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Phosphate recovery from iron phosphate

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Motivation

Phosphorus (P) is a major ingredient of fertilizer. Despite of its importance, P is not used sustainable. It is mined from finite reservoirs and the degree of recycling is not noteworthy.
Sewage has a high potential for P recovery. Few sewage plants use biological P removal with marginal recovery. Currently, P is mainly eliminated from sewage by adding iron to form various iron phosphate compounds (FeP) that end up in the sludge. This technique is effective, simple and cheap and allows high biogas production. However, the recovery of P in a concentrated form is not yet economical.




A key for P recovery is to understand the complex FeP biogeochemistry which is relevant for various research disciplines (Fig. 1).
Iron and P are an odd couple:

I. Economic recovery of P from FeP-sludge is difficult.
II. In contrast, P release from FeP in sediments can cause eutrophication. Apparently, microbial sulphide production in the sediment contributes to P remobilisation (Fig. 2).
III. In soils, P availability from FeP to plants is difficult to predict. Plants, fungi and microbes have developed various strategies to access this P.

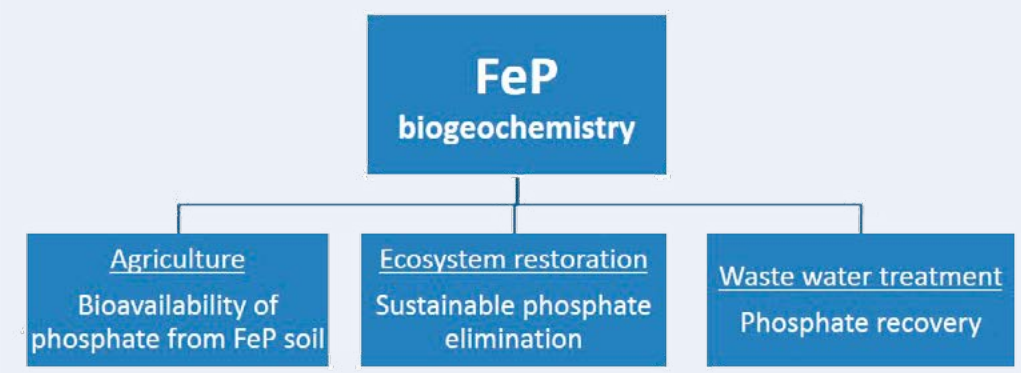
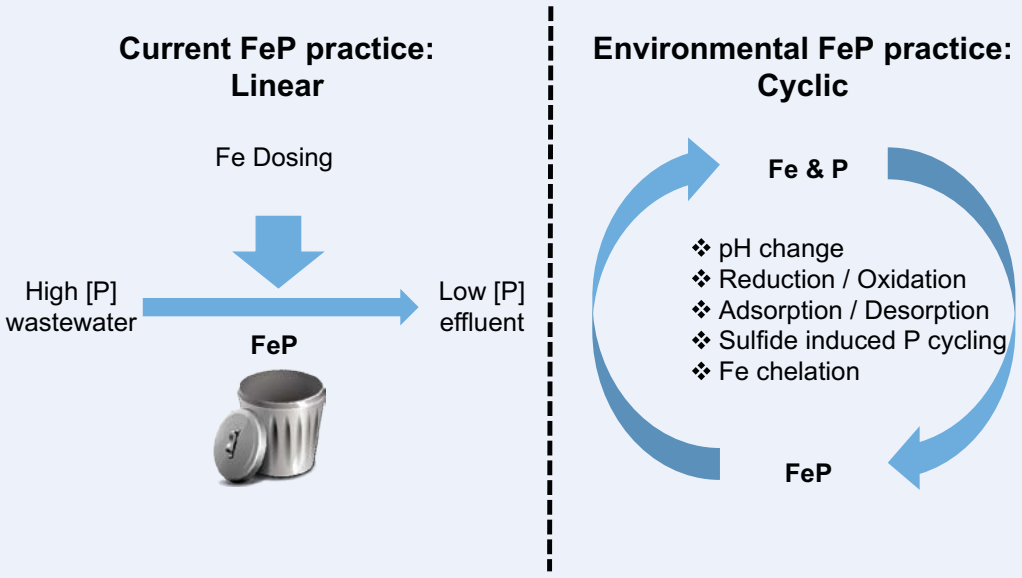


Fig. 1: Iron phosphate as key parameter for different research disciplines.

Technological challenge

Understanding relevant FeP biogeochemistry will help to identify drivers that facilitate respectively prevent P mobilisation (Fig. 1).
Different FeP exist with different:

- Sensitivity to sulphide
- Iron to P ratios
- Strength of P retention
- Bioavailability of iron and phosphate



Research goals

- Understand FeP biogeochemistry in natural and sewage systems
- Model dissolution equilibria of FeP and iron sulphide
- Understand natural P mobilization from FeP
- Translate this knowledge into an economical feasible (bio) technological P recovery process

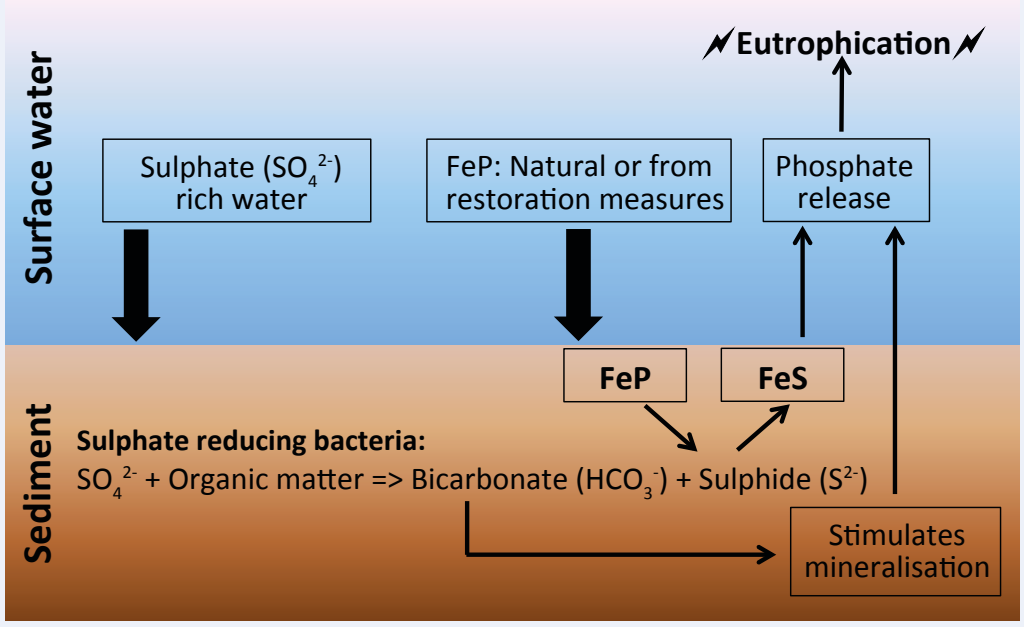


Fig. 2: Release of phosphate caused by bacterial sulphide production in sediments[1]. This mechanism could be a natural prototype for phosphate recovery from FeP sludge.

1 Smolders AJP, Lamers LPM, Lucassen ECHET, Van der Velde G, Roelofs JGM (2006) Chem Ecol 22:93–111

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