Simulating Brownification – A Stressful Time for Zooplankton
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The current changing climate is altering many different natural processes in the northern latitudes. This is especially true for freshwater ecosystems such as lakes and rivers. Although often overlooked, lake ecosystems have important processes that can have a great effect on humans if they are drastically changed. As the rainfall in the temperate regions increases with climate change, it flushes more carbon from the land into freshwater ecosystems. This carbon, especially from wetlands, is rich in humic matter, which can turn the water into a darker brown colour, a phenomenon called brownification or browning. This browning effect can have varying impacts on the ecosystem, such as the reduction of light penetration, which in turn effects the growth of aquatic plants and predatory organisms that rely on clear visibility. As scientists, it is our job to learn more about these processes and how they affect the organisms in their ecosystems, and to do this, we must study brownification.

It might sound like a simple task to study brownification, but it is difficult to find the method which simulates the natural process accurately. The most common method is using mesocosms, which are scaled down lake ecosystems often in a large cylinder. This allows the variables and parameters to be controlled more easily. The next task is finding the right way to make the water brown. In recent decades, researchers have been using carbon-based commercial products HuminFeed and SuperHume for brownification experiments, with tests showing that they should be a good substitute for natural carbon. In 2016, HuminFeed was used for a mesocosm experiment at Uppsala University. After the addition of HuminFeed, the researchers noticed that the abundance of zooplankton decreased significantly. This raised the question whether the commercial product HuminFeed was to blame for this occurrence and of whether it is a good substitute for natural carbon after all.

The study I conducted was an isolated test on two types of zooplankton: a cultured water flea Daphnia magna and copepods from a typical Swedish lake, to see if the commercial products HuminFeed and SuperHume have a different effect on the zooplankton compared to a natural source of carbon collected through reverse osmosis. I conducted an immobilisation test on the Daphnia and copepods, and a reproduction test on the Daphnia. The immobilisation test was to see if the browning agents (HuminFeed, SuperHume, and reverse osmosis concentrate) had a lethal or immobilising effect on the zooplankton after 48 hours. The reproduction test was to see if the reproductive capabilities of Daphnia were compromised when they lived in the browning agent for 21 days.

Neither the copepods nor Daphnia responded to the immobilisation experiment, but for the reproduction experiment, the Daphnia in the HuminFeed treatment produced significantly less offspring after 21 days compared to the control treatment. From the same reproduction test, the Daphnia in the reverse osmosis and SuperHume treatments did not produce a significantly different number of offspring compared to either the control or HuminFeed treatments. Just from this simple result it is clear that HuminFeed does not have an effect on the zooplankton in the same way as a more natural source of carbon, as it has a stronger negative affect on their reproduction. In the future, researchers need to take this into account when choosing the right source of carbon for brownification experiments.