

knowledge base

Lab Project at **RWZI Ede**

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



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Objective

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

Plant Overview

RWZI Ede is a municipal wastewater treatment plant operated by Waterschap Vallei en Veluwe. The installation is a Biotenipho (biological denitrification and phosphate removal) plant, built in 1995, discharging to the Valleikanaal. The reported biological capacity is 300,000 i.e. (at 136 g COD/(PE-d)) / 272,000 i.e. (at 150 g COD/(PE-d)), and the reported wet weather flow (WWF) capacity is 6,750 m³/h.

The water line typically includes mechanical pre-treatment (screening and grit removal), primary clarification (where present), biological treatment based on activated sludge (Biotenipho configuration for nutrient removal), and secondary clarification (final settling) prior to discharge.

Sampling notes & limitations

Influent water of RWZI Ede, post-sieve and after first sedimentation, was collected on the 25th of April 2025. The phosphate influent concentration was 16.84 mg P/L. For convenience and sample availability, sieved influent water was used. It should be mentioned that this would not be a full replication of the full-scale RWZI process configuration (including stage separation, sludge recirculation and on-site chemical dosing points), as biological processes were not simulated.

Nevertheless, the results provide a practical indication of phosphate removal performance with CIWI-Fe under controlled conditions. Different coagulant H+/Fe-ratios were tested using acid (HCl), varying in product acidity and iron speciation and so affecting phosphate binding and floc formation. Varying the H+/Fe-ratio allows to 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

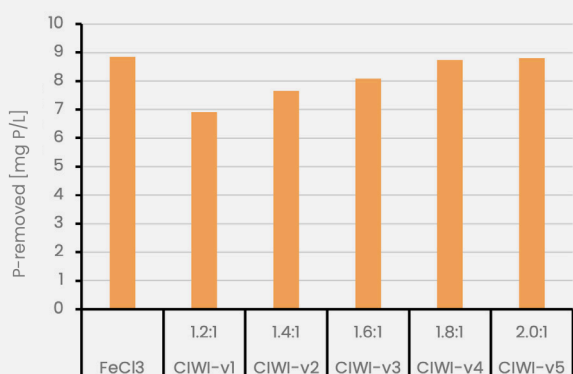
A fixed process condition was selected for CIWI's lab system; pH and salt matrix were fixed, and the formed product was tested for Fe content using HACH cuvette kits (LCK 321). The formed product was conditioned to enable phosphate removal; in these experiments this was achieved by HCl dosing to CIWI-Fe 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 FeCl₃ 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 (50 rpm) for 2 minutes and slow mixing (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 PO₄-P concentration, samples were diluted when necessary.

The Result

The effectiveness of the CIWI-Fe product for the removal of phosphate was investigated. Results showed that a similar phosphate removal (mg PO₄-P/L removed) could be achieved by CIWI-Fe dosing for a product with a H+/Fe-ratio of 1.8:1, compared to FeCl₃. Lower H+/Fe-ratio's resulted in slightly lower P-removal. The ideal ratio of 1.8 had a chloride-load equivalent to FeCl_{2.3} (with FeCl_{0.5} from the original product and FeCl_{1.8} 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 FeCl₃ and CIWI-Fe products. Near-similar removal to FeCl₃ could be achieved by both CIWI-Fe of 1.4:1 and 1.8:1.

Data P-removal at different H+/Fe ratios



Data Phosphate removal by Fe dosing

