

knowledge base

Lab Project at **RWZI Nieuwveer**

Phosphate removal using CIWI-Fe product produced by CIWI-ME Lab system to demonstrate potential of the technology.



RWZI Nieuwveer

Type project Lab project

Sector Sewage treatment

Application P-removal

Lab project at RWZI Nieuwveer

Objective

Phosphate removal using CIWI-Fe product produced by CIWI-ME Lab system to demonstrate potential of the technology.

Plant Overview

RWZI Nieuwveer (Breda/Prinsenbeek) is a large municipal wastewater treatment plant operated by Waterschap Brabantse Delta, treating sewage from Breda and surrounding areas before discharge into the Hollands Diep. The plant has a reported hydraulic capacity of 16,500 m³/h (peak wet-weather flow).

In addition to its core treatment function, the site is positioned as “Innovatiefabriek Nieuwveer”, providing space for pilots and demonstrations focused on energy, resources recovery and low emission wastewater treatment.

Sampling notes & limitations

Influent water of RWZI Nieuwveer, as direct influent, was collected on the 18th of February 2025. The phosphate influent concentration was 2.31 mg P/L. For convenience and sample availability, we used influent water; therefore, a 100% replication of the full-scale Nieuwveer process configuration (including stage separation, sludge recirculation and on-site chemical dosing points) is not feasible in a lab test. Nevertheless, the results provide a practical indication of phosphate removal performance with CIWI-Fe under controlled conditions. Different H⁺/Fe ratios were tested because the CIWI-Fe affects phosphate binding and floc formation.

Varying the H⁺/Fe ratio helps identify a practical operating window that achieves the required P-removal while limiting unnecessary acid addition (and associated chloride load and pH impact).

Custom-made dosing for P-removal

The Procedure

A fixed process condition was selected for CIWI's lab system; pH and salt matrix were fixed, and the formed product was tested for Fe content using HACH cuvette kits (LCK 321). The formed product was conditioned to enable phosphate removal; in these experiments this was achieved by HCl dosing to CIWI-Fe to reach a target H+/Fe ratio. Based on the determined Fe content, product was dosed to 200–400 mL beakers in a flocculator setup. CIWI-Fe or FeCl_3 was dosed to the beaker containing water from the selected RWZI to achieve the desired Fe dose (4–10 mg Fe/L).

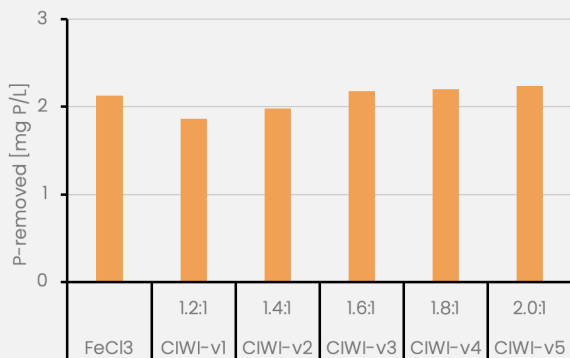
The general procedure followed a standard jar-test approach: dosing during rapid mixing (200 rpm), followed by medium-intensity mixing at 50 rpm for 2 minutes and slow mixing at 10 rpm for 15 minutes. After 15–30 minutes of settling, supernatant samples were taken for phosphate analysis.

HACH kits (LCK 348 & 349) were used to determine $\text{PO}_4\text{-P}$ concentration; samples were diluted when necessary.

The Result

Results showed that similar P-removal (mg $\text{PO}_4\text{-P/L}$ removed) could be achieved by CIWI-Fe dosing for a product with a H+/Fe-ratio of 1.6:1. Lower H+/Fe-ratio's resulted in decreased P-removal. The ideal ratio of 1.6 had a chloride-load equivalent to $\text{FeCl}_{2.1}$ (with $\text{FeCl}_{0.5}$ from the original product and $\text{FeCl}_{1.6}$ by the HCl dosing). Results for a range of Fe dosages (4, 7 and 10 mg Fe/L) showed the similarities in P-removal by FeCl_3 and CIWI-Fe 1.6:1 ($\text{FeCl}_{2.1}$ -equivalent). For the CIWI-Fe 1.2:1 product, somewhat lower P-removal could be observed compared to FeCl_3 . Phosphate concentrations as low as 0.1 mg P/L were observed, showing direct potential for application of the technology in low-range phosphate environments.

Data P-removal at different H+/Fe ratios



Data Phosphate removal by Fe dosing

