

## Multi-purpose Respirometer

BM-EVO is a respirometer specially developed for practical and efficient biological wastewater treatment management, design and research



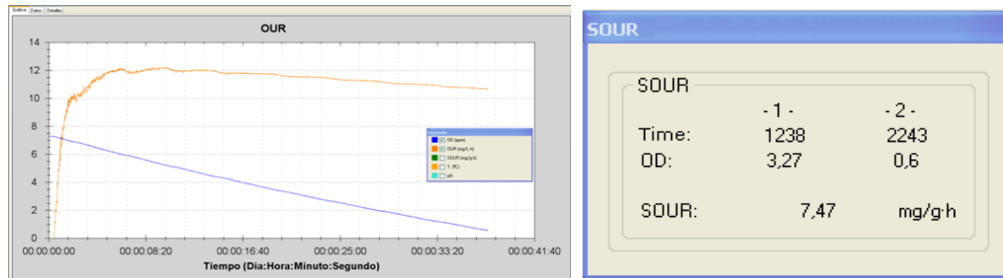
### Main features

- Compact analyzer, with very low maintenance and user friendly operation
- Direct oxygen measurements from a *maintenance-free* oxygen sensor
- No oxygenation restriction during test performance
- Full control and results by means a powerful software already loaded in the PC of the system
- Automatic software update versions from internet
- Capacity for test conditions setting and modify them throughout the test performance.
- Automatic measurements: OUR, SOUR, bCOD, rbCOD, sbCOD, U (COD utilization rate) and q (specific U)
- Last, minimum, maximum and moving average results throughout any moment of the test
- Several results at any time during the test and option to see them simultaneously on tabular or graphic modes
- Option to open several stored tests and compare their results
- Automatic temperature control integrated in the own console.
- Package of measurements at any moment during test performance
- Capacity for different respirograms and simultaneous overlying
- BM respirometers measure data that can be directly input into modeling – simulating software
- Option for a special reactor assembly for moving beds bio-films (MBBR)

# Operation modes

## OUR static

From a mixed-liquor of the aeration tank it is determined the OUR & SOUR within the time and section we have selected in the corresponding respirogram.

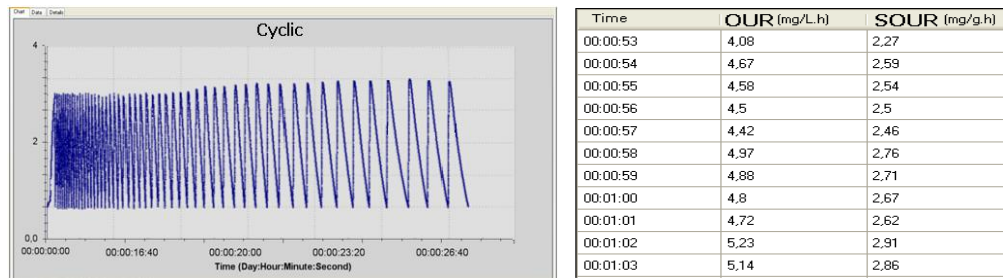


**OUR** (mg/l.h) Total oxygen uptake rate from mixed-liquor.

**SOUR** (mg/g.h) Specific OUR

## OUR cyclic

On this mode, the analyzer performs a respirogram within a programmed DO threshold and determines the corresponding **OUR & SOUR** in base of a continuous sequentially measurements.



## R dynamic

A DO base line is fixed from an endogenous respiration activated sludge and then added a certain amount of sample to be analyzed. In the respirogram, continuous measurements of  $R_s$  are showed permitting the simultaneous and continuous determination of CO and bCOD. In this way we can track the values evolution along the time as an actual window of the substrate oxidation from activated sludge.

**$R_s$**  (mg/l.h) Exogenous respiration rate corresponding to the substrate oxidation.

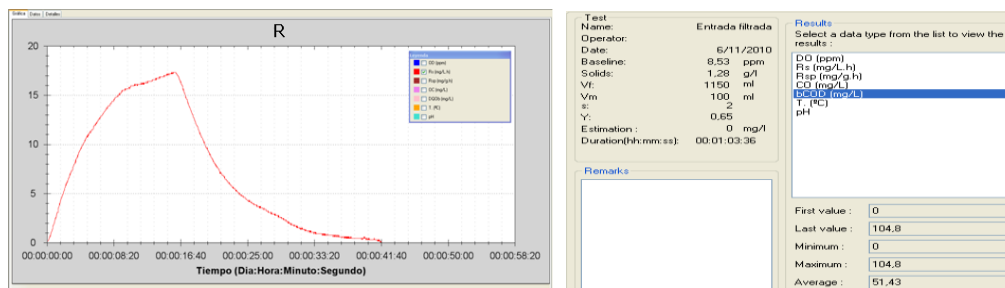
**$R_{sp}$**  (mg/g.h) Specific  $R_s$ .

**CO** (mg/l) Consumed oxygen accumulated in the substrate oxidation (BOD<sub>st</sub>)

**bCOD** (mg/l) Biodegradable fraction of total COD (bCOD) or Readily biodegradable fraction of COD (rbCOD)

**U** (mg COD/l.h) Substrate utilization rate

**q** (COD/SS.d) Specific substrate utilization rate



# Typical applications

## Oxygen requirement and energy optimization

Actual oxygen requirement (AOR) can be determined for any specific process.

Optimal and minimum DO level in the aeration tank, without any detriment of the process efficiency.

## Bioaugmentation control and tracking

By means the regular respiration rate measurement we can assess the result of the augmentation effect, to know if it is necessary to increase the dose of biomass and when it has reached its maximum effect.

## COD fractionation

Automatic calculation of the COD biodegradable fraction (bCOD) or COD readily biodegradable (rbCOD)

## BOD5 estimation

The software has the option to automatically estimate the BOD5 when the system is calibrated with three BOD standards and their corresponding consumed oxygen parameters (CO) measured in the respirometer.

## Influence of the temperature, pH and oxygen and other conditions

Thanks to the capacity to set and modify the test conditions, we can analyze the influence of any of them (or any combination) in the biomass activity and figure out break-points, optimum and minimum working levels.

## Operative parameter optimization

Loading rate (F/M), Sludge age (SRT) y Returned sludge rate (RR)

## Nitrification

Nitrification rate (AUR), Specific nitrification rate (SAUR,  $q_N$ ), optimal DO range for nitrification, Necessary hydraulic time for ammonium-nitrogen removal, Nitrification capacity, minimum sludge age for nitrification ( $SRT_N$ )

## Denitrification

Calculation of the rbCOD that is actually needed for the denitrification process.

NUR estimation can be calculated from the consumed oxygen uptake rate of the corresponding rbCOD.

In model BM-Advance Pro, together with the pH, we can analyze the ORP evolution during denitrification.

## Toxicity referred to one specific biomass

Fast screening qualitative test and by means of comparison of the actual respiration rates of one mixed-liquor prepared with the sample and another from one standard compound as reference.

## Kinetic parameters

Kinetic parameters calculation for heterotrophic and autotrophic biomass.

## Support for simulation programs

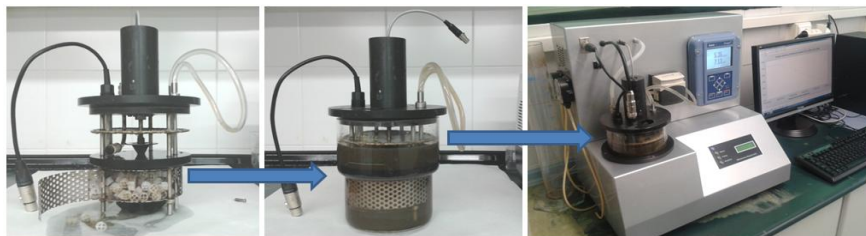
Such as GPS-X, BioWin, ...

## Many others

BM respirometers are open systems and, as such, support all kinds of combinations to step into an endless number of applications.

# Option for biomass carriers

BM-respirometers can be easily adapted to biomass carriers, and run any respirometry test by means the simple installation of a special reactor provided with a special cage vessel where the carriers are contained.



# BM-EVO Technical specifications

Type	Optimized batch with closed recirculation.
Use	Laboratory.
Oxygen sensor	Maintenance free oxygen sensor. It is not necessary to replace neither membrane nor electrolyte
Measurements	Dissolved oxygen (OD), Temperature. OUR & SOUR, Rs & Rsp, CO (Consumed Oxygen) and bCOD determinations. Calculation of U (Substrate utilization rate) and q (Specific U) Measurements visualization throughout the time on tabular and graphical modes . Results package overview at any time. Data acquisition interval setting. During the test, we get the last, minimum, maximum and average values.
Test files	Automatic generation of a security file just when the test is starting. Possibility to save any test under the own software format and/or Excel.
Operation modes	Static, Cyclic and Dynamic controlled by a specific software loaded in the PC of the system. Automatic respirograms generation throughout the test. Preset test conditions (T, DO, pH, sample volume,...) and possibility to change them during its performance.
Aeration system	From a small air compressor and a ceramic diffuser. The air flow can be controlled by means the software for different percentages of air supply for a non limited time.
Respirograms	Automatic graphic respiromgrams generation with the possibility to overlay them for comparison. Zoom application for total or partial periods. Option for several data displays on simultaneous visualization, under tabular and/or graphic modes.
Partial measurements	During the test and to its finalization, there is the option to get selective partial measurements from the values table or from any selected period of the respirogram.
Dynamic calibration	Only for R mode, the measuring system is calibrated by means the reaction of a chemical standard in distilled water, where the total oxygen demand is already known.
Biomass-carrier reactor	Option for a special reactor for biomass carriers to get all respirometry applications for any MBBR process type.
MBBR reactor	Option for a special reactor assembly for moving beds bio-films (MBBR)
Temperature	10 to 50° C, by means a peltier & heating system, installed in the analyzer console, controlled by the software
Ouput	RS232 (for console ↔ PC communication)
Display	LCD in sensor controller, LEEDS in front panel and PC screen.
Power	230 ACV or 115 ACV (under demand) 50/60 Hz - 1800 W
Dimensions/Weight	50 x 40 x 46 (wide x deep x high) / 38 kg

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