

## NEW MICROFLUIDIC TECHNOLOGIES FOR CONTINUOUS MEASUREMENT OF NITRATE IN SURFACE WATER

### THE NITRATE PROBLEM

Nitrates occur naturally in soil, air and water in low concentrations and do not pose a danger to human health and the environment.

However, human activity generates an excess of nitrates that are deposited in the soil and pose a risk that can lead to serious consequences such as disease, water pollution and an imbalance of the environment, water pollution and environmental imbalance.

Both cases contribute to increased nitrate concentrations in the aquatic environment. In fact, the most common contamination is generated by nitrate that reaches water through filtration or runoff, contaminating wells and aquifers.

The main human activities that generate nitrates are:

- **Industrial livestock farms, which** accumulate a large amount of animal waste and whose ammonia oxidation produces nitrates.
- **Excessive use of fertilizers and nitrogenous fertilizers** in intensive agricultural crops and their subsequent dragging by irrigation or rainwater.

Nitrates can also be found in reservoirs, natural lakes, ponds, estuaries and estuaries, and coastal and transitional waters, as well as in natural lakes, ponds and estuaries.

The areas with the highest levels of nitrates in Spain can be found almost throughout the country, along almost the entire Ebro river basin, in a large part of Catalonia, the province of Valencia, Castilla y León, Mallorca and Gran Canaria according to the interactive map available for consultation on a geoportal of the Ministry for the Ecological and Climate Transition and the Demographic Challenge (Miteco).

However, excess nitrates are an emerging problem throughout the country, throughout the country.

To more effectively combat the contamination of groundwater and surface and surface water pollution more effectively, Spain has updated the regulations, approved more than 25 years ago, with **RD 47/2022, January 18, 2022**, on pollution caused by nitrates of agricultural origin.

The regulation considers surface water to be affected by nitrates when the concentration exceeds 25 mg/l. For groundwater, the threshold is 37.5 mg/l.

It also includes limitations on the use of fertilizers, increases the surface area of protected zones by 50% and calls for the implementation of more rigorous action programs.

Today there are innovative technological solutions that measure and detect the presence of nitrates in water with maximum reliability and speed and make it possible to make decisions, comply with current regulations and improve the quality of our water sources.



# Adasa's SOLUTIONS (field tested)

Adasa has carried out a field test of SWS's **DropletSens™** sensor at the Ballobar Station of the SAICA network of the Ebro Hydrographic Confederation in 2021.

**DropletSens™** is a continuous readout device that optimizes the colorimetric analysis method for serial measurement of nitrate and nitrite at a wavelength of 540 nm.

The use of microfluidic technology allows the laboratory to be brought to the point of analysis without loss of accuracy or reliability, complying with the **EU Water Framework Directives and the EPA in the USA**.

Its **main advantages** are:

- **Measurement of key nutrients: NO3/NO2** (nitrate/nitrite), 4 (ammonium), PO4 (phosphate), etc. NH.
- **Continuous measurements** every 10 seconds.
- **Programmable to perform analysis** in a wide range of time.
- **Immediate results.** Other alternatives postpone the delivery of results from 24/48 hours to 5 days.
- **Offers maximum accuracy** and reliability.
- **System based on the Griess method**, a highly accepted and internationally recognized standard.
- **It provides a continuous study** not only punctual over time.
- **It is energy autonomous** thanks to the installation of solar panels and batteries.
- **Very low power consumption:** maximum 3 watts.
- **Remotely connected** device.
- **Requires minimal maintenance through** a very simple reagent cartridge replacement system.
- **High data frequency** and extraction of valuable information.
- **Versatile: suitable** for fresh and sea water.

## Applications:

- **Environmental monitoring and watershed management**
- **Effluent monitoring to avoid discharge penalties**
- **Process control, dosing and aeration optimization**

## CONCLUSIONS

Current data on the presence of nitrates in Spain and the current mandatory regulations make it imperative to apply technologies that determine as accurately, reliably and quickly as possible the concentration of nitrates in groundwater and surface water.

The field test of the **DropletSens™** device carried out by Adasa at the Ballobar Station has shown optimal results for this type of analysis, validating that:

- **Measurement accuracy is above 96% when compared to laboratory results**, making them statistically identical. The margin of error is well below the 10% required in SAICA networks and in European standards.
- **The period between maintenance** (filter and cartridge change) can be extended up to one year.
- **It can work in remote and unsupervised** environments for long periods of time.
- The density of measurements it can provide (up to 1 every 10 seconds), **allows real-time decision making and long-term data collection for aquifer optimization**.

**DropletSens™** is thus confirmed as a safe, accurate and fast solution for measuring nitrate concentration in groundwater and surface water.

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