

THE KEY TO MORE EFFICIENT AND S

R&D&I

Population growth and the effects of climate change pose clear challenges to the water sector. In this context, scientific research and technological development are the basis on which more sustainable and efficient water infrastructures and treatment processes can be developed to guarantee drinking water supplies, access to sanitation and the conservation of the environment.

R&D&I, an essential support tool in the end-to-end management of the water cycle

ACCIONA's R&D&I Department in its Water Division has been working for more than 30 years to find pioneering solutions in desalination, potabilization, treatment and reuse in order to take on the challenges mentioned above.

It is home to a multidisciplinary team of over thirty researchers, focused on the development of in-house technologies and innovative solutions to support ACCIONA's activities in the end-to-end management of the water cycle.

ACCIONA's R&D&I Department in its Water Division covers everything from laboratory research to the study of pilot technologies and plants and their later industrial upscaling, always work-

ing closely with the company's other business areas and operational teams.

To do this, it has a number of facilities, in particular the Water Technology Center in Barcelona, which has a water research laboratory and a hydraulics process laboratory equipped with the latest equipment and analytical techniques.

These facilities are complemented by demonstration units in water treatment plants operated by ACCIONA, so the technologies can be validated in a semi-industrial setting prior to their implementation on a large scale.

The demonstration units work under real conditions, a differentiating factor that means that the results obtained can be applied almost immediately, and thereby add value to the business.

Some examples can be found in San Pedro del Pinatar (Murcia), where the LEAD® experimental desalination platform is located, and also in wastewater treatment plants in Madrid and Gran Canaria.

The R&D&I Department also provides direct support for the construction and operation of plants through the analysis and characterization of membrane modules (RO, NF, UF, MF); character-



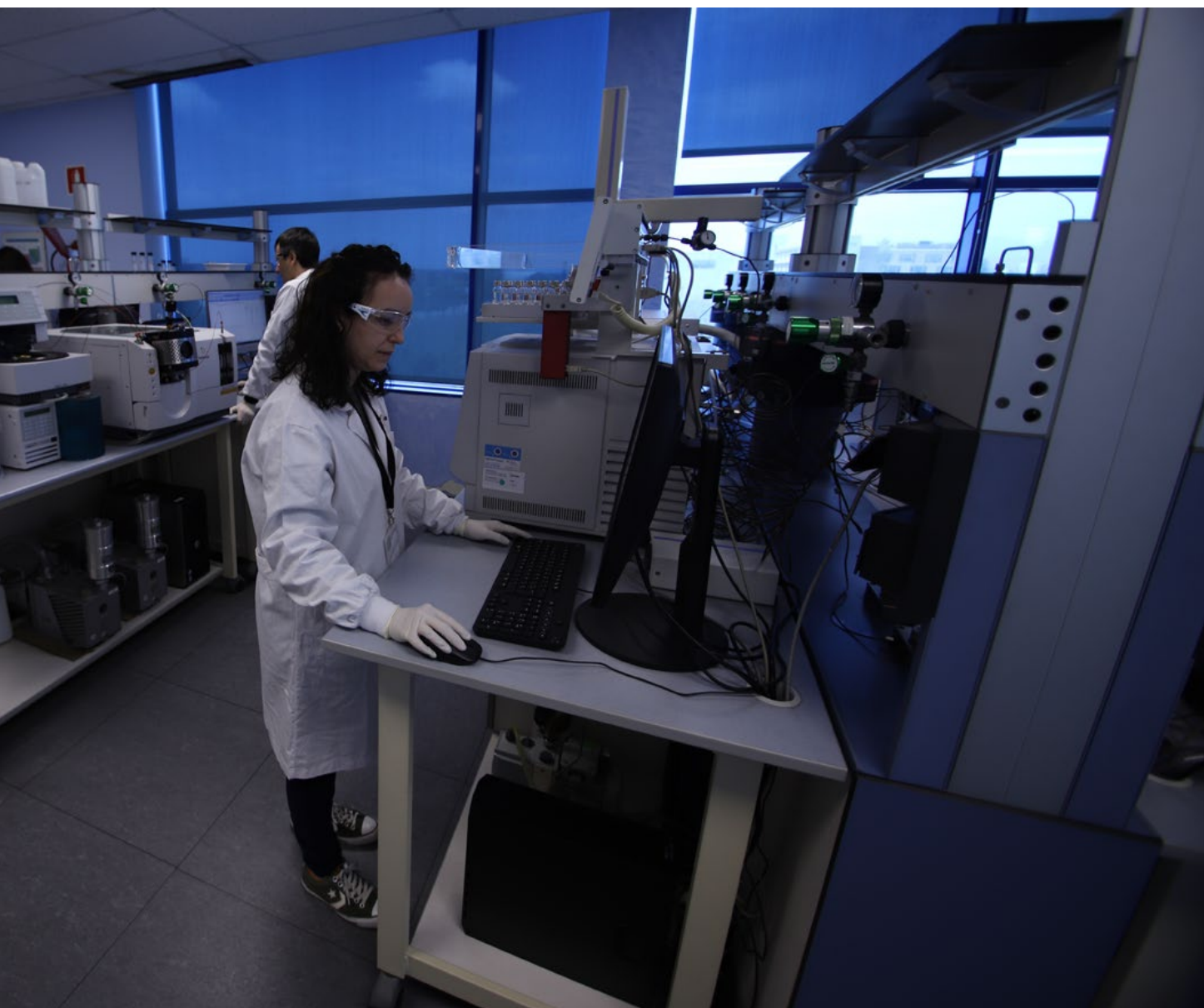
ACCIONA Water Technology Centre, Barcelona

The company's R&D&I activity responds to the needs of the business to take on the great challenges faced by the water sector

ization of soiling; autopsies on membranes; testing cleaning equipment and products; modelling of hydrodynamic and biological processes using specific software (CFD or GPSX fluid dynamics and Biowin), checking of parameters and results, etc.

Reducing energy consumption in desalination through reverse osmo-

USTAINABLE WATER MANAGEMENT



sis, developing new processes based on membrane technology, improving biological treatments in drinking water plants and wastewater treatment plants, fostering the circular economy and valorising resources, guaranteeing a safe and stable drinking water supply and incorporating digital technologies into the operation of water plants and

networks are some of the challenges faced by the water sector, which seeks to address them through an innovative approach.

To deal with these challenges, ACCIONA develops pioneering R&D&I products that are later used on an industrial scale in water treatment plants all over the world.

Demonstration units in water treatment plants operated by ACCIONA validate the technologies in a semi-industrial setting

ACCIONA has developed a hybrid biological treatment system that consists of a fixed biological reactor with biomass on a moving bed

Some of the technologies developed by the R&D&I Department and currently installed in plants operated by ACCIONA include:

NIPARMOX®, the sustainable removal of nitrogen from treatment plant sludge

Removing contaminants in water is one of our main lines of research to comply with the legislation on water treatment and ensure that the water is returned to the environment in a safe manner after treatment.

In many cases, water quality can be affected by nitrogen from agricultural fertilizers and other products. Its removal by conventional methods involves high operating costs.

NIPARMOX® is a process developed by ACCIONA to remove high nitrogen loads in the return lines of sludge treatment, using special bacteria in different phases of the nitrogen cycle. This ensures a lower consumption level of oxygen and reagents than in the conventional process.

These bacteria remove the nitrogen, consuming up to 60% less oxygen than in the conventional nitrification process, thereby reducing energy consumption in the process.

ACCIONA headed the “Smart Water4Europe” project, a pioneering European initiative that demonstrated the Smart Water Network concept

The NIPARMOX® technologies, patented and validated in a series of R&D projects, are used in the Kütahya WWTP in Turkey. Direct benefits have been achieved in terms of operating costs and the quality of output water.

Biofilpas®, a biological filter to optimize water potabilization and treatment processes

ACCIONA has developed Biofilpas®, a highly versatile biological filter that adapts to different types of effluent, combining the retention of solids through filtration and the biological transformation of contaminants in the water to be treated. This is done through a biofilm of micro-organisms on top of the filling material.

Biofilpas® is a solution that reduces the space needed for biological treatment and eliminates the secondary settling stage, making it a very interesting option in plants with problems of space, such as in the Putatan WWTP in the Philippines. The implementation of Biofilpas® in this plant means a construction cost saving of around 30%. This system has also been applied in the wastewater treatment plants in Almoradí (Spain) and Scicli (Italy).

MBBR-IFAS, providing higher biological treatment capacity in plants, complemented by FILMACTIV® technology, a biofilm system on a plastic base for the treatment of wastewater

Also in the field of wastewater treatment, ACCIONA has developed a hybrid biological treatment system that consists of a fixed biological reactor with biomass on a moving bed (MBBR, Moving Bed Biofilm Reactor) with sludge in suspension (IFAS, Integrated Fixed-Film Activated Sludge), to simultaneously eliminate the organic load and nutrients without taking up too much space.

This kind of hybrid reactor, which is more compact, means that the treatment capacity of a reactor can be increased with a slight rise in volume. This com-

plies with the parameters set in Directive 91/271/CEE on wastewater treatment in terms of the elimination of nutrients. This is also supported by FILMACTIV® technology by ACCIONA, which can reduce start-up times up to 50% in comparison with previous periods for mobile bed reactors.

The technology can be applied to existing WWTPs, increasing their treatment capacity and output water quality. In Spain, it has been implemented in the wastewater treatment plants in Alcalá Oeste, Casaquemada and Práceres.

ACTIDAFF® and ULTRADAF®, for the pretreatment of water with high turbidity levels

The ACTIDAFF® system combines granular bed flotation and filtration to treat



water with a high level of solids in suspension/turbidity, algae or oil and grease. It is, therefore, an ideal solution in desalination plants that use reverse osmosis technology, in tertiary treatment systems or in drinking water plants located in regions likely to suffer algae blooms or with open water intake pipes.

ULTRADAF® has similar applications but is solely based on dissolved air flotation, a physical-chemical process that separates solid particles from liquid ones through the addition of micro-bubbles. As it does not have a filter bed, it works much faster.

Both ACTIDAFF® and ULTRADAF® are widely used in plants built by ACCIONA, such as the desalination plants Al Jubail and Al Khobar I & II (Saudi Arabia), Ras Abu Fontas 3 and Umm

Al Houl (Qatar), or the drinking water plants at Mundaring (Australia), Laguna Lake and Putatan (Philippines), Alcantarilha (Portugal) and Chilibre (Panama).

Towards smart water networks

Water infrastructure managers are facing great challenges in terms of efficiency, extending the working life of their assets, regulatory requirements and users' expectations. The water sector is therefore making great progress in the concept of "smart water", driven by technologies such as Big Data, IoT, robotics, cloud computing or artificial intelligence.

In this area, ACCIONA headed the "Smart Water4Europe" project, a pioneering European initiative that demonstrated the Smart Water Network concept

in a number of cities, among them Burgos (Spain).

SmartWater4Europe served as the starting point for ACCIONA to implement a series of innovation projects together with other departments. This has led to the launch of BIONS®, a cloud-based data intelligence platform.

BIONS detects, analyses and manages events and incidents in water networks, incorporating data from a range of sources and converting the captured data into knowledge and proactive measures through the use of Artificial Intelligence and Machine Learning. The company has installed the system in the water system of Andratx (Mallorca) and will gradually incorporate all the company's services.

The SmartWater4Europe project is a good example of how R&D&I in a particular area can lead to benefits for a number of sectors. One case in point of joint work between divisions is the "SmartWaterLights" project currently being developed in Toro (Spain). It extends the Smart Network concept to a range of municipal services such as street lighting, the end-to-end water cycle, garbage collection and municipal vehicle fleet management.

All these technologies developed by ACCIONA are constantly being evolved, and the R&D&I Department continues to optimize them to ensure their competitiveness. Considering the challenges faced by the water sector, innovation is not only a differentiating factor but is of inherent value to the business, and essential to design sustainable solutions that respond to the major challenges on a world level.



BIONS®, a cloud-based data intelligence platform, detects, analyses and manages events and incidents in water networks