale.
- CSTR photoreactor made of borosilicate.
- External radiation: multistrip distribution (10 strips).
- UV-A LEDs with selectable switching-on by pair of strips.
- External protective case.
- Magnetic stirring.
- Continuous online measurement of pH, T, and O_2.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.



Photolab LED365-24er



Characteristics:

- Lab scale.
- CSTR photoreactor made of borosilicate.
- External radiation: multistrip distribution (10 strips).
- UV-A LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Magnetic stirring.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.

Photolab LED365-24er / Photolab LED450-24er

Characteristics:

- Lab scale.
- CSTR photoreactor made of borosilicate.
- Exchangeable LED lamps with external UV-A / vis radiation: multistrip distribution (10 strips).
- LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Magnetic stirring.
- Electrical console with PLC to control the LEDs.
- Assembly mounted on aluminum frame.

Photolab LED 365-16er

Characteristics:

- Lab scale.
- Cubic reactor illuminated in 5 of its faces.
- UV-A LED lamp of adjustable intensity (formed by 5 plates).
- Refrigeration through forced air convection.
- Electrical console with PLC for the control of the LEDs.
- Support for the collocation of the photocatalyst (photocatalyst provided by the client).
- Pump for the recirculation of the gas.
- Instrumentation for flow and pressure control.
- Assembly mounted on aluminum frame.

Photolab LED275-0.01/300-0.03/365-1cb

Characteristics:

- Lab scale.
- 3 lamps with LED technology: 1 for UV-C, 1 for UV-B and 1 for UV-A. Each type of light has independent switching-on and adjustable total irradiated power. 1, 2 or 3 lamps can be used simultaneously.
- 3 collimation systems (one for each lamp). Each system includes: 1 collimating tube + 1 collimating lens.
- Sample holder with wells for the colocation of 3 Petri dishes.
- Regulation of the distance from the LED lamps to the Petri dishes.
- External protective case.
- Electric console with PLC to control the LED lamps.
- It includes a portable radiometer.

Photolab LED275-0.01/300-0.03/365-1cb

Characteristics:

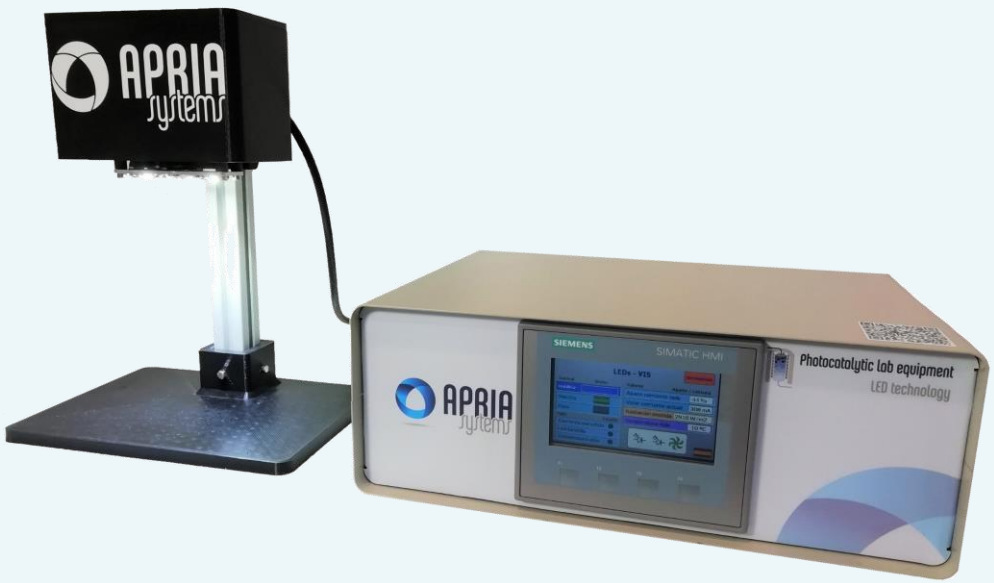
- Lab scale.
- 3 lamps with LED technology: 1 for UV-A, 1 for vis and 1 for IR. Each type of light has independent switching-on and adjustable total irradiated power. 1, 2 or 3 lamps can be used simultaneously.
- 3 collimation systems (one for each lamp). Each system includes: 1 collimating tube + 1 collimating lens.
- With sample holder with 3 wells for the colocation of reactors for gas phase.
- Regulation of the distance from the LED lamp to the reaction system.
- External protective case.
- Electric console with PLC for the control of the LED.

Photolab LED275-0.01/300-0.03/365-1/450-1cb

Characteristics:

- Lab scale.
- 4 lamps with LED technology: 1 for UV-C, 1 for UV-B, 1 for UV-A, and 1 for vis. Each type of light has independent switching-on and adjustable total irradiated power. 1, 2, 3 or 4 lamps can be used simultaneously.
- 4 collimation systems (one for each lamp). Each system includes: 1 collimating tube + 1 collimating lens.
- With sample holder with 4 wells for the colocation of Petri dishes.
- Regulation of the distance from the LED lamp to the reaction system.
- Electric console with PLC for the control of the LED.
- External protective case.
- It includes a stirring system.

Photolab LED365-3/450-3/850-3c



Características:

- Lab scale.
- 3 exchangeable lamps with LED technology: 1 for UV-A, 1 for visible, and 1 for IR. Each type of light has adjustable total radiated power and refrigeration through forced air convection. The lamps cannot be used simultaneously.
- Regulation of the distance from the LED lamps to the reaction system (cell provided by the client).
- Electric console with PLC for the control of the lamps.
- Assembly mounted on aluminum frame.

Photolab LED275-0.2/365-14i

Characteristics:

- Lab scale.
- Silver CSTR photoreactor made of borosilicate with mirror finish.
- UV-A and vis LED of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Electrical console with PLC for the control of the LED lamp.
- Magnetic stirring.
- Aeration system: air evacuation ring and air injection chamber.
- Assembly mounted on aluminum frame.

Photolab LED365-6/450-6i

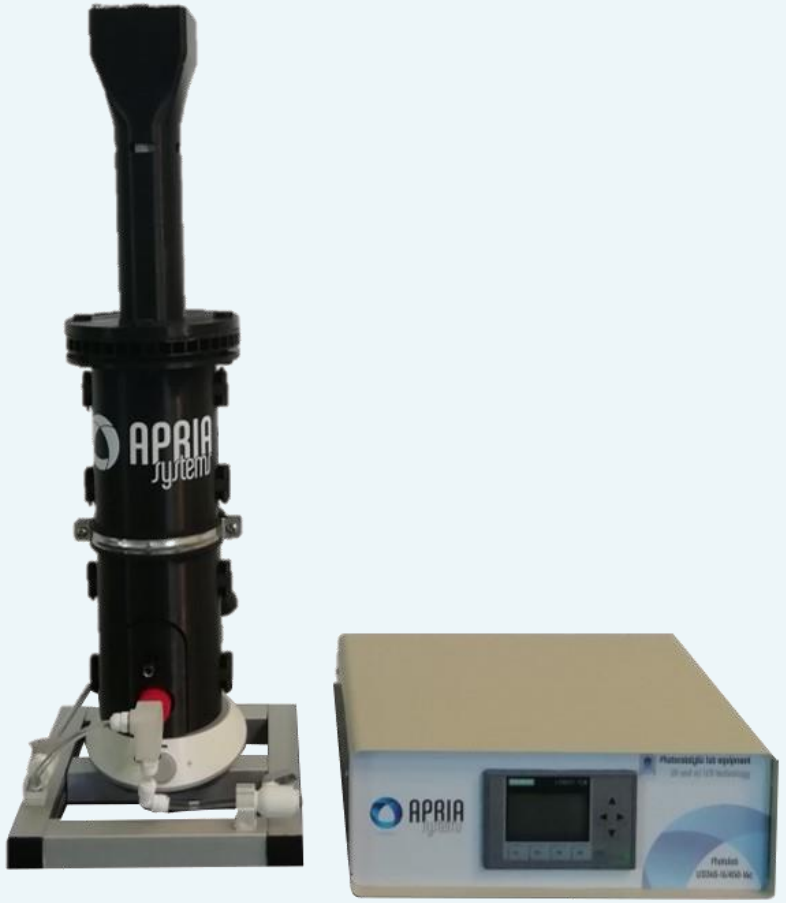
Characteristics:

- Lab scale.
- System for liquid and gas.
- Silver CSTR photoreactor made of borosilicate with mirror finish.
- Internal radiation: immersion lamp (4 strips).
- UV-A and vis LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Electrical console with PLC to control the LED lamp.
- Magnetic stirring.
- Assembly mounted on aluminum frame.

Photolab LED365-16/450-16i

Characteristics:

- Lab scale.
- Jacketed CSTR photoreactor made of borosilicate.
- Internal radiation: immersion lamp (4 strips).
- UV-A and vis LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Electrical console with PLC to control the LED lamp.
- Magnetic stirring.
- Aeration system: air evacuation ring, air injection chamber and air blower.
- Assembly mounted on aluminum frame.



Photolab LED365-16/450-16i

Characteristics:

- Lab scale.
- Jacketed CSTR photoreactor made of borosilicate.
- Internal radiation: immersion lamp (4 strips).
- UV-A and vis LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Distribution and maneuver panel with PLC to control the LED lamp.
- Magnetic stirring.
- Peristaltic pump.
- Aeration system: air evacuation ring, air injection chamber, and air blower.
- Continuous online measurement of pH, T, and O_2.
- Assembly mounted on aluminum frame.

Photolab LED275-0.4i

Characteristics:

- Lab scale.
- CSTR photoreactor made of borosilicate with mirror finish.
- Internal radiation: immersion lamp (4 strips).
- UV-C LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Electrical console with PLC to control the LED lamp.
- Magnetic stirring.
- Peristaltic pump.
- Instrumentation for flow and pressure control.
- Assembly mounted on aluminum frame.

Photolab LED365-16/450-16a

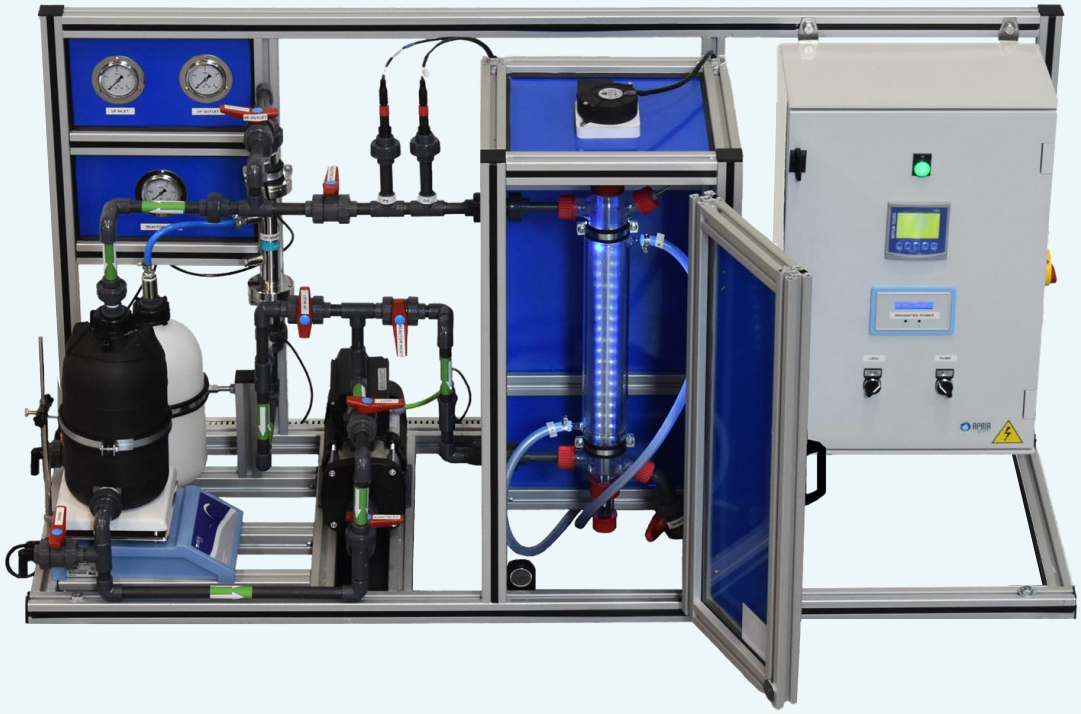
Characteristics:

- Lab scale.
- UV-A and visible LED of adjustable intensity and refrigeration through forced air convection.
- Magnetic stirring.
- Recirculation pump.
- Continuous online measurement of pH, T, and O_2.
- Electrical console with PLC for the control of the LED system, stirrer, pump, and analyzer.
- Membrane for the recovery of the photocatalyst.
- Instrumentation for flow and pressure control.
- Temperature control with a thermostatic bath.
- Assembly mounted on aluminum frame.

Photolab LED365-32a

Characteristics:

- Lab scale.
- Jacketed annular photoreactor made of borosilicate.
- Internal radiation: inner annulus (2 strips).
- UV-A LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective cabinet.
- Magnetic stirring.
- Recirculation pump.
- Continuous online measurement of pH, T, and O_2.
- Membrane to recover the photocatalyst.
- Instrumentation for pressure control.
- Temperature control with a thermostatic bath.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.



Photobench LED365-32a

Characteristics:

- Pre-pilot plant scale.
- Annular photoreactor made of borosilicate.
- Internal radiation: inner annulus (2 strips).
- UV-A LEDs of adjustable intensity and refrigeration through forced air convection.
- External protective case.
- Recirculation pump.
- Continuous online measurement of pH, T, and O_2.
- Membrane to recover the photocatalyst.
- Instrumentation for pressure control.
- Temperature control with a heat exchanger and a thermostatic bath.
- Ability to operate in semi-continuous or batch mode.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.

Photolab LED365-1/450-1c

Characteristics:

- Pilot plant scale.
- 2 annular photoreactors with mirror finish. LEDs of adjustable intensity and with their own refrigeration (reactor 1: UV-C LEDs, reactor 2: UV-A and visible LEDs).
- Recirculation pump.
- Pretreatment by filtration.
- Ozone generation system.
- Air extraction and filtration system.
- Continuous online measurement of pH and T.
- Chemical dosing system.
- Instrumentation for flow and pressure control.
- Temperature control through a heat exchanger and a thermostatic bath.
- Operation through PLC.
- Assembly mounted on aluminum frame.

Photobench LED365-48/450-48a/CPC2

Characteristics:

- Pilot plant scale.
- 2 annular photoreactors made of borosilicate with mirror finish.
- Internal radiation (inner annulus, 4 strips).
- UV-A and vis LEDs of adjustable intensity and refrigeration through forced air convection.
- Compound parabolic concentrator (CPC) solar reactor.
- Radiometer.
- Filtration system in two stages: prefiltration and/or microfiltration.
- 2 chemicals dosing systems.
- Recirculation and filtration pumps.
- Instrumentation for pressure and flow control.
- Temperature control with a heat exchanger.
- PLC operated.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.

Photobench LED365-64a/CPC5

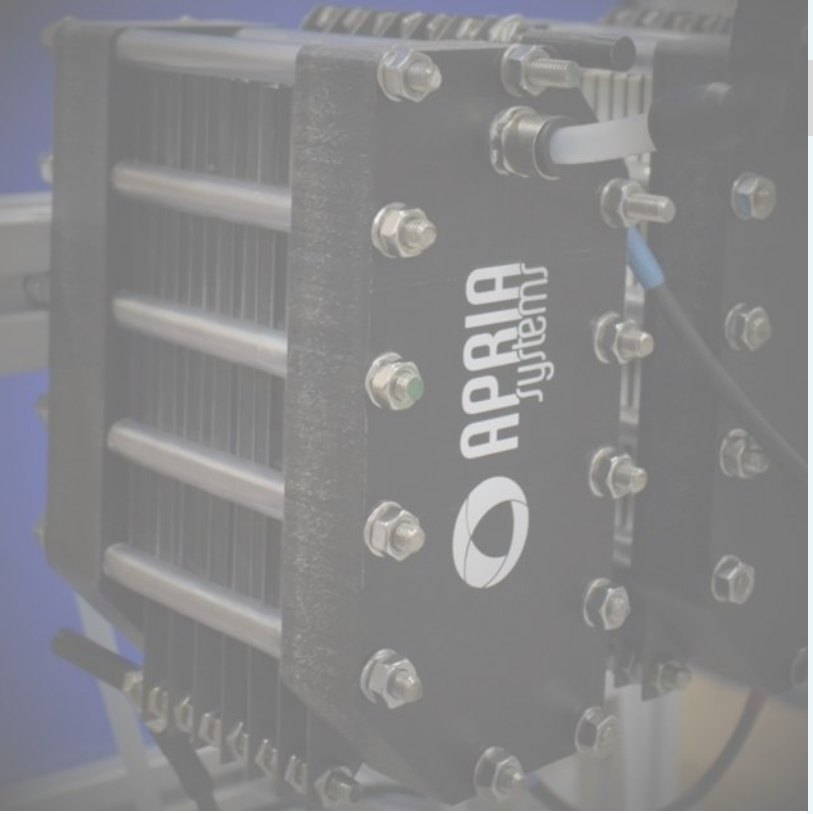
Characteristics:

- Pilot plant scale.
- 2 annular jacketed photoreactors made of borosilicate: internal radiation (inner annulus, 4 strips), UV-A LEDs of adjustable intensity, and with own refrigeration.
- External protective cabinet.
- Compound parabolic concentrator (CPC) solar reactor.
- Radiometer.
- Recirculation and filtration pumps.
- Instrumentation for flow and pressure control.
- Continuous online measurement of pH, T, O_2, and ORP.
- Membrane to recover the photocatalyst.
- Ability to operate in continuous or batch mode.
- Temperature control with a heat exchanger.
- Automatized operation through PLC.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.

Photobench LED365-224a

Characteristics:

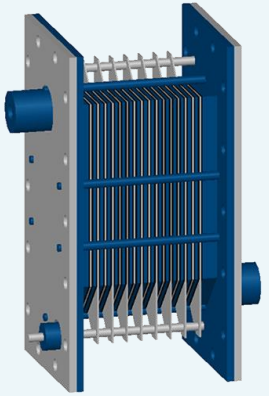
- Pilot plant scale.
- 5 lamps with UV-A LEDs of adjustable intensity.
- Simultaneously operation of the 5 lamps.
- Refrigeration of the lamps through forced air convection.
- Maximum recommended flowrate: 5 m3/h
- Distribution and maneuver panel with PLC for the control of the lamps.
- Assembly mounted on aluminum frame



ELECTROCHEMICAL EQUIPMENT

Introduction

APRIA Systems designs customized electrochemical cells, **whose configuration, active anodic area and electrode material can be selected.** In addition, thanks to their simple connection by quick plug or barb fitting, we offer the **possibility of easily exchanging the cells**, allowing you to apply the electrochemical treatment with different electrodes in a single equipment.



Available models

- ELOX / ELFEN
  - Electro-oxidation
  - Electro-Fenton
- lab / bench / ind
- (1) - (2) (3)
  - Selectable anodic material:
    B (BDD), I (IrO_2), P (Pt), Pb (PbO_2), R (RuO_2),
    S (stainless steel), Sn (SnO_2), T (Ti), etc.
  - Selectable cathodic material:
    B (BDD), I (IrO_2), P (Pt), Pb (PbO_2), R (RuO_2),
    S (stainless steel), Sn (SnO_2), T (Ti), etc.
  - Selectable anodic useful surface:
    50 (50 cm^2), 100 (100 cm^2), etc.

Available models

Technologies	Electro-oxidation / Electro-Fenton
Configuration	Cell
Volume of treatment / flow rate	Selectable
Operation mode	Alternating / Batch / Continuous
Scale	Laboratory / Pilot / Industrial
Anodic useful surface	Selectable
Separation between electrodes	Adjustable and selectable (> 1 mm)
Number of compartments	Selectable
Electrodes material	BDD / IrO_2 / Pt / PbO_2 / RuO_2 / Stainless steel / SnO_2 / Ti
Case material	Polypropylene / Stainless steel
Sealing gaskets material	EPDM / TPU / Viton®
Connection type	Barb fitting / Quick plug
Optional features	Automatization / Online measurements (pH, O_2, etc.) / Temperature control

ELOXlab B-B50

Characteristics:

- Lab scale.
- BDD anode and cathode.
- Approximate useful anodic surface of 50 cm^2.
- Plate and frame configuration.
- Adjustable separation of 3 mm between electrodes.
- One anode-cathode compartment.
- Maximum flow rate of 600 L/h.

ELOX labI-T50

Characteristics:

- Lab scale.
- Titanium anode.
- MMO cathode.
- Approximate useful anodic surface of 50 cm^2.
- Plate and frame configuration.
- It contains accessories for the adequate inclusion of a membrane.

ELOXlab B-T270

Characteristics:

- Plate and frame configuration.
- BDD anode and titanium cathode.
- Approximate useful anodic surface of 270 cm^2.
- 2 compartments.
- With power supply.

ELOXbench R-R4900

Characteristics:

- Pilot plant scale.
- 4 electro-oxidation cells: MMO anode and cathode, plate and frame configuration, approximate useful anodic surface of 1,225 cm^2/cell, and 14 bipolar electrodes.
- Power supply for the electrodes.
- Recirculation pump.
- Filtration system for the removal of solids.
- Continuous online measurement of pH, T, and ORP.
- Instrumentation for flow and pressure control.
- Temperature control with a heat exchanger.
- Extractor to evacuate the potential harmful and flammable gases generated by the treatment.
- Automatized operation through PLC.
- Distribution and maneuver panel.
- Assembly mounted on aluminum frame.

PHOTOELECTROCHEMICAL EQUIPMENT

Introduction

We use **LED technology as a source of light**, where the amount of radiation emitted is adjustable to the needs of the treatment. **Regarding the electrodes, the client can select** their active anodic area, configuration, and materials.

Available models

PE

lab / bench / ind

LED (1) - (2) (3) / (4) - (5) (6)

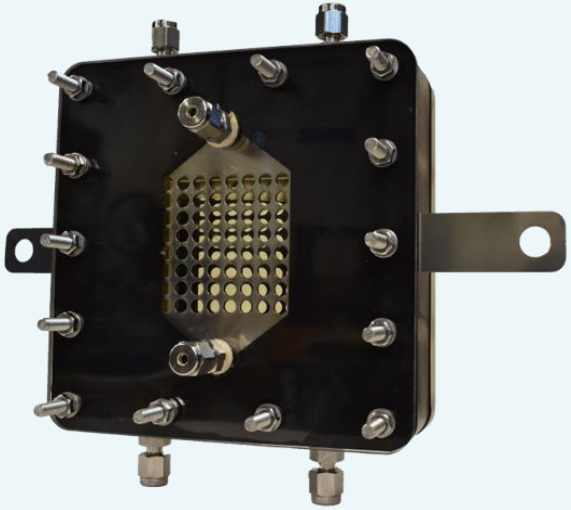
- (4): Selectable anodic useful surface:
  50 (50 cm^2), 100 (100 cm^2), etc.
- (5): Selectable cathodic material:
  B (BDD), I (IrO_2), P (Pt), Pb (PbO_2), R (RuO_2), S (stainless steel), Sn (SnO_2), T (Ti), etc.
- (6): Selectable anodic material:
  B (BDD), I (IrO_2), P (Pt), Pb (PbO_2), R (RuO_2), S (stainless steel), Sn (SnO_2), T (Ti), etc.
- (1): Maximum wavelength emission:
  365 (365 nm), 450 (450 nm), etc.
- (2): Total irradiated power:
  10 (10 W), 25 (25 W), 50 (50 W), etc.
- (3): Photoreactor configuration:
  c (cell), i (immersion).

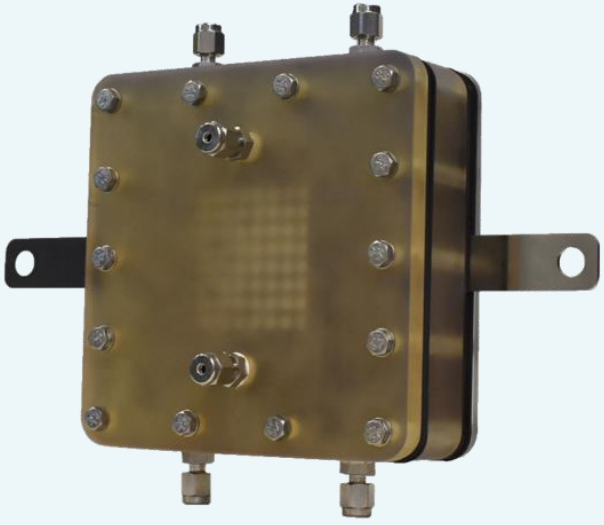
Technologies	Photoelectrocatalysis / Photoelectro-Fenton
Source of light technology	Light emitting diode (LED)
Configuration	Cell / Immersion
Volume of treatment / flow rate	Selectable
Operation mode	Alternating / Batch / Continuous
Scale	Laboratory / Pilot
Radiation type	UV-A / UV-B / UV-C / visible / IR
Radiant flux	Adjustable through an electric console with PLC
Refrigeration system for the LED	Forced air convection
Anodic useful surface	Selectable
Separation between electrodes	Adjustable and selectable (> 1 mm)
Number of anode-cathode compartments	Selectable
Electrodes material	BDD / IrO_2 / Pt / PbO_2 / RuO_2 / Stainless steel / SnO_2 / Ti
Reactor material	Borosilicate / Methacrylate / PP / Quartz / Stainless steel
Sealing gaskets material	EPDM / TPU / Viton®
Connection type	Barb fitting / Quick plug
Optional features	Automatization / Online measurements (pH, O_2, etc.) / Jacketed reactor / Mirror finish / System to recover the photocatalyst / Temperature control

PElab c/R-S25

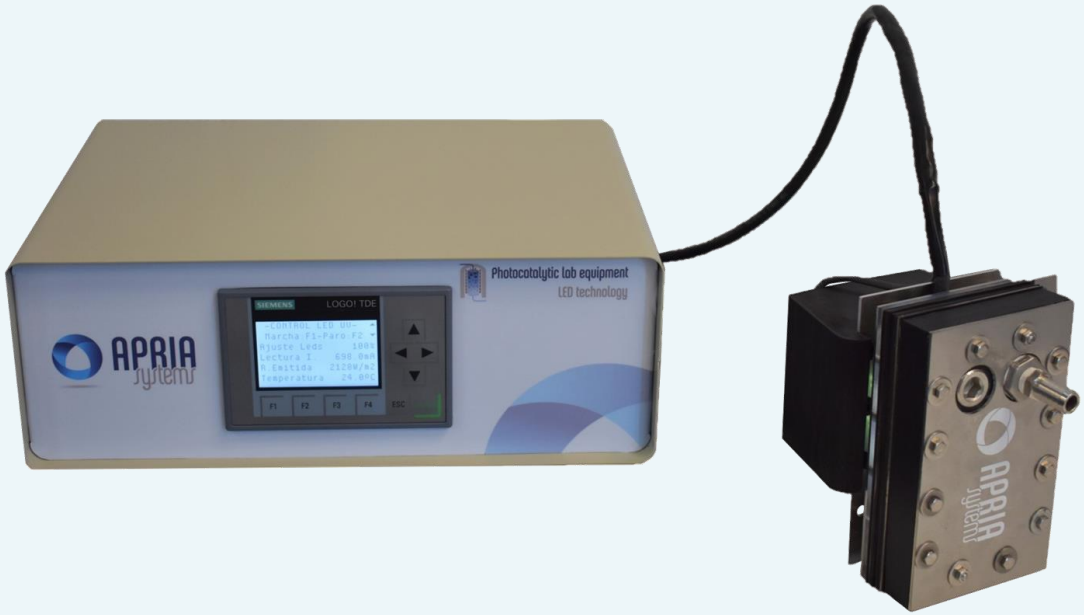
Characteristics:

- Lab scale.
- Cell made of technical resin.
- External radiation: plate.
- MMO mesh anode and stainless steel mesh cathode.
- Approximate useful anodic surface of 25 cm^2.
- Power supply for the electrodes.





PElab LED365-3c/S-N25



Characteristics:

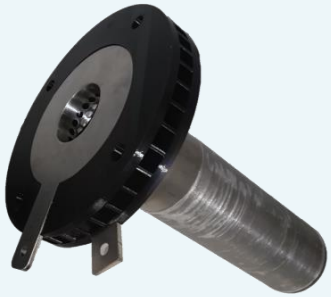
- Lab scale.
- External radiation: plate.
- UV-A LEDs of adjustable intensity and refrigeration through forced air convection.
- Electrical console with PLC to control the LED lamp.
- Support for the photoanode of stainless steel.
- Nickel mesh cathode.

PElabLED365-5/450-5c/S-S50

Characteristics:

- Lab scale.
- External radiation: plate.
- UV-A and vis LEDs of adjustable intensity and refrigeration through forced air convection.
- Electrical console with PLC to control the LED lamp.
- Stainless steel support for the photoanode.
- Stainless steel mesh cathode.
- Approximate useful anodic surface of 50 cm^2.
- Power supply for the electrodes.
- Assembly mounted on aluminum frame.

PElab LED365-16i/T-S430



Characteristics:

- Lab scale.
- Silver CSTR photoreactor made of borosilicate with mirror finish.
- Internal radiation: immersion lamp (4 strips).
- UV-A LEDs of adjustable intensity and refrigeration through forced air convection.
- Electrical console with PLC to control the LED lamp.
- Titanium support for the photoanode.
- Stainless steel mesh cathode.
- Approximate useful anodic surface of 430 cm^2.
- Separation of approximately 1 cm between electrodes
- Aeration system: air evacuation ring, air injection chamber and air blower.
- Assembly mounted on aluminum frame.

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