

WWTmod2010 Workshop

Modelling micropollutants fate: status and challenges

The modelling of urban water quality (i.e. wastewater) is a growing issue in water management. New regulations stress the importance of estimating the loads and the fate of micro-pollutants (MPs) in the urban water cycle. The models available to simulate the transport and removal of “traditional” pollutants such as overall organic pollution, nutrients and suspended solids in wastewater treatment plants are extended with processes describing the fate of MPs (i.e. physical, chemical and biological) and new post-treatment processes (e.g. ozonation, PAC addition) are modelled depending on the compound’s inherent properties. This workshop aims at picturing the current status of MP models and at identifying the challenges and perspectives lying ahead. A discussion among the workshop contributors led to the following impressive list of discussion topics regarding micropollutant modelling:

Possible discussion topics

- Modelling methodology
 - Current modelling approaches in simulation of MP fate in WWTPs.
 - Can MPs be grouped (e.g. as organic pollution is lumped into COD) to be modelled with less efforts to each time find the specific compound’s properties?
 - Different scales in time and concentration between compounds/processes. Numerical problems related to this aspect.
 - Cometabolism of MPs and the impact of growth substrate (competitive inhibition) on MP biodegradation.
 - Research needs/developments required at academic/research level for MP fate modelling.
- Technology and process
 - Modelling of new post-treatment processes, e.g. ozone or PAC addition (effect of background DOC, reactor flow scheme, etc.) to improve design of post treatment processes and calculate overall efficiency of the WWTP with respect to MP removal.
- Data
 - Data and parameters needed for MP fate models and their lack of availability or quality. Uncertainties and costs related to this aspect.
 - Can easily measurable “surrogate” MPs be used as indicators (as e.g. *E. coli* in bacterial contamination)?
 - Characterisation of municipal wastewater’s MP content (e.g., human conjugates) for modelling purposes.
 - Model calibration: parameter assessment from batch experimental data using pre-clarified municipal sewage instead of spiking with reference substances.
 - Validation of models: collecting representative samples to determine meaningful environmental concentrations and loads is a challenging task.
- Model use

- Steady state versus dynamic modelling of MPs: important for ecotoxicological risk assessment?
- Dynamic modelling of MP fate in secondary sewage treatment as a means to optimise reactor design and chemical dosing in enhanced tertiary treatment.
- Adaptation phenomena at long sludge age and implications on operational procedures.
- Assessing MP degradation pathways and the ecotoxicological effects of degradation products, thereby defining the minimum biological removal requirements.
- What are the regulatory drivers for MP modelling? How and why practitioners/users/engineers can and will use MP fate models? At which temporal and spatial scale, for which MP, dynamically or in steady-state?

Workshop set-up

The workshop is organized as a round table discussion seeded by short presentations, after two keynote presentations. The topics of the discussion starters have been selected from the above list on the basis of their importance and to achieve the maximum possible return from the workshop. Break-out sessions will be organized around some of the themes to ensure wider discussion and active involvement of all participants to the workshop.

Moderators

Lorenzo Benedetti – Chair/Moderator (Ghent University, Belgium, lbene@biomath.ugent.be)

Hansruedi Siegrist – Co-moderator (Eawag, Switzerland)

Workshop contributors

The following people have contributed to the workshop programme, and will contribute to the consensus paper after the workshop:

Name	Affiliation
Core Group	
Lorenzo Benedetti	Ghent University, Belgium
Hansruedi Siegrist	Eawag, Switzerland
Christoph Ort	AWMC, Brisbane, Australia
Peter Vanrolleghem	Université Laval, Canada
Hugh Monteith	Hydromantis, Canada
Wayne Parker	University of Waterloo, Canada
Benedek Plósz	NIVA, Norway; DTU Environment, Denmark
Review group (some attending conference and/or workshop others not)	
Adriano Joss	Eawag, Switzerland
Peter Steen Mikkelsen	DTU Environment, Denmark
Frederik Verdonck	ARCHE, Belgium
Thomas Ternes	Federal Institute of Hydrology, Germany
Rajesh Seth	University of Windsor, Canada
Henrik Fred Larsen	DTU Management Engineering, Denmark

Participants

Professionals interested in the practical application of MP fate modelling:

- Consultants, who use or plan to use MP fate models in their daily work, for design, upgrade, evaluation, optimization or control of urban water systems.
- Plant Managers and Operators, interested in understanding how the involved processes work and how modelling can benefit their plant's operation.
- Educators, using mathematical models for training the new generation of engineers and operators.
- Researchers, who want to extend their knowledge to MP fate modelling or are interested to contribute to MP fate models development.

Programme

Time	Topic	Presenter
09:00 - 09:10	Introduction: Motivation, scope, and objectives Present workshop structure, participants, etc.	Lorenzo Benedetti
09:10 - 09:30	Presentation #1: Modelling MP fate in WWTPs in the context of environmental risk assessment.	Lorenzo Benedetti
09:30 - 9:50	Presentation #2: Development and calibration of fate models for MPs in wastewater.	Hugh Monteith
09:50 - 10:00	Short pres. #1: Sampling for model validation.	Christoph Ort
10:00 - 10:30	Coffee break	
10:30 - 11:00	Short pres. #2: Post ozonation. Short pres. #3: PAC addition. Short pres. #4: Surrogate and indicator compounds.	Adriano Joss Hansruedi Siegrist Thomas Ternes
11:00 - 12:00	Discussion Period	
12:00 - 13:30	Lunch break	
13:30 - 14:00	Short pres. #5: An activated sludge model for xenobiotic organic micro-pollutants (ASM-X): factors influencing the solid-liquid partitioning in wastewater treatment. Short pres. #6: Putting micropollutants, energy, nutrients and GHG emissions on an equal basis: An LCA approach. Short pres. #7: Modelling co-metabolic transformations.	Benedek Plósz Henrik Fred Larsen Peter Vanrolleghem
14:40 - 15:00	Discussion Period	
15:00 - 15:30	Coffee break	
15:30 - 16:30	Discussion Period <ul style="list-style-type: none"> • Develop consensus opinions. • Prepare presentation to the conference participants. • Plan a paper for Water Science and Technology. 	
16:30 - 17:00	Wrap-up, composing summary, report and presentation.	