Deltares

Enabling Delta Life

The Deltares Laboratory in Utrecht

Soil and water are home to a complex range of microbiological and geochemical processes that have a major impact on the quality of soil and water, but also on the objects and materials they contain, such as pipelines and sheet piling. The Deltares Laboratory has the expertise and facilities to answer all sorts of questions about these effects.

The emphasis is on applied experimental research: we look for answers to questions from the field, and we have the expertise and experience to use innovative methods or to develop them ourselves. Of course, we do this in close consultation with our clients, whether they are government authorities or commercial enterprises. The Deltares Laboratory is a part of the newly built GML (Joint Environmental Laboratory) at our Princetonlaan premises in Utrecht. At the GML, Deltares collaborates closely with the Earth Sciences Faculty of Utrecht University (GeoLab), and TNO Applied Environmental Chemistry.

The field covered by the Deltares Laboratory is wide: from model validation to testing measures for improving water quality. This involves innovative small-scale test setups that can be scaled up later for use on pilot projects and/or field trials.

What makes the Deltares Laboratory so unique is the state-of-the-art research facility, which allows for a wide range of experimental research. We have microbiological and DNA technologies at our disposal, as well as sensitive organic and inorganic detection methods.

Deltares has years of experience in designing and conducting laboratory experiments, fieldwork, and working with sensors. We also have wide-ranging expertise in the field of microbiological and geochemical processes. Short lines of communication with researchers in different disciplines make it possible to adjust the setup during the course of the project to obtain the best possible experimental situation.

Due to the continual expansion of our understanding of natural water and soil systems, the concentration of a variety of disciplines including microbiology, geochemistry and hydrology, and intensive collaboration with other research institutes, the Deltares Laboratory can deliver top research in response to complex issues raised by government authorities, society as a whole, and corporate organizations.

The Deltares Laboratory

Research assignments

We have made a selection from the research projects conducted by the Deltares Laboratory.

Tackling phosphate release

The challenge

Large amounts of phosphate can be released from the beds of lakes, entering the water and causing algal blooms. All sorts of preventive measures are possible. They include covering the bed, for example with sand, to stop phosphate releases.
The water management authority "Schieland en de Krimpenerwaard" wondered whether it might not be more effective to add a substance to the sand to bond the phosphate more strongly. The Bergse Voorplas in the authority's area was selected as the research location.

The research

The Deltares Laboratory tested a range of additives to see how well they bonded the phosphate. Polyaluminium chloride emerged as the most suitable. Tests were then conducted to see how this substance worked in a covering layer. Column tests and flow columns were used to simulate the situation in the field. In that way, it was possible to study the effectiveness of polyaluminium chloride in field conditions. That involved looking at the best way of applying the substance and the amount of additive required for the Bergse Voorplas.

Flow columns for determining the bonding capacity of polyaluminium chloride for phosphate

The solution

On the basis of the findings from the laboratory experiments, a field pilot study was designed and conducted in the Bergse Voorplas. The bed of the lake was covered with a mixture of sand and the polyaluminium chloride. The Deltares Laboratory monitored the effect in the field.

Using polyaluminium chloride in the Bergse Voorplas to prevent phosphate release from the bed of the lake

More efficient management for subsurface infrastructure possible

The challenge

Corrosion damages subsurface infrastructure, such as steel pipes and sheet piling. The associated costs can mount up. Corrosion is caused by both chemical and microbiological processes. The second is known as 'microbial corrosion' (MIC). MIC represents a challenge because it is fast and localised. Agencies managing subsurface infrastructure need to have a clear picture of where corrosion occurs, and when.

The research

KEMA-DNV asked Deltares to organise a study on MIC. The research is focusing on unravelling the microbiological mechanisms involved in MIC and on the development and application of straightforward approaches for measuring the risk of MIC potential. Using the 'ERprobes', sensors specifically adapted by the Deltares Laboratory, measurements were made to determine the corrosion rates of a steel surface in the laboratory and in the field. In addition, specific

DNA detection methods were used to track the presence of groups of micro-organisms and their enzymes involved in the MIC process. In that way, factors important in MIC can be tested quickly and systematically.

The solution

Measuring the corrosion rate using the sensors makes it possible to determine the corrosion risks associated with a range of types of groundwater, but also to assess the role of local factors or protective measures.
Identifying the factors that are important in MIC makes it easier to predict the time and place where MIC may occur.
The results of the study will open the way to more effective management of subsurface infrastructures and generate cost savings.

Subsurface infrastructure can be damaged by microbial corrosion, causing leaks.

Peat oxidation

The challenge

The reduction of groundwater levels in peat areas to help agriculture and protect infrastructure facilities, allows oxygen to come into contact with the peat, resulting in large-scale peat oxidation. That can have drastic consequences, including land subsidence and increased CO_2emissions.
There are different types of peat. It is generally assumed that they are homogenous in nature and therefore all equally susceptible to oxidation. But it is not clear whether this is actually the case.

The research

The Deltares Laboratory is studying the chemical composition of different types of peat in order to determine whether they are homogenous or heterogeneous in nature. Deltares Laboratory is also engaged in research to find out whether these different types of peat also have different oxidation rates.
For the chemical composition analysis methods are used such as a pyrolysis technique that involves heating the peat in anoxic conditions. To determine susceptibility to oxidisation, microbiological batch experiments are being conducted. A range of types of peat in different laboratory conditions are being looked at and the enzymes responsible for oxidation are being quantified.

The solution

This project will provide a picture of susceptibility to oxidation in different peat areas. This can help to make land use more efficient, reduce land subsidence, make cost savings in dike technologies, enhance the composition of reinforced peat, improve water management in peatland areas, and further our understanding of eutrophication and climate issues.

Peat sampling

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The Deltares Laboratory is housed in the GML (Joint Environmental Laboratory)

Detecting toxic blue-green algae quicker

The challenge

Blue-green algae are a global problem. They thrive in the presence of nutrients and in warm weather. The micro-organisms in question are cyanobacteria and they contain both blue and green pigments. Some blue-green algae produce toxic substances. That constitutes a health risk for humans and animals, particularly when these toxic algae are located in bathing or drinking water.

That is why proper monitoring of blue-green algae is important. However, current monitoring techniques are time-consuming, they are not reproducible in some cases, and these techniques do not allow precise identification of the toxic species.

The research

In the Deltares Laboratory, a method was developed for detecting the toxic cyanobacteria on the basis of their DNA. The method is reproducible, quick and efficient. The method was tested in collaboration with the water authorities and the Dutch Ministry of Infrastructure and Environment in a large number of recreational waters.

The result

The DNA test that has been developed can measure levels of toxic blue-green algae, even types that are not detected using other methods. In addition, the advantage of the DNA method is that large numbers of samples can be analysed within a reasonably short time.

The Deltares Laboratory has now distributed the DNA method to a number of laboratories so that they can also measure the toxicity of cyonabacteria quickly. Although this DNA method was developed, the research is continuing. The Deltares Laboratory is teaming up with commercial partners to develop a mobile system for DNA detection. As a result, it will soon be possible to conduct analyses outside the laboratory so that the results will be available even faster. This method also opens up opportunities for the subsequent development of of a reliable prediction system for toxic cyanobacteria, protecting both people and the environment.

Toxic blue-green algae are a threat to the health of people and animals.

More information

Would you like to know more about the Deltares Laboratory in Utrecht?
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Version 1.0, 2014

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Deltares is a leading, independent, Dutch-based research institute and specialist consultancy for matters relating to water, soil and the subsurface. We apply our advanced expertise worldwide, to help people live safely and sustainably in delta areas, coastal zones and river basins.