

## Multi-purpose Double Respirometer

**BM-EVO2 is a two reactors respirometer specially developed for practical and efficient biological wastewater treatment management, design and research**



The two reactors system saves time, by allowing two tests to run simultaneously on identical or different conditions

### Main features

- Compact analyzer, with very low maintenance and user friendly operation
- Specially designed for two tempered reactors which can run simultaneously controlled by two softwar (one per reactor) loaded in the PC.
- Direct oxygen measurements from a *maintenance-free* oxygen sensors
- No oxygenation restriction during test performance
- Full control and results by means a powerful double software already loaded in the PC
- Automatic software update versions from internet
- Capacity for test conditions and indistinctly setting and modify them throughout the test performance for each of the reactors.
- Automatic measurements: OUR, SOUR, bCOD, rbCOD, sbCOD, U (COD utilization rate) and q (specific U) from the current running tests in the reactors.
- 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.
- Capacity for Excel exportation
- Option to open several running and stored tests to be overlaid and compared
- Automatic temperature control integrated in the own analyzer
- Package of measurements at any moment during test performance
- Option for a special reactor assembly for moving beds bio-films (MBBR)

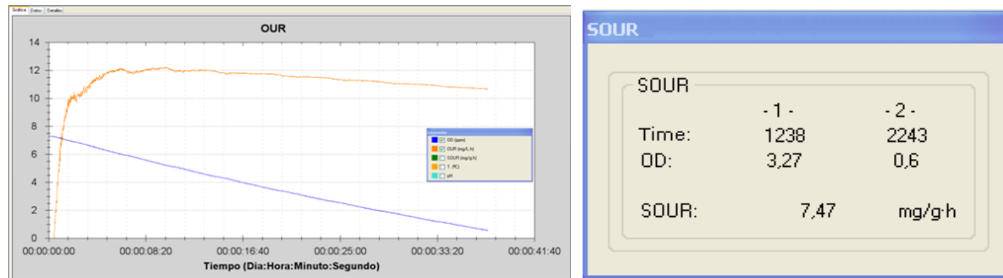
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# Operation modes

## 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.

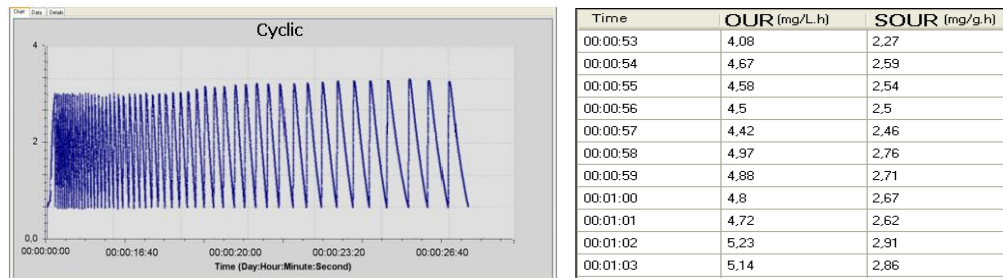


**OUR (mg/l.h)** Total oxygen uptake rate from mixed-liquor.

**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.

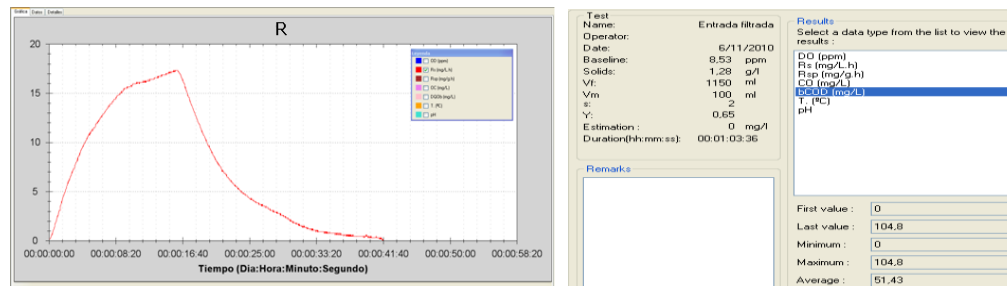
**$R_{sp}$  (mg/g.h)** Specific  $R_s$ .

**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



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# Typical applications

## Oxygen requirement and energy optimization

Actual oxygen requirement 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 asses 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.

## Simultaneous COD fractions

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

## Influence of the temperature, oxygen and other conditions on the activated sludge process

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

## Denitrification

Starting from the actual value of rbCOD, it is possible to determine the actual nitrate concentration that the process is capable to remove.

Starting from the specific respiration rate of the anoxic biomass, it is possible to estimate the corresponding denitrification rate (NUR)

## Toxicity referred to one specific biomass

Qualitative test by means of a simultaneous comparison of the actual respiration rates of mixed-liquor prepared with the sample (in one reactor) and another one from standard compound as reference (in the other reactor).

## Kinetic parameters

For heterotrophic and autotrophic biomass.

## SBR

Aeration cycle control in SBR systems.

## Biomass carrier (MBBR)

By making use of a special reactor we can calculate the total number of carriers per volume unit, Amount of oxygen needs to maintain the biomass carriers under optimal condition, COD and Ammonium removal capacity, and rest of same applications we can do in a normal activated sludge process

## Support for simulation programs

Such as GPS-X, BioWin, ...

## Others

BM-EVO2 respirometer is an open double system and, as such, supports all kind of combinations to step into an endless number of applications.

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# BM-EVO2 Technical specifications

Type	Optimized double batch respirometer system with closed recirculation.
Use	Laboratory.
Oxygen sensor	Maintenance free oxygen sensor.
Software	Two BM software (one per reactor) loaded in the PC
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) Capacity for double measurements visualization throughout the time, on tabular and graphical modes. Results package overview at any time. Data acquisition interval setting. Last, minimum, maximum and average results during the tests performance
Test files	Automatic generation of a security files 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, 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, bio-film or granular biomass.
Temperature	10 to 50° C, by means a peltier (cooling) & heating system, installed in the analyzer, for each reactor, automatically controlled by the software
Ouput	2 x RS232 (for analyzer and PC communication)
Display	2 x LCD in sensor controller, LEEDS in front panel and PC screen.
Power	230 ACV or 115 ACV (under demand) 50/60 Hz - 3600 W
Dimensions/Weight	70 x 40 x 66 (wide x deep x high) / 55 kg

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