

Advanced Multi-purpose Respirometers BM™ Series

BM-Respirometers are laboratory analyzers specially developed for practical and efficient biological wastewater treatment management, design and research



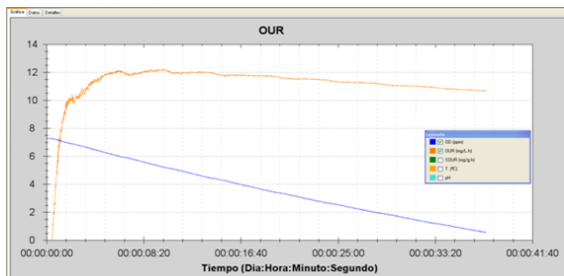
Main BM Multi-purpose Respirometer features

- PC and software included in the system
- Compact analyzer, with very low maintenance and user friendly operation
- Direct oxygen measurements from a *maintenance-free* oxygen sensor
- Double reactor in models BM-EVO2 and BM-Advance2
- 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 see them simultaneously on tabular or graphic modes
- Option to open several stored tests and compare their results
- Automatic temperature control in the analyzers EVO, EVO2 & Advance, Advance2, and out of the analyzer in BM-T+
- pH monitoring and automatic control system in the BM-Advance and BM-Advance2
- ORP monitoring in the BM-Advance Pro
- Results package 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) and/or granular biomass

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.



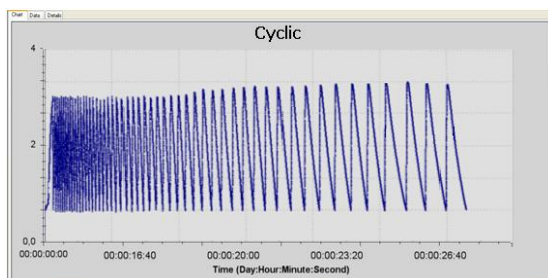
| SOUR | | |
|-------|-------|--------|
| SOUR | - 1 - | - 2 - |
| Time: | 1238 | 2243 |
| OD: | 3,27 | 0,6 |
| SOUR: | 7,47 | mg/g.h |

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.



| Time | OUR (mg/L.h) | SOUR (mg/g.h) |
|----------|--------------|---------------|
| 00:00:53 | 4,08 | 2,27 |
| 00:00:54 | 4,67 | 2,59 |
| 00:00:55 | 4,58 | 2,54 |
| 00:00:56 | 4,5 | 2,5 |
| 00:00:57 | 4,42 | 2,46 |
| 00:00:58 | 4,97 | 2,76 |
| 00:00:59 | 4,88 | 2,71 |
| 00:01:00 | 4,8 | 2,67 |
| 00:01:01 | 4,72 | 2,62 |
| 00:01:02 | 5,23 | 2,91 |
| 00:01:03 | 5,14 | 2,86 |

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

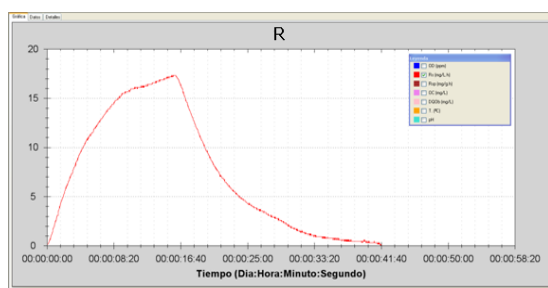
bCOD (mg/l) Biodegradable fraction of total COD (bCOD) or Readily biodegradable fraction of COD (rbCOD)

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

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

pH (only in BM-Advance, Advance2 and Advance Pro)

ORP (mV) (only in BM-Advance Pro)



| Test | | Entrada filtrada |
|---|-------------|------------------|
| Name: | | |
| Operator: | | |
| Date: | 6/11/2010 | |
| Baseline: | 8,53 | ppm |
| Solids: | 1,28 | g/l |
| Vr: | 1150 | ml |
| Vm: | 100 | ml |
| s: | 2 | |
| Y: | 0,65 | |
| Estimation: | 0 | mg/l |
| Duration(hh:mm:ss): | 00:01:03:36 | |
| Remarks | | |
| | | |
| Results | | |
| Select a data type from the list to view the results: | | |
| <input type="checkbox"/> DO (ppm) <input type="checkbox"/> R_s (mg/L.h) <input type="checkbox"/> R_{sp} (mg/g.h) <input type="checkbox"/> CO (mg/L) <input checked="" type="checkbox"/> bCOD (mg/L) <input type="checkbox"/> T (°C) <input type="checkbox"/> pH | | |
| First value: | 0 | |
| Last value: | 104,8 | |
| Minimum: | 0 | |
| Maximum: | 104,8 | |
| Average: | 51,43 | |

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.

Anoxic - Anaerobic process

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

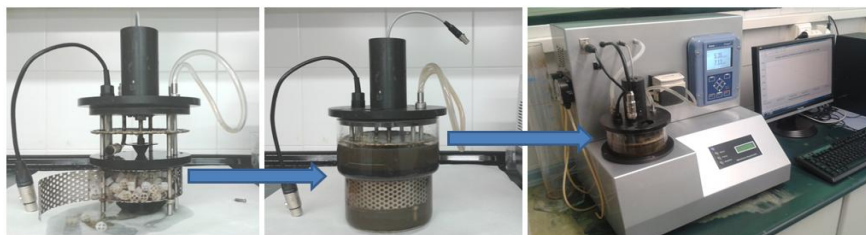
Such as GPS-X, BioWin, ...

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.



Comparative table of BM respirometers

| Comparative items | BM T+ | BM EVO | BM EVO2 | BM Advance | BM Advance2 | BM Advance Pro | Comments |
|--|-------|--------|---------|------------|-------------|----------------|--|
| Automatic measurements: OUR (mg/l.h) SOUR (mg/g.h) OUR & SOUR cíclico Rs dinámica (mg/l.h) Rsp (mg/g.h) CO (mg/l) bCOD (mg/l) rbCOD (mg/l) U (mg DQO/l.h) q (mg DQO/mgSS.d) | ✓ | ✓ | 2 x ✓ | ✓ | 2 x ✓ | ✓ | From the automatic measurements we can go to the corresponding applications. |
| Thermostatic system installed in the analyzer | | ✓ | 2 x ✓ | ✓ | 2 x ✓ | ✓ | Cooling (Peltier) + Heating system included in the own console. |
| External thermo unit | ✓ | | | | | | External unit (separated unit) formed by Cooling (Peltier) + Heating system. |
| Easy transportable system: | ✓ | | | | | | Analyzer + case → 20 kg MD-40 + case → 5 kg |
| Padded aluminium cases for easy transportation | ✓ | | | | | | 1 case for the console + 1 case for the external thermostatic unit. |
| pH measurement and control throughout the test | | | | ✓ | 2 x ✓ | ✓ | Especially important in all tests related to nitrification and in those where there is a special sensitivity to the pH changes. |
| ORP measurement | | | | | | ✓ | Redox |
| Possibility to set the conditions at the start of the test and be able to modify them during its course | ✓ | ✓ | 2 x ✓ | ✓ | ✓ | ✓ | Important to carry out studies to analyze the influence of the conditions (pH, OD, Temperature) changes in the biological process. |
| BM software update from Internet | ✓ | ✓ | 2 x ✓ | ✓ | ✓ | ✓ | When connected to the internet URL, the BM software is automatically updated. |
| Capability for biomass-carrier reactor option | ✓ | ✓ | 2 x ✓ | ✓ | 2 x ✓ | ✓ | The biomass carrier reactor ifor BM-T+ is rather different (and more expensive) than the one for EVO y Advance |

SURCIS

Encarnación, 125 – Barcelona

Tel. +34 932 194 595 Fax. +34 932 104 30

E-mail: surcis@surcis.com Internet: www.surcis.com