

Modelling microconstituent fate and transport in the environment : Dynamic behaviour of Bisphenol A in wastewater treatment plants

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on Water Quality Modelling*



Overview

- Problem statement
- Objectives
- Materials and methods
- Modelling
- Results
- Conclusion

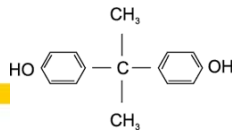


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Problem statement

- Influent of a WWTP:
 - Traditional pollutants:
 - Organic matter (excrements, kitchen, shower, leaves)
 - Nitrogen (urine, fertilizer)
 - Phosphorus (detergents, fertilizer)
 - Toxic products
 - Xenobiotic organic compounds (perfumes, detergents)
 - Heavy metals

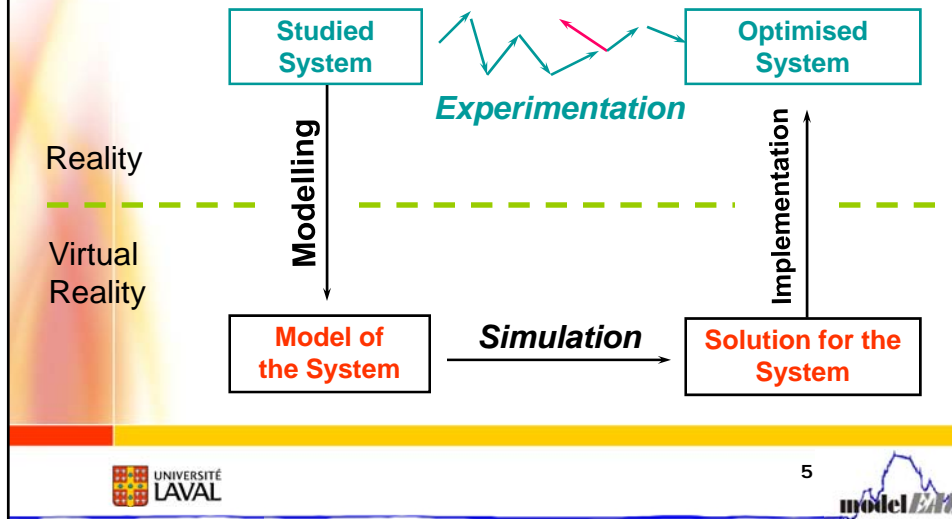


Micropollutants
Emerging pollutants
Priority pollutants

Problem statement

- Effluent of a WWTP
 - A certain amount of pollutants will be rejected
 - Which fraction?
 - How can we improve the situation?
 - Limit the use of certain products
 - Modify the configuration/operation of the WWTP

Problem statement: Why modelling ?



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Objectives

- Develop a dynamic model able to describe the fate of micropollutants in addition to traditional pollutants in a WWTP
(and in the sewer system and the river)

ScorePP



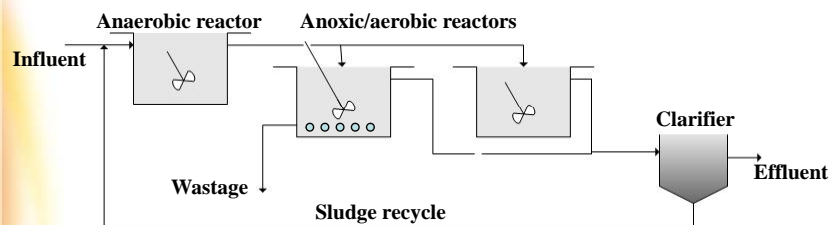
*Source Control Options
for Reducing Emissions
of Priority Pollutants*

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Materials and methods

- Pilot plant at Copenhagen (Denmark)
 - WWTP Lynetten
 - Biotenipho™ process
 - Total volume of the reactors: 11.6 m³



Materials and methods

- Pilot plant at Copenhagen (Denmark)



Materials and methods

- Pilot plant at Copenhagen (Denmark)



Modelling

$$\frac{dXOC}{dt} = \frac{Q_{in}}{V} (XOC_{in} - XOC_{out}) - \text{Dégradation biologique} - \text{Sorption} - \text{Volatilisation}$$

- Bisphénol A is non-volatile
- Biodegradation by a specialised bacterium
- Biodegradation only in presence of O₂

Materials and methods

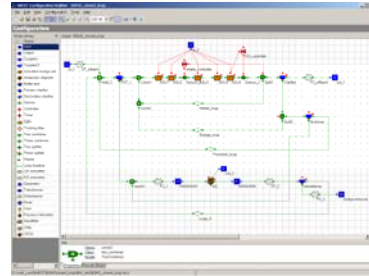
- WEST[®] simulator

- Developed by:

- BIOMATH

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- Functionality:

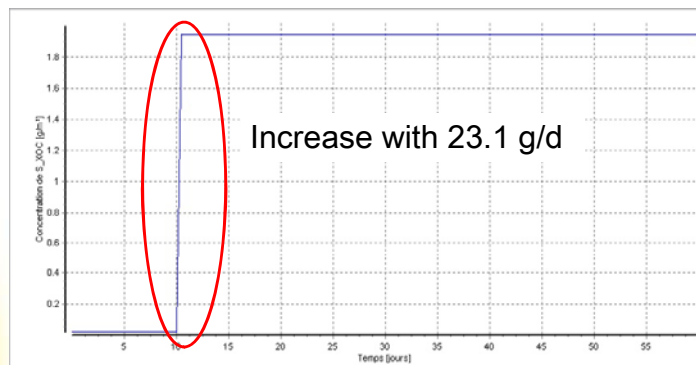
- Dynamic simulation
 - Add/extend models yourself
 - Extensions for sewers (KOSIM) and rivers (RWQM1)

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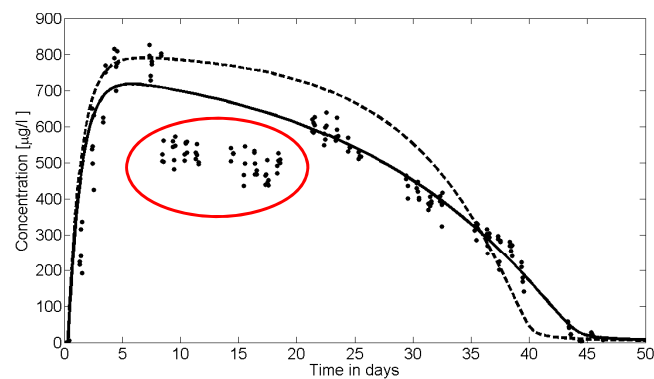
Results

- Experiment: Step load change to BPA



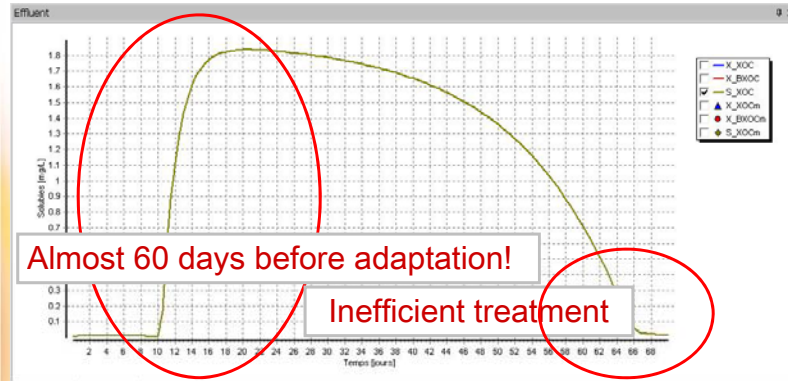
Results

- Case study Lynetten (Injection of 10 g/d of BPA)



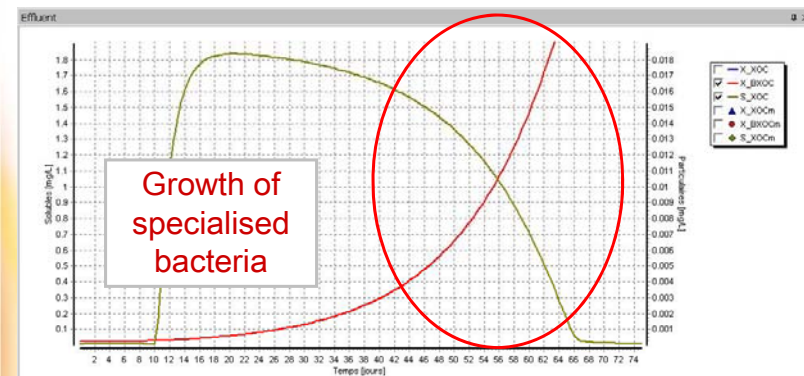
Results

- Effluent BPA concentration



Results

- Effluent BPA concentration

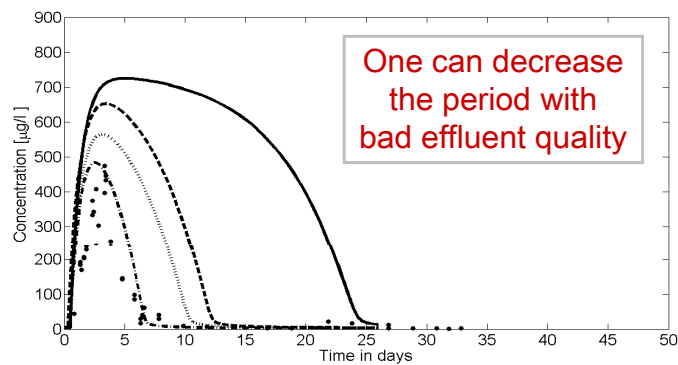


Results

- Use of the model:
Effect of operational parameters:
 - Increase temperature and aeration
 - Injection of 1 g/d of BPA for 60 days in order to adapt the biomass to the new pollutant
 - No injection for 14 days
 - Injection of 10 g/d of BPA

Results

- Effect of operational parameters



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Conclusion

- Case studies:
 - Xenobiotic Organic Compounds (XOC)
 - Heavy metals
- Development of a model that deals with:
 - Traditional pollutants
 - Heavy metals
 - Bisphenol A
- Potential of the model
 - Optimising the design/operation of WWTPs

Conclusion

- Acknowledgement



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