



Smart Air MBR
Air-scour Control System



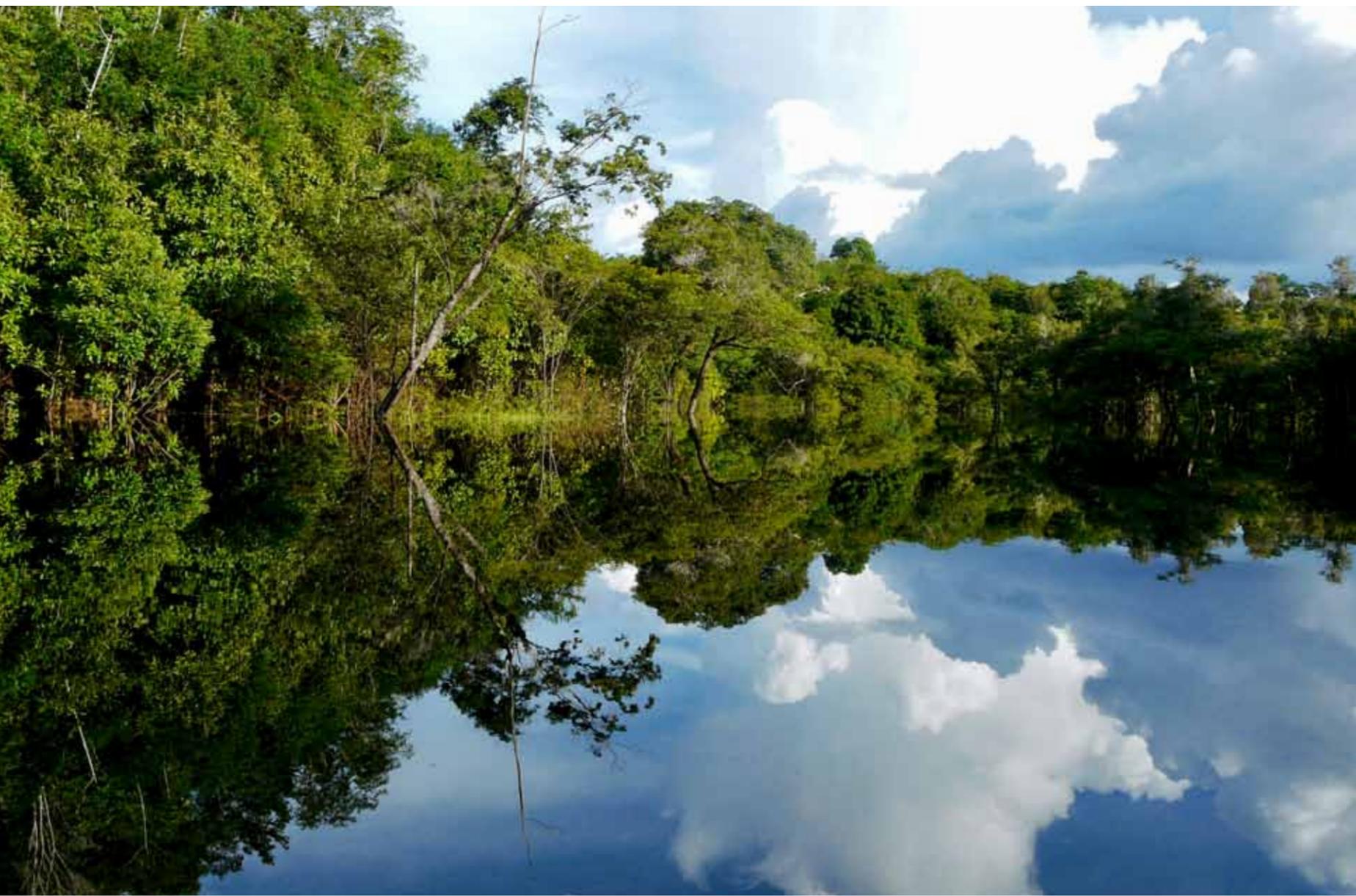
GS Inima

UdG

lequia

Laboratory of Chemical and
Environmental Engineering

Energy saving



MEMBRANE BIOREACTORS

The urban and industrial wastewater treatment technology that guarantees a better water quality.

Membrane bioreactors (MBR) are a consolidated technology for biological treatment of industrial and municipal wastewater. The high water quality they guarantee favours their use and acceptance by end-users over other conventional treatment systems. That has led to a growing demand for this technology, especially in areas where water is scarce and its re-use must be prioritised.

The main disadvantage of MBRs is membrane fouling. Minimising this fouling can be achieved by supplying air and incorporating backwashing cycles or relaxation modes to clean the membranes, actions that significantly increase operating costs. As consequence, the relatively high energy consumption has slowed the implementation of MBRs and their introduction on the market.

The possibility of reducing energy consumption during membrane aeration in MBRs has become the key to promoting their use, benefiting their users and accelerating the technology's implementation. **Smart Air MBR** is the only product on the market that effectively reduces the energy costs associated with MBR aeration according to the online monitoring of permeability, and places it in an excellent competitive position.



*More sustainable
and competitive
MBRs with reduced
energy consumption*



A NEW PRODUCT, A NEW SOLUTION

Smart Air MBR is an automatic control system that regulates the air scour flow required to physically clean the membranes and monitors its effect on the process.

The MBRs currently on the market operate according to predetermined parameters, with fixed filter cycles, fixed aeration flows and physical and chemical cleanings of membranes according to the manufacturer's specifications. These operational conditions do not take into account the variability of the process, in which the characteristics of the influent, the concentration and the quality of the biomass, the temperature, and many other dynamic variables of the process can affect the filterability of the biomass and, consequently, the rate and the nature of the membrane fouling. That is why MBR operation is far from optimal and the associated energy costs are higher than necessary.

The University of Girona and GS Inima Environment have developed **Smart Air MBR**, an automatic control system whose main goal is to optimise MBR performance and reduce their energy consumption. **Smart Air MBR** monitors in real time the permeability of the membranes and regulates the air scour flow according to the real requirements of the process. The system is hierarchically structured in three modules: one for data acquisition and signal processing, one for control and one for expert supervision.



This product patented by the University of Girona and GS Inima Environment regulates the amount of air supplied according to the real needs of the process, minimising the energy costs of MBR operation.



AN EXPERT SYSTEM FOR THE AUTOMATIC AERATION CONTROL OF MBRs

Smart Air MBR reduces in real time the air scour supplied based on membrane permeability. It requires neither a large initial investment nor probes nor any additional equipment.

The technology is innovative compared to existing technologies, which do not take into account the real status of membrane fouling to control the process.

The main advantages that make **Smart Air MBR** innovative and competitive are:

- 1 Reductions down to 20% of the air scour required to clean the membranes.
- 2 Savings up to 35% of the cost of membrane aeration.
- 3 Reliable control of membrane fouling parameters evolution together with biological process parameters.
- 4 Optimisation on the frequency of maintenance cleanings.
- 5 Stabilisation of the biological nutrient removal, maintaining or improving the quality of the effluent, in comparison with existing control systems.
- 6 Extension of membrane life.

At the same time, implementing **Smart Air MBR** in membrane bioreactors does not require a large initial investment. The control system, adaptable to any membrane configuration, only requires the standard instruments of a conventional MBR, and does not need any additional equipment, other than remote connection and a server.



*Savings
Reduction
Optimisation
Stabilisation*



INNOVATION





LEQUIA

Experience and excellence in wastewater treatment,
world leaders

The Laboratory of Chemical and Environmental Engineering (LEQUIA) is a consolidated research group of the University of Girona with a history of more than 20 years. Its mission is to develop innovative technological solutions for wastewater treatment, and ensure their transfer to industry and society at large. Its experience in the field of control of MBRs has been documented by the publication of more than 30 research articles, several PhD theses, and for numerous international conferences and workshops, and its leadership in various research and technology transfer projects, which have led to the invention, together with GS Inima Environment, of the **Smart Air MBR**.



GS Inima Environment, S.A.

Environmental project specialists

GS Inima Environment began to work in 1954 on wastewater treatment, drinking water production and desalination. Nowadays, is the company with the longest history of reverse osmosis desalination in Spain. Current references include plants with production capacities equal to or greater than 200,000 m³/day.

It is involved in all the stages of the projects it participates: design, technology, construction, funding, operation and maintenance, and is active in both, public and private markets, including nationally and internationally scales.

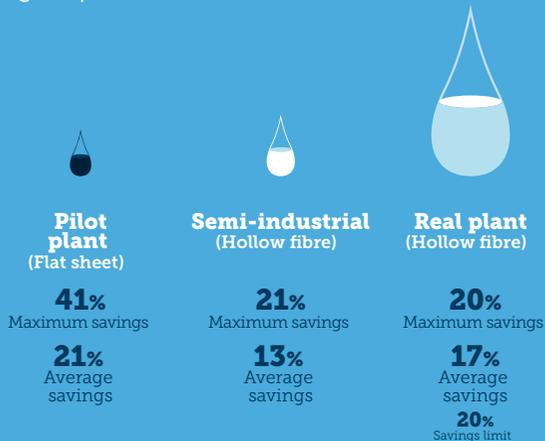
It is a reference point in environmental technology, incorporates the most advanced technologies, invests in research and development, and pays special attention to the environmental integration of its designs, energy savings and the reduction of atmospheric emissions.

VALIDATION OF Smart Air MBR

SUCCESS STORY OF LA BISBAL D'EMPORDÀ

Different validation trials and demonstration projects have been carried out with very satisfactory results in pilot and full-scale treatment plants. The WWTP of La Bisbal d'Empordà is the most recent example.

During the product's initial research and development stage various pilot-scale trials were carried out (volumes between 2 and 14 m³, and treated flow between 3 and 24 m³/d) with different membrane configurations (hollow fibre and flat sheet), which demonstrated the control system's great potential.



The WWTP of La Bisbal d'Empordà

The MBR of the WWTP of La Bisbal d'Empordà, operated by DAM (Depuración de Aguas del Mediterráneo), treats an average water flow rate of 3,200 m³/day using two parallel trains of hollow fibre membranes. A **Smart Air MBR** has been installed to carry out a demonstration project in one of the two trains and to quantify the cost savings of membrane aeration. An average saving of 0.037 kWh/m³ has been achieved, which for the case of La Bisbal d'Empordà, and considering a cost of 0.11 €/kWh, leads to annual savings of almost 5,000 euros and emission reductions of 28.1 tons of CO₂ without any negative effect on the filtration process.

Without Smart Air MBR (Line 2)

285,6 kWh/day

x0,11 €/kWh*
x365 days/year

11,466,84 €/year*

With Smart Air MBR (Line 1)

226,7 kWh/day

x0,11 €/kWh*
x365 days/year

9,102,01 €/year*

R_{Es} = 0,037 kWh/m³
Energy savings rate

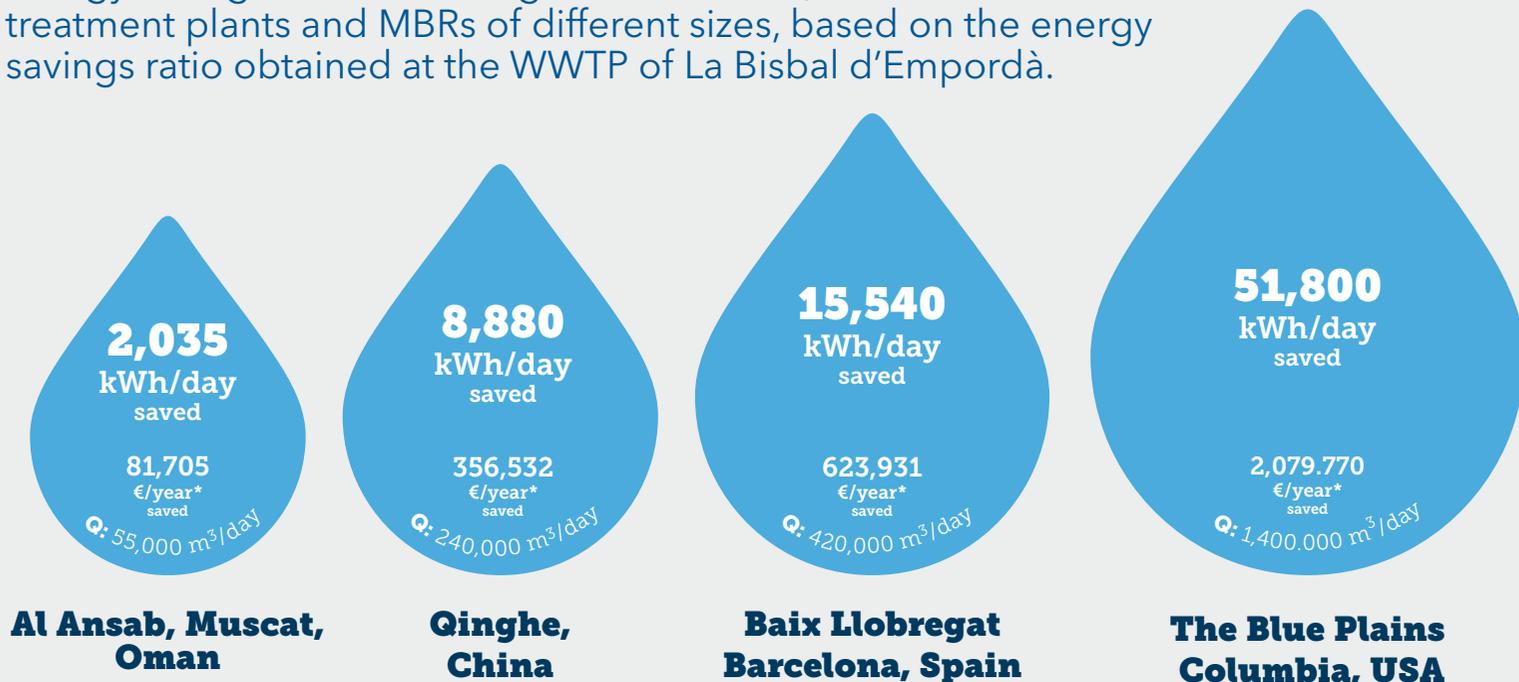
Savings

58,9 kWh/day

2,364,83 €/year

POTENTIAL ENERGY SAVINGS WITH THE Smart Air MBR

Energy savings obtained using Smart Air MBR, scaled to other treatment plants and MBRs of different sizes, based on the energy savings ratio obtained at the WWTP of La Bisbal d'Empordà.



*All amounts are calculated according to the average price of energy in Spain in September 2012 adjusting time discrimination.



Energy savings

Laboratory of Chemical and Environmental Engineering (LEQUIA)
Institute of the Environment (IMA)

University of Girona
17071 Girona

Phone: +34 972 41 98 59
Web: lequia.udg.cat
E-mail: info@lequia.udg.cat
Twitter: @LEQUIA_UdG