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TOXICITY OF ENGINEERED NANOCOMPOSITE PARTICLES OF VARIOUS METAL OXYHYDROXIDES TO CRUSTACEAN *DAPHNIA MAGNA*

METALLI-PÕHISTE NANOKOMPOSIITOSAKESTE TOKSILISUS VESIKIRPUDELE *DAPHNIA MAGNA*

MASTER THESIS

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SUMMARY

The objective of the current study was to assess potential hazard of eleven nanocomposite sorbent materials designed for phosphorus recovery from wastewater to aquatic ecosystems. The toxicity of nanocomposite materials' to crustacean *Daphnia magna* was evaluated in 48 h acute immobilization test (OECD202). The main hypothesis of the thesis was that due to the release of toxic Zn ions, Zn-containing nanocomposites are more toxic to aquatic organisms than the ones not containing Zn. This hypothesis was confirmed. Concentrations of the metals - main components of the tested composites - in the exposure media were measured using reflection X-ray fluorescence spectroscopy (Bruker Picofox).

The main outcomes of the study are:

1. Five nanocomposite materials out of eleven materials analysed were found to be toxic. One composite was harmful and five were non-toxic.
2. The toxicity of nanocomposites depended on their chemical composition and especially on the release of toxic Zn into exposure media. All the nanocomposites which did not include Zn were not toxic to *D. magna*.
3. Zn concentrations in the water column did not depend on the nominal concentrations in the test solutions.
4. Investigation of test organisms under the microscope revealed that at the high nominal concentrations adsorption of the composite particles on the Daphnia's exoskeleton and ingestion of the nanocomposites by daphnids may also adversely effect daphnids.
5. The elemental analysis using reflection X-ray fluorescence spectroscopy (Bruker Picofox) revealed that it is not the most suitable method to measure concentrations of Zr, Mg and Ca and that other analytical methods could be applied to quantify these metals in the aqueous solutions.
6. It was confirmed that the crustacean *Daphnia magna* is more sensitive to the tested nanocomposites compared to bacteria *Vibrio fischeri*.