

Physicochemical modelling of phosphorus removal and recovery from wastewater

Phosphorus removal is of central importance for the operation of many WRRFs. Stricter discharge criteria and needs for nutrient recovery lead to increased interest in P removal modeling, in particular physicochemical modeling. P removal modeling is still a challenge due to the complexity of involved reactions, interactions between chemical and biological processes, and inability of conventional models to account for this complexity.

Expected discussions and results

This workshop is intended to report and challenge recent phosphorus physicochemical modeling (PPCM) research developments:

- PCMI extension (colloidal P, adsorption, sulfur cycle, EBPR, precipitation, aquatic chemistry, biological processes and half saturation indices, interfacing vs general models)
- Fractionation, speciation, elemental balances
- P-Fe models (P-Fe-S interactions, surface complexation model)
- Alkaline filtration for extensive P removal
- Plant-wide modeling (sewer, influent characterization costs and needs, EBPR, uncertainty analysis, resource recovery from high strength digestate).

In this context, the workshop will focus on two objectives:

- 1- Model development
 - a. Development of a general framework
 - b. Are models complex enough? Which aspects should be added or removed?
- 2- Model integration and validation
 - a. Are the presented model/approaches compatible or comparable?
 - b. What are the main issues of plant-scale utilization of PPCM models?

Main conclusions from this workshop will be integrated in the discussion work of the IWA task group on a Generalized Physicochemical Framework. These conclusions will be presented to the whole WWTmod community in a presentation.

Workshop set-up

First, a short workshop welcome by the Chair will present the objectives of the workshop and the chosen format. The workshop will then be divided into four model applications: block 1 – Model development; block 2 – Anaerobic digester modelling and P recovery; block 3 – Simulation of P removal in mainstream and whole-plant modeling and block 4 – Whole-plant modeling. Each block will be composed of a 15-minute presentation followed by a discussion period.

Some discussion periods will be initiated by a short discussion starter. A discussion starter consists of 3 slides presented in 5 minutes by a participant. The first two slides present the context on a given topic (ex. methodology, results, conclusion, ...) and the last slide presents perspectives or questions asked by the presenter. After this 5-minute presentation, other participants can answer, ask new questions and contribute to the discussion. One discussion starter is planned for each block of the workshop program, but participants are invited to submit additional discussion starters to moderators, preferably prior to the workshop. The moderator's task will be to animate discussions, notably by choosing to integrate new topics from submitted

discussion starters as the discussion evolves. Participants who wish to submit a discussion starter prior to the workshop are invited to send it to dominique.claveau-mallet@polymtl.ca.

Conferences for blocks 2 and 3 are «duo conferences». These conferences will be presented by two participants from different institutions but working on similar subjects. The conference will be divided as follow: 8 minutes for expert #1, 8 minutes for expert #2, and 5 minutes of combined presentation.

Chair

Dominique Claveau-Mallet (Polytechnique Montreal)

Speakers / Moderators

Moderators

Yves Comeau (Polytechnique Montreal)

Mathieu Spérandio (INSA Toulouse)

George Ekama (University of Cape Town)

Peter Vanrolleghem (Laval University)

Speakers for presentations

Damien Batstone (University of Queensland)

George Ekama (University of Cape Town)

Alexis Mottet (INSA Toulouse)

Xavier Flores-Alsina (Lund University and Technical University of Denmark)

Lisha Guo (University of Queensland)

Youri Amerlink and Tony Flameling (University of Ghent)

Speakers for discussion starters

Hélène Hauduc (Dynamita)

Peter Vanrolleghem (Laval University)

Dominique Claveau-Mallet (Polytechnique Montreal)

Albert Guisasola (Universitat Autònoma de Barcelona)

Target Participants

Those with an interest in P removal and recovery.

- Researchers
- Software developers
- Consultants
- Public utility managers

Programme

Time	Topic	Moderator/ Presenters
Block 1 – Model development		Yves Comeau
09:45 - 09:55	Introduction: Motivation, scope, objectives and structure of the present workshop.	Dominique Claveau-Mallet
09:55 - 10:25	Presentation #1: PCM1 model update	Damien Batstone
10:25 - 10:45	Discussion period Discussion starter #1: HFO models	Hélène Hauduc
10:45 - 11:15	Coffee break	
Block 2 – Anaerobic digester modeling and P recovery		Mathieu Spérandio
11:15 - 11:45	Presentation #2: ADM & P recovery	George Ekama and Alexis Mottet
11:45 - 12:15	Discussion period	
12:15 - 12:45	Discussion period Discussion starter #2: P recovery	Peter Vanrolleghem
12:45 - 13:45	Lunch break	
Block 3 – Simulation of P removal in main stream and whole-plant modeling		George Ekama
13:45 - 14:15	Presentation #3: Fe-P-S interaction	Xavier Flores-Alsina and Lisha Guo
14:15 - 14:45	Discussion period	
14:45 - 15:15	Discussion period Discussion starter #3: Ca-P precipitation	Dominique Claveau-Mallet
15:15 - 15:45	Coffee break	
Block 4 – Whole-plant modeling		Peter Vanrolleghem
15:45 - 16:15	Presentation #4: The Eindhoven study case	Youri Amerlink and Tony Flameling
16:15 - 16:45	Discussion period Discussion starter #4: EBPR interfaction with PPCM	Albert Guisasola
16:45 - 17:15	Wrap-up, summary, report to WWTmod participants	Dominique Claveau-Mallet