


knowledge base

# Lab Project at **RWZI Meijel**

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



 RWZI Meijel

Type project Lab project

Sector Sewage treatment

Application P-removal

# Lab project at RWZI Meijel

## Objective

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

## Plant Overview

**RWZI Meijel** is a municipal wastewater treatment plant operated by Waterschap Limburg. Based on publicly available information, the installation is an ultra low-loaded activated sludge plant (built in 1977, last modified in 1992). The reported biological capacity is 15,900 PE (at 136 g COD/(PE-d))/14,416 PE (at 150 g COD/(PE-d)), and the reported wet weather flow (WWF) capacity is 400 m<sup>3</sup>/h. The water line typically includes mechanical pre-treatment (screening and grit removal), followed by (where present) primary clarification (first sedimentation), biological treatment based on activated sludge (aeration; typically including zones for carbon removal and nutrient conversion), and secondary clarification (final settling) prior to discharge.

Return activated sludge is recirculated from the secondary clarifiers back to the biological stage, while excess sludge is removed for further handling on the sludge line (typically thickening and mechanical dewatering, with subsequent processing depending on the operator's regional sludge strategy). Iron chloride dosing is applied for (additional) phosphate removal / effluent polishing.

## Sampling notes & limitations

Influent water of RWZI Meijel, just prior to current FeCl<sub>3</sub> dosing, was collected on the 25th of April 2025. The phosphate influent concentration was 10.76 mg P/L. For convenience and sample availability, an influent sample 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<sup>+</sup>/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<sup>+</sup>/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

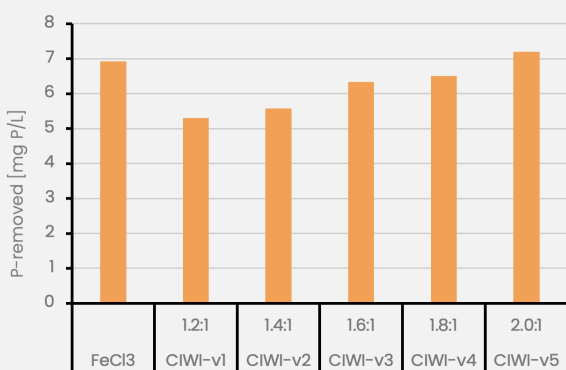
A fixed process condition was selected for CIWI's lab system; pH and salt matrix were fixed, and the formed product was tested for Fe content using HACH cuvette kits (LCK 321). The formed product was conditioned to enable phosphate removal; in these experiments this was achieved by HCl dosing to CIWI-Fe 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 FeCl<sub>3</sub> 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 PO<sub>4</sub>-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 desired P-removal (mg PO<sub>4</sub>-P/L removed) could be achieved by CIWI-Fe dosing for a product with a H+/Fe-ratio of 2:1. Lower H+/Fe-ratio's resulted in slightly lower P-removal. The ideal ratio of 2:1 had a chloride-load equivalent to FeCl<sub>2.5</sub> (with FeCl<sub>0.5</sub> from the original product and FeCl<sub>2</sub> 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<sub>3</sub> and CIWI-Fe products. Near-similar removal to FeCl<sub>3</sub> could be achieved by both CIWI-Fe of 1.6:1 and 2:1 products.

Data P-removal at different H+/Fe ratios



Data Phosphate removal by Fe dosing

