Nilsa opts for BioTector technology for the complete vision of the process

Problem

The WWTP of Tudela needed a reliable TOC / TN / TP monitoring solution at different points of its wastewater plant to obtain information in real time, since they periodically received high loads from industries connected to the network. These episodes could harm the effluent quality.

Solution

Following an evaluation of the plant, Hach proposed the installation of the BioTector B7000 analyzer. This analyzer is capable of measuring simultaneously on three streams, allowing continuous monitoring of critical plant parameters in real time.

Benefits

The installation of BioTector was key to optimizing the plant's processes. The capacity to detect spills made it possible to identify their origins. In addition, by monitoring the intermediate quality of the process it would be possible to divert the sample that meets the required discharge quality to effluent without passing through the second filter stage. This process would result in significant energy savings.

Background

NILSA (Navarra de Infraestructuras Locales, S.A.) is a public company of the Government of Navarre attached to the Department of Territorial Cohesion, which manages the Sewage Treatment Plan of Navarre, including the operation of 93 medium/small-sized wastewater treatment plants for all the towns in the Community, excluding Pamplona. The Tudela wastewater treatment plant, which serves a population of 114,000 equivalent inhabitants, is the largest.

The Tudela WWTP receives a significant industrial contribution, between 30 and 40% of its influent load, from different industries in the agri-food sector and, to a lesser extent, from paper production. The plant discharges into the Ebro River, with current limits on COD/BOD, Kjeldhal Nitrogen and Suspended Solids, with the future possibility of stricter limits than the current ones - including a limit on Total Phosphorus content.

The WWTP process consists of a primary treatment with settling, and a biological treatment consisting of 2 stages of trickling filters with dedicated settling in each stage. Trickling filters are a robust and highly efficient solution for the treatment of organic matter, but they are not flexible enough to adapt to peak load situations and controlled nutrient removal.

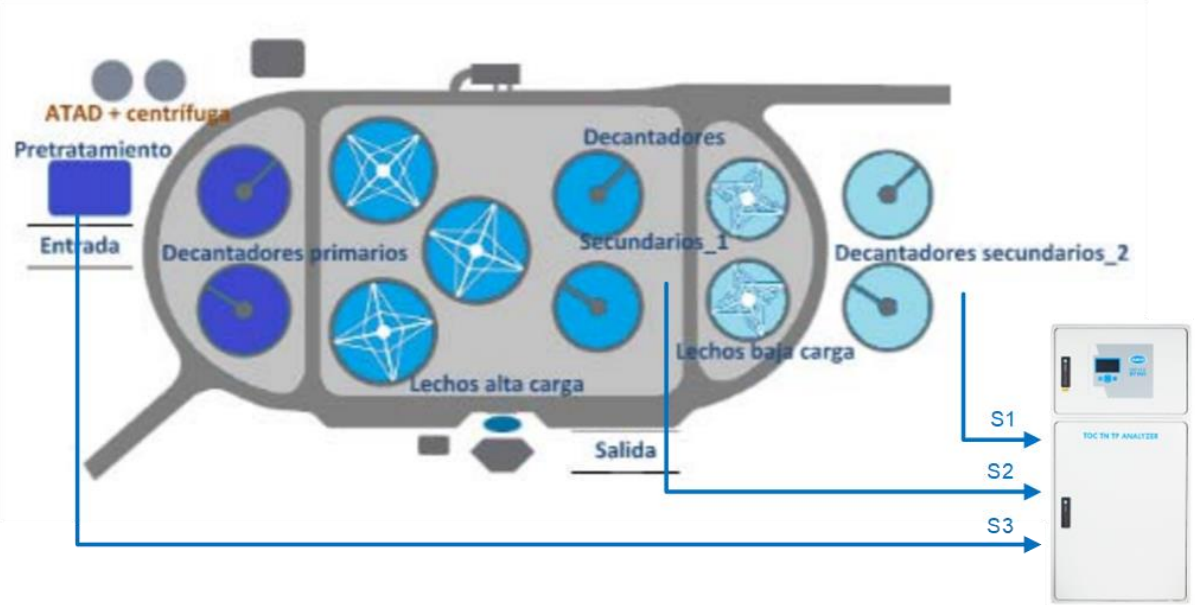
1. First stage biological filters

The repeated occurrence of episodes with high contamination in the discharge, together with the need to provide the plant with tools that would allow a better understanding of its internal processes, led NILSA to search for instrumentation solutions to achieve the following objectives:

- Monitoring TOC, TN and TP in plant effluent for compliance with current and future discharge regulations.
- Measurement of TOC/TN/TP at the inlet to detect possible load peaks.
- Measurement of TOC/TN/TP at the outlet of the first stage of biological filters for a more exhaustive control of the plant.

The solution at the Tudela plant

Following an assessment of the plant and a thorough analysis of the TN, TP, TIC and TOC analysis results, Hach proposed the installation of the BioTector B7000 analyzer. This analyzer is capable of simultaneous measurement on three streams, allowing continuous monitoring of key plant parameters in real time for the feed water, intermediate process water and outlet water. The versatility of the BioTector B7000 analyzer, which allows the combined analysis of the 3 required parameters TOC, TN and TP, and with 3 possible measurement ranges for each parameter, offers a unique solution to the plant needs, constituting a system that allows the monitoring of the key process parameters at all points required by the customer.



2. Sample streams for B7000 analyzer

NILSA's previous experience with HACH instrumentation and service, together with the proposed solution that perfectly matched the needs, facilitated the decision to purchase the B7000 TOC TN TP analyzer. The acquisition was co-financed 60% with European funds by the NAdapta LIFE 16 IPC ES 01 Project, a project of adaptation to climate change of the Government of Navarra.

For the implementation NILSA transported the samples from the plant inlet, first stage filter outlet and plant outlet, to a sampling system consisting of 3 cuvettes for the 3 streams of the BioTector B7000. Additionally, installing in the cuvettes other measurements such as pH, conductivity, solids, nitrates and membranes probes for the Filtrax system of ammonium analyzers. The sampling system together with the analyzer was initially placed inside a room of the control building, but this caused problems of S2H generation from the plant inlet sample, so NILSA proceeded to place the sampling rack outside the wall on which the BioTector B7000 analyzer was placed. Figures 3 and 4 show the installation of the analyzer and sampling system. Figure 5 shows the synoptic with the set of measurements performed in each sample stream.

3. B7000 TOC TN TP Analyzer

Maintenance by the operator of the analysis system takes an average of 10 hours per month, including daily cleaning of the sample cuvettes and review of the condition of the analyzer, monthly verification of the TOC, TN and TP values, and bimonthly change of reagents with adjustment of the zeros of the different parameters.

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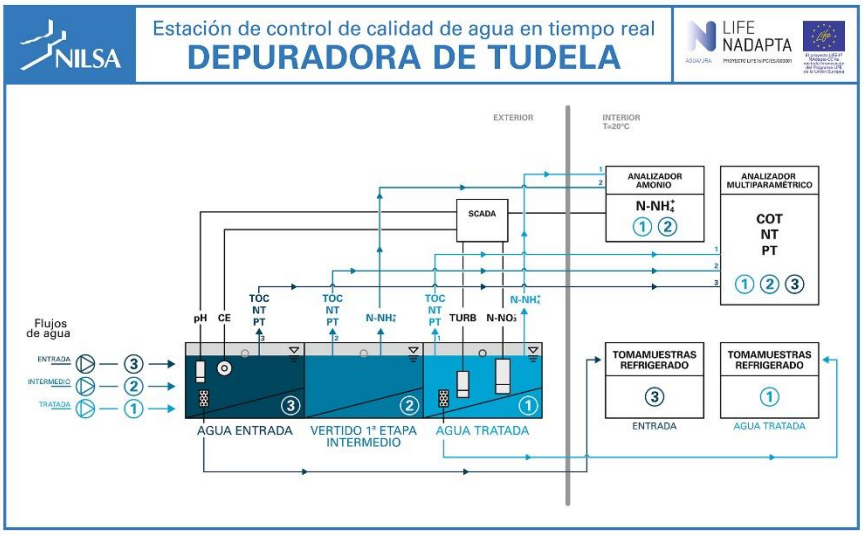
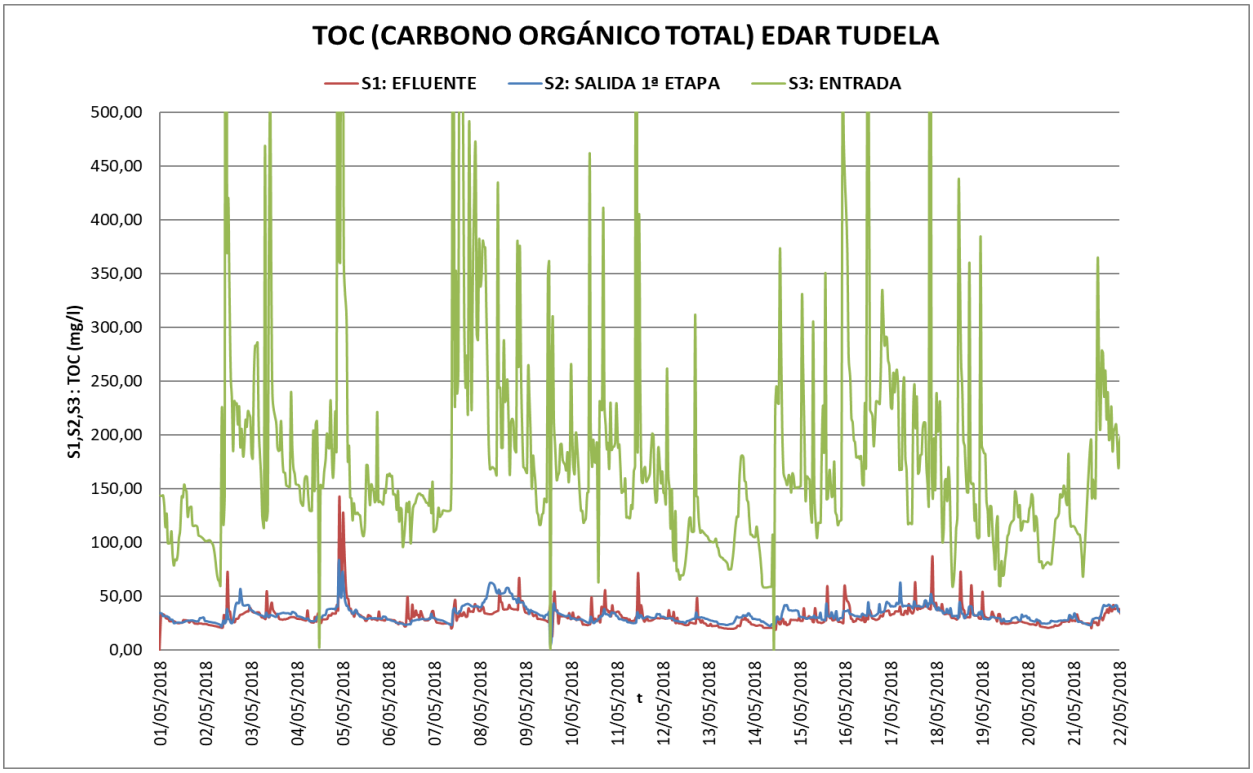
4. Sampling cuvette rack



5. Synoptic of measurements in sample cuvettes

Benefits

Since the installation of the analyzer in April 2018 it has provided relevant data for plant management, proving to be a robust system with high uptime of measurements. After the first weeks of operation the historical measurements allowed to identify the problems of point discharges with high organic and phosphorus loads. In addition, the existence of real time data of the 3 parameters in inlet, 1st stage outlet, and plant effluent allowed an exhaustive knowledge of the behavior of the biological filters. Thus, verifying the high performance (70 - 80%) in the reduction of the first stage, while the nitrification process was developed mainly in the second stage with ammonium reduction of 70%. Figure 6 shows the TOC results at the three points measured during the month of May 2018.



6. TOC in inlet, 1st stage outlet and effluent

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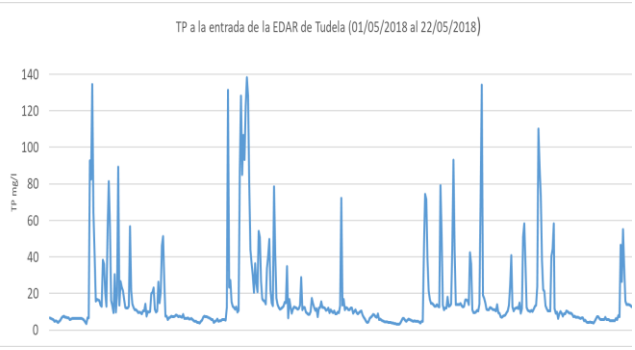
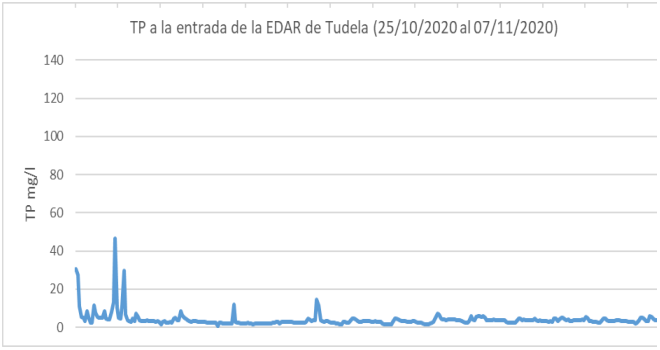
From the analysis of the behavior of the 2 stages of biological filters, with the knowledge of the concentration of TOC and TN in the output of the first stage, it would be possible to establish criteria to derive to effluent the output of this stage without passing through the second stage of biological, which would report important savings in the energy consumption of the plant. In addition, when storm discharges occur, the B7000 allows analyzing the quality of the discharged water in the different stages of the WWTP (inlet raw water and partially treated water) in compliance with RD 1290/2012.

Figure 7 shows the concentration of Total Phosphorus at the plant inlet during the same period. Peaks with a high concentration can be appreciated, which respond to episodes of uncontrolled discharges. The rapid detection of these episodes made it possible to identify their origin, thus avoiding their repetition. Figure 8 shows the current profile of Total Phosphorus concentration at the plant inlet, where the great progress obtained compared to the previous situation can be seen.



7. Historical TP May 2018



8. Current inbound TP concentration

Conclusion

From the moment of its installation, the BioTector B7000 analyzer has proved to be a valuable tool for the understanding and management of plant processes. It was able to detect wastewater discharge over time with high accuracy, facilitating the identification and elimination of uncontrolled discharge episodes. The analyzer allowed real-time monitoring of the water from the beginning to the end of the treatment, assuming the compliance of the discharge at present and in future more demanding situations. The robustness of the instrument allows high uptime of the measurements with low maintenance requirements.

It was also used to study nutrient removal processes and process performance, as well as to calibrate and verify the R&D study of a trickling filter process, enabling the plant modeling process (validation and calibration), as a source of data to build a Decision Support System (DSS). This is one of the company's priority R&D&I lines.

After 1 year of implementation, the customer was completely satisfied with the acquired product and in 2019 they decided to replicate the solution composed by instruments plus analysis rack, configuring the so-called Automatic Monitoring Stations (AMSs) to be equipped in different NILSA plants. They currently have similar installations in 2 other plants and are considering the acquisition of another 2 units by 2021.

The current plant manager confirms that he would recommend the acquisition of a similar system to any plant (public or private) that presents complications similar to those described in this success story.

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AGUA/URA LIFE NADAPTA PROYECTO LIFE16IPC/ES/01

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