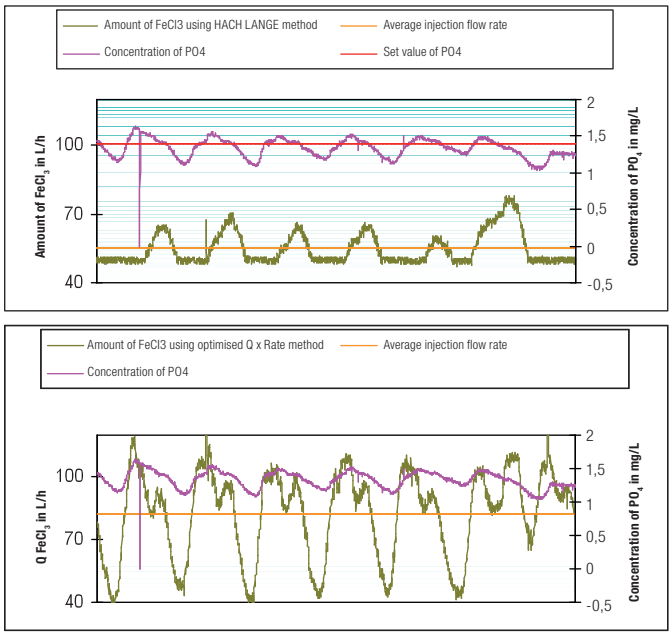
Regulation of reagent injection for phosphate removal

Background

Treatment plants are required to observe increasingly strict obligations regarding water quality, particularly in terms of phosphorus parameters.

Phosphate treatment can be carried out using biological and/or physical-chemical methods. The latter option requires a reagent to be injected in order for orthophosphates to be precipitated.
The automated metering systems currently implemented by operators are relatively basic. Some treatment plant manufacturers are working on specific algorithms, but injections proportional to the inflow of the system (Q x Rate method) are often found. The injection rate is fixed and a maximum threshold is preset in L/m^3 so that the reagent consumption is limited during rainfall (dilution).

This injection method ensures that the water quality requirements generally stipulated in discharge authorisation orders (annual average output and/or concentration) are observed, but it does not actually optimise the reagent consumption.



Comparison of the two injection systems (over 8 days)

Site

The treatment plant for the Evry Centre Essonne urban community in France operates on the principle of low-load activated sludge aeration. The effluent undergoes pre-treatment (involving screening, grit removal and grease removal). After this stage, the wastewater is directed towards two primary settling tanks before being transferred to the biological channel, which comprises an anoxic area, an aeration tank and two clarifiers.

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Evry urban community treatment plant

Optimisation

SC 1000 acquisition unit

This equipment is used to communicate with the various devices via Modbus and transmits the phosphate measurements to the WTOS (water treatment optimisation solution) controller.

The data can also be transferred to a monitoring system.

WTOS controller

The controller receives the following data:

- The phosphate measurements via the SC 1000 unit
- The treatment plant flow rate via a 4–20 mA connection

In addition to these signals, the internal and external recirculation flow rates are programmed in the controller (either fixed or as a percentage of the inflow) in order to integrate the dilution or additional loads associated with these flow rates.

A "backup" mode is integrated in the controller, which is activated in the event that data is lost, for example the analyser data and/or the plant flow rate. This function ensures that treatment continues if various faults are encountered, such as communication failures or a fault with a device etc. When this mode is activated, reagent injection will be based on hourly profiles programmed in the controller (phosphate flow to be treated, flow rate).

A minimum reagent injection flow rate is also programmed.

Results

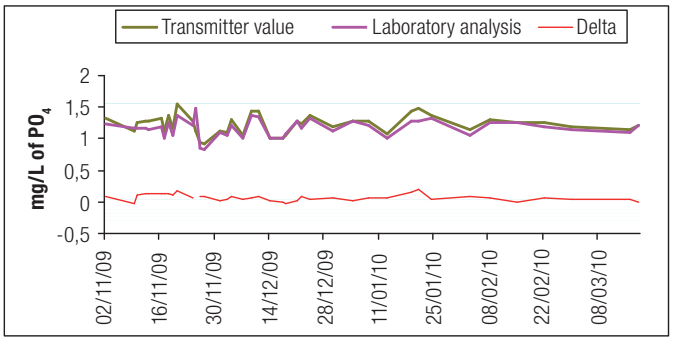
The controller was implemented at the end of November 2009. HACH LANGE worked on adjusting the various parameters on several occasions in order to find the right balance to ensure an output of 80 % without an excessive consumption of reagent. The system has been operational since 21 December 2009 and the two injection systems were compared during January and February 2010.
When compared with the Q x Rate method, the reduction in injected reagent was 25% after more than a year of use.

The average of the injection flow rates using the Q x Rate method is noticeably higher than the average recorded when the HACH LANGE controller system is used.

The algorithm developed by HACH LANGE has enabled the quantity of injected reagent to be optimised significantly.

HACH LANGE would like to thank Evry urban community for carrying out this study and publishing the results.

Measurement hydrographs



Comparison of laboratory and analyser values

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