

BTO Executive Summary

Bioassays offer water sector possibilities to investigate neurotoxicity in water quality monitoring

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Substances with potential adverse effects on the nervous system are increasingly being found in the aquatic environment. However, hardly any effect-measurements are carried out for chemical water quality assessment with regard to neurotoxicity. Based on exploratory research, this study shows that neurotoxicity tests are in principle available for the water sector. These test methods make use of human and animal nerve cells and model organisms (bioassays). Further research is needed to determine which models and techniques are most suitable for application purposes. It is recommended that developments in the area of bioassays for neuroactive substances will be closely followed. This knowledge contributes to a future implementation of neurotoxicity tests for water quality monitoring.

Interest: presence of neuroactive substances in water requires effect-based test methods

Substances with potential adverse effects on the nervous system are found in the aquatic environment. There are many developments ongoing involving test methods (bioassays), using human or animal nerve cells and model organisms, which are aimed at demonstrating the presence of such substances and determining their possible adverse health effects. However, despite the fact that increasing numbers of neuroactive substances are being found in the aquatic environment, effect-based measurements of the chemical water quality with regard to neurotoxicity are hardly implemented.

Approach: overview of national research and relevant literature on neurotoxicity tests

When exposure to substances – for example, through food or the environment – changes the nervous system in some manner, one can speak of neurotoxicity. Humans and animals are particularly sensitive to this during their (early) development.

To study the extent to which test methods, which can monitor the possible adverse effects of substances on the nervous system, are available and applicable for the water sector, an overview of national research and relevant literature was prepared.

Results: several methods are available and applicable for the water sector

This report describes the results of exploratory research into the availability and suitability of neurotoxicity tests for the Dutch and Flemish water sector. To this end, contacts were established with academic groups and research institutes in the Netherlands in the field of neurotoxicity and/or effect-measurement of water quality. The report also outlines the relevant developments in European research projects.

The report concludes that *in vitro* neurotoxicity tests and tests with alternative organisms are available. However, further research is needed to determine which models and techniques would be the most suitable for application today and in the future. The reason for this is that neurotoxicity is a complex toxicological endpoint that is difficult to estimate with a single simple bioassay. There are bioassays that test the effects of micropollutants based on several relevant mechanisms. To estimate the probability of the occurrence of adverse health effects, a solution could be found through the use of a tiered testing strategy, which combines different methods. Within the legal and regulatory framework for the approval of substances for the chemicals, pharmaceutical and food industries, several developments are ongoing concerning the application of *in vitro* tests and tests with alternative organisms for neurotoxicity. At the same time, developments are also ongoing in this field regarding water quality monitoring. It is recommended that these developments continue to be followed.

Application: Implementation of neurotoxicity tests in the water sector in the long term

Following upon the literature study described in this research, one can focus more closely on different models and techniques. This may include defining a proposed endpoint/working mechanism, the need for specific expertise or equipment, costs and lead time. Knowledge about these elements would contribute to the development of a strategy and the implementation of neurotoxicity tests in water quality monitoring.

Report

[This research is described in the report *Bioassays voor neuroactieve stoffen* \(BTO-2020.035\).](#)