OUR Respirometer

The OUR Respirometer is a device to assess aerobic bioprocesses and/or evaluating properties of materials/wastewater. It applies a technique to determine the Oxygen Uptake Rate (OUR) based on the Dissolved Oxygen (DO) level in the liquid phase.
It is available in 2 versions, one is an off-line testing device dedicated to evaluate properties of biomass/substrate/wastewater (OFF-LINE), one is dedicated to the on-line constant monitoring of the OUR parameter in a by-pass stream of a lab/pilot/industrial bioreactor, during its normal working cycle (ON-LINE).

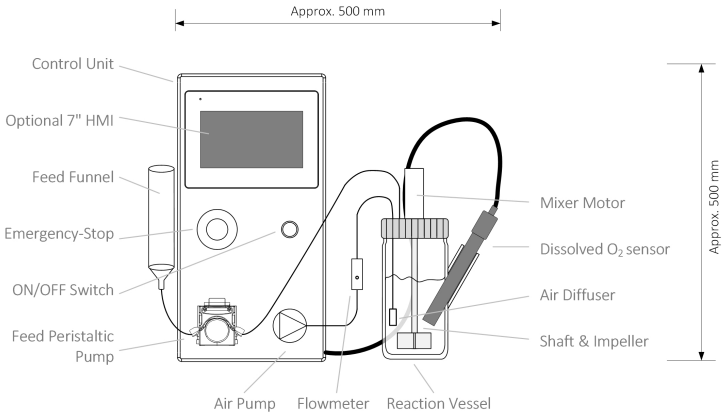
OUR Respirometer (OFF-LINE)

Description

The OFF-LINE respirometer has been specifically developed for the determination of kinetic information, toxicity and inhibitions as well as for the estimation of the biodegradable COD, COD fractionations, nitrification in wastewater applications. It is a Gas Static-Liquid Static (LSS) respirometer that performs cyclic aeration steps increasing the DO concentration, measuring the following DO decline after stopping the aeration (DO drops due to respiration) and automatically evaluating the Oxygen Uptake Rate (OUR). Test execution requires a low level of manpower: the user has only to prepare reagents and substrates and the system will automatically inject them at the right time.

Basic package (1 test unit)

- 1 x Control unit fully compatible with machine directive (emergency stop, etc.), including a PLC, a virtual Industrial HMI[1] and all the electronic components needed for the experiment.
- 1 x 3 lpm max air pump regulated with a manual needle valve and an anagogic flow-meter.
- 1 x peristaltic pump for feeding the liquid substrate automatically for the right execution of the test.



- 1 x DO sensor[2] featuring digital communication and optical technology with temperature compensation, range up to 40 mgDO/L, T max 60°C, response time t90 30 sec @ 25°C (the fastest in commerce), maintenance and trouble free, fast start up (1 sec).
- 1 x GL100 reaction vessel (1 L max) equipped with an overhead stirrer magnetically coupled with mixing shaft (50-250 rpm, step of 10 rpm), an air supply line + PE diffuser.
- 1 water-bath with IN/OUT connectors (the temperature controller is excluded from the basic package).

Add on & options

- Multiple test units (2, 3, …);
- 7" or 10" physical HMI instead the virtual HMI included in the basic package;
- pH/ORP/… sensors for monitoring purposes;
- pH control system (sensor + peristaltic pump/pumps) for pH sensible processes;
- gas flow measuring cell to assess anoxic/anaerobic processes;
- temperature controller;
- software and hardware customization and adaptation to specific processes (e.g. photo-bioreactions);

1. A PC is required to execute the visualize the virtual HMI on a internet browser or a 7/10" HMI must be considered
2. A PC is required for USB connection to the control unit to execute the periodical sensor calibration according to the manufacturer of the sensor.

OUR Respirometer (ON-LINE)

Description

The ON-LINE respirometer constantly estimates the OUR parameter in a by-pass stream of a lab/pilot/industrial bioreactor, during its normal working cycle. Differently from standard approaches, here the OUR is calculated using Oxygen measurement in the liquid phase (where the process is localized).

First, the sample is taken out the main vessel into the test vessel (feeding step), where it is maintained mixed by recirculating it. Then, once the O2 decline is observed (aeration is not present in test vessel) the OUR value of the culture is estimated (measuring step).

Basic package (1 test unit)

- 1 x Control unit fully compatible with machine directive (emergency stop, etc.), including a PLC, a 4.3" Industrial HMI and all the electronic components needed for the experiment.
- 1 x peristaltic pump for feed the by-pass stream and the test vessel.
- 2 x pinch valves for recirculating on the vessel during the measuring cycle.
- 1 x DO sensor[1] featuring digital communication and optical technology with temperature compensation, range up to 20 mgDO/L, T max 60°C, response time t90 30 sec @ 25°C (the fastest in commerce), maintenance and trouble free, fast start up (1 sec).
- 1 x test vessel.

Add on & options

- 7" HMI instead the 4.3 HMI included in the basic package.
- software and hardware customization and adaptation to specific processes (e.g. photo-bioreactions)

1. A PC is required for USB connection to the control unit to execute the periodical sensor calibration according to the manufacturer of the sensor.

Features

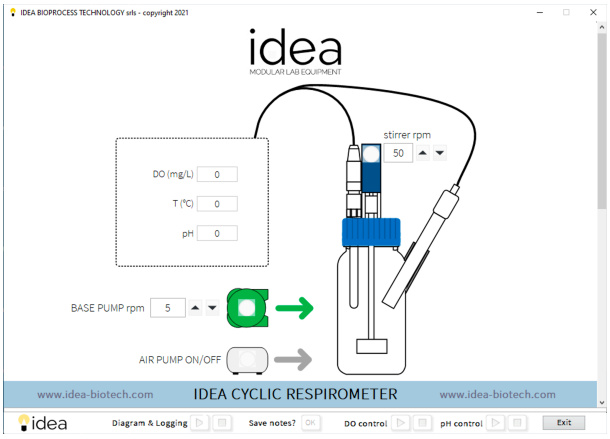
- Software for the control of the experiment and for the automatic elaboration of the results (OFF-LINE version only).
- High level of test automation
- Remote access and control.
- Small impact in the lab space.
- Maintenance free and trouble free optical digital Hamilton DO sensor.
- 30° inclined DO sensor (OFF-LINE) / 90° inclined DO sensor (ON-LINE) for no air entrapment under the sensor.
- Fully customizable (software and hardware).

Applications

Metabolic activity of aerobic biomass.
Inhibitions and toxicity prevention.
Kinetics estimation.
Wastewater characterization (COD/BOD removal, nitrification).

HMI control software

It provides a guide for the experiment set-up and for the execution of the test. It also features a manual control of mixing (ON/OFF, rpm setting) and peristaltic pumps (ON/OFF, rpm setting), data acquisition and data logging capabilities. Also, it executes all the automatic tasks for the OUR test and provides live graphs for the need of monitoring the test by the user.

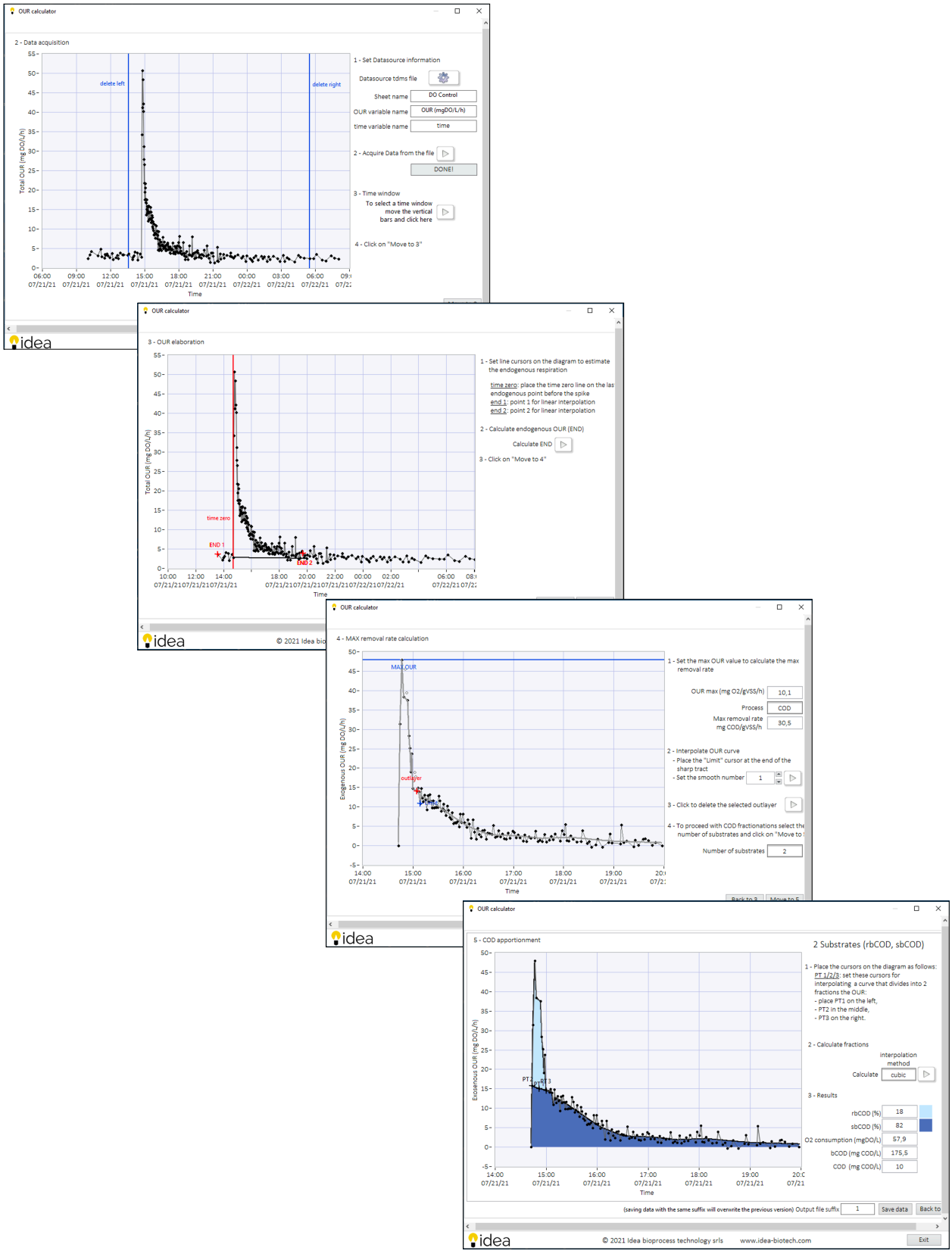


OFF-LINE elaboration software (installed on a user Windows PC)

Automatic elaboration of the OUR profile to obtain the net OUR profile (eliminating the endogenous activity), the max OUR, the max removal rate of the heterotrophic or nitrification test and COD fractionation.

Some of the steps of the software:

- OUR profile and windows of elaboration: when more experiments are conducted with this feature it is possible to isolate only some parts
- Endogenous decay profile identification
- Out-layer identification and curve fitting
- COD fractionation


OUR calculator
2 - Data acquisition
delete left
delete right
Total OUR (mg DO/L/h)
Time
1 - Set Datasource information
Datasource tdms file
Sheet name
DO Control
OUR variable name
OUR (mgDO/L/h)
time variable name
time
2 - Acquire Data from the file
DONE!
3 - Time window
To select a time window move the vertical bars and click here
4 - Click on "Move to 3"
idea
OUR calculator
3 - OUR elaboration
time zero
END 1
END 2
1 - Set line cursors on the diagram to estimate the endogenous respiration
time zero: place the time zero line on the last endogenous point before the spike
end 1: point 1 for linear interpolation
end 2: point 2 for linear interpolation
2 - Calculate endogenous OUR (END)
Calculate END
3 - Click on "Move to 4"
idea
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OUR calculator
4 - MAX removal rate calculation
MAX OUR
outlayer
Exogenous OUR (mg DO/L/h)
Time
1 - Set the max OUR value to calculate the max removal rate
OUR max (mg O2/gVSS/h)
10,1
Process
COD
Max removal rate mg COD/gVSS/h
30,5
2 - Interpolate OUR curve
- Place the "Limit" cursor at the end of the sharp tract
- Set the smooth number
1
3 - Click to delete the selected outlayer
4 - To proceed with COD fractionations select the number of substrates and click on "Move to
Number of substrates
2
idea
OUR calculator
5 - COD apportionment
2 Substrates (rbCOD, sbCOD)
PT1
PT2
PT3
Exogenous OUR (mg DO/L/h)
Time
1 - Place the cursors on the diagram as follows:
PT 1/2/3: set these cursors for interpolating a curve that divides into 2 fractions the OUR:
- place PT1 on the left,
- PT2 in the middle,
- PT3 on the right.
2 - Calculate fractions
interpolation method
Calculate
cubic
3 - Results
rbCOD (%)
18
sbCOD (%)
82
O2 consumption (mgDO/L)
57,9
bCOD (mg COD/L)
175,5
COD (mg COD/L)
10
(saving data with the same suffix will overwrite the previous version) Output file suffix
1
Save data
Back to
idea
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Exit