

Phosphorus recovery from municipal wastewater via electrolysis

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Introduction: Phosphorus is an element used as a fertilizer and is essential for modern agriculture. Unused phosphorus from plants and from other sources, however, ends up in wastewater where it is then separated from water and discarded. To reuse phosphorus and create a sustainable cycle, a method has been developed to recover phosphorus from wastewater. This process involves separating phosphorus from the wastewater and making it available for reuse in agriculture or other applications in form of struvite. Struvite is a mineral composed of magnesium, ammonium and phosphate and is primarily used in fertilizers and as a soil additive, due to its high content of nitrogen and phosphorus.

Approach: The essay begins by exploring the importance of phosphorus in aquatic ecosystems and other fields, followed by an overview of wastewater treatment plants (WWTPs). Subsequently, experiments that were performed in this work are explained and discussed.

The precipitation of iron phosphate in iron hydroxide was investigated, focusing on the pH level to monitor the speed of the reaction. The reaction rate at pH 10.5 was also compared between a solution with ultrasonic treatment and a solution over only a magnetic stirrer, demonstrating the significant acceleration effect of the ultrasound on the reaction rate.

An experiment with all steps of the process has been performed, starting with the separation of phosphorus from iron using the optimal pH of 10.5, and culminating in the electrolysis-assisted precipitation of struvite.

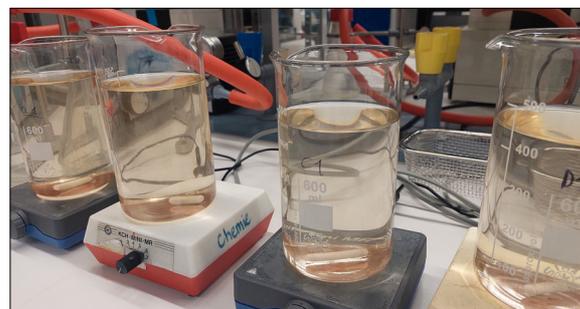
Conclusion: The experiments confirmed that it is possible to cause the precipitation of iron phosphate, even at pH values lower than 12.5.

Conc. of the precipitated product
On the right the concentration progress of P
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Additionally, the experiments successfully achieved precipitation of struvite using a lab-created solution, demonstrating that it is possible to form this mineral under controlled conditions.

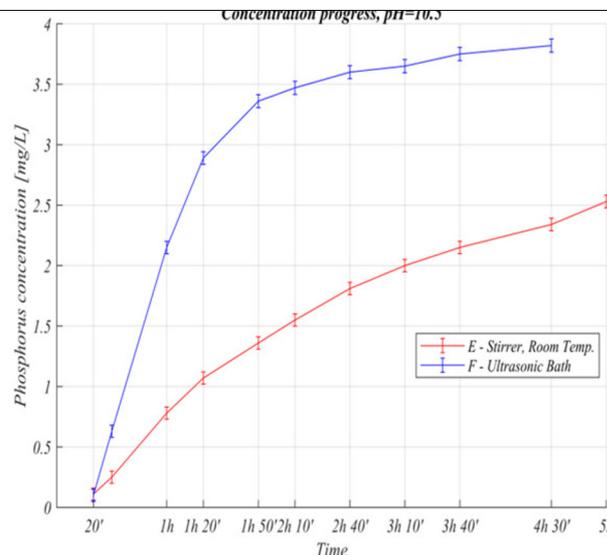
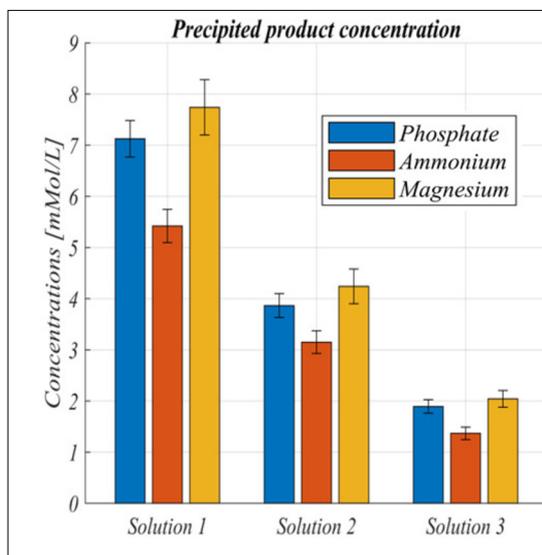
Iron phosphate precipitation

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Precipitated product after electrolysis

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Subject Area
Water treatment