

Investigating the Trojan horse effect of nanoparticles on an aquatic community – An outdoor mesocosm study



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Mesocosm test facility

Outdoor facility with 13 artificial ponds of 3 m³ volume (1m water depth)



Application

Addition of a concentrated stock solution below the water surface followed by slight stirring into the water column via paddle



Sampling

of representative water samples



Sampling of plankton



Sampling of macroinvertebrates



Aim

Investigating the effects of carbon based manufactured nanomaterials (C-MNMs) on aquatic communities and their role as carrier of toxicants (Trojan horse effect)

Nanoparticles

Fullerenes (C60, Sigma-Aldrich)

Treatments:

- Control (4 replicates)
- Fullerenes C60 (nominal 20 µg/L, 3 replicates)
- Biocide triclocarban (TCC, nominal 20 µg/L, 3 replicates)
- Fullerenes + triclocarban (nominal 20 µg/L each, two replicates)



Specific questions

- How will fullerenes affect aquatic communities over a longer time period?
- Will the combination of both fullerene and biocide behave differently compared to the single compounds?



Data evaluation

- For populations
 - abundance of single taxa over time
- For communities
 - number of species/taxa
 - Diversity measures
 - Principal response curves (PRC)

First results on plankton

- Direct effects of TCC on daphnids (Fig.1), followed by indirect effects on phytoplankton (Fig.2) and rotifers (Fig.3).
- Reduced effects on daphnids in the combined treatment of TCC and C60 (Fig.1)
- Slight reduction of phytoplankton measured as chlorophyll-a concentration in both C60 treatments (Fig.2)

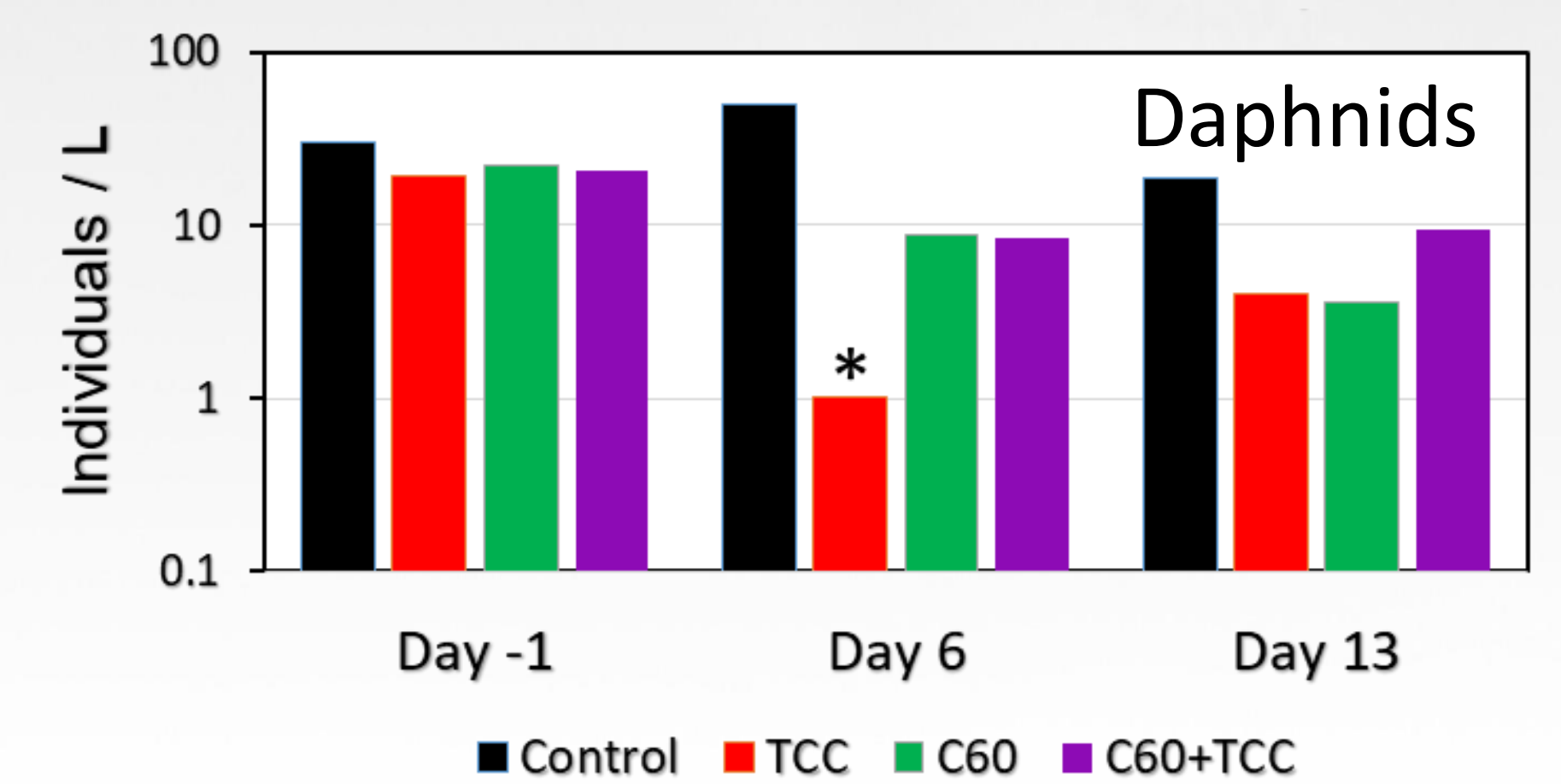


Figure 1: Mean Daphnia densities before (day -1) and after application for the tested treatments. *: significant difference (p<0.1)

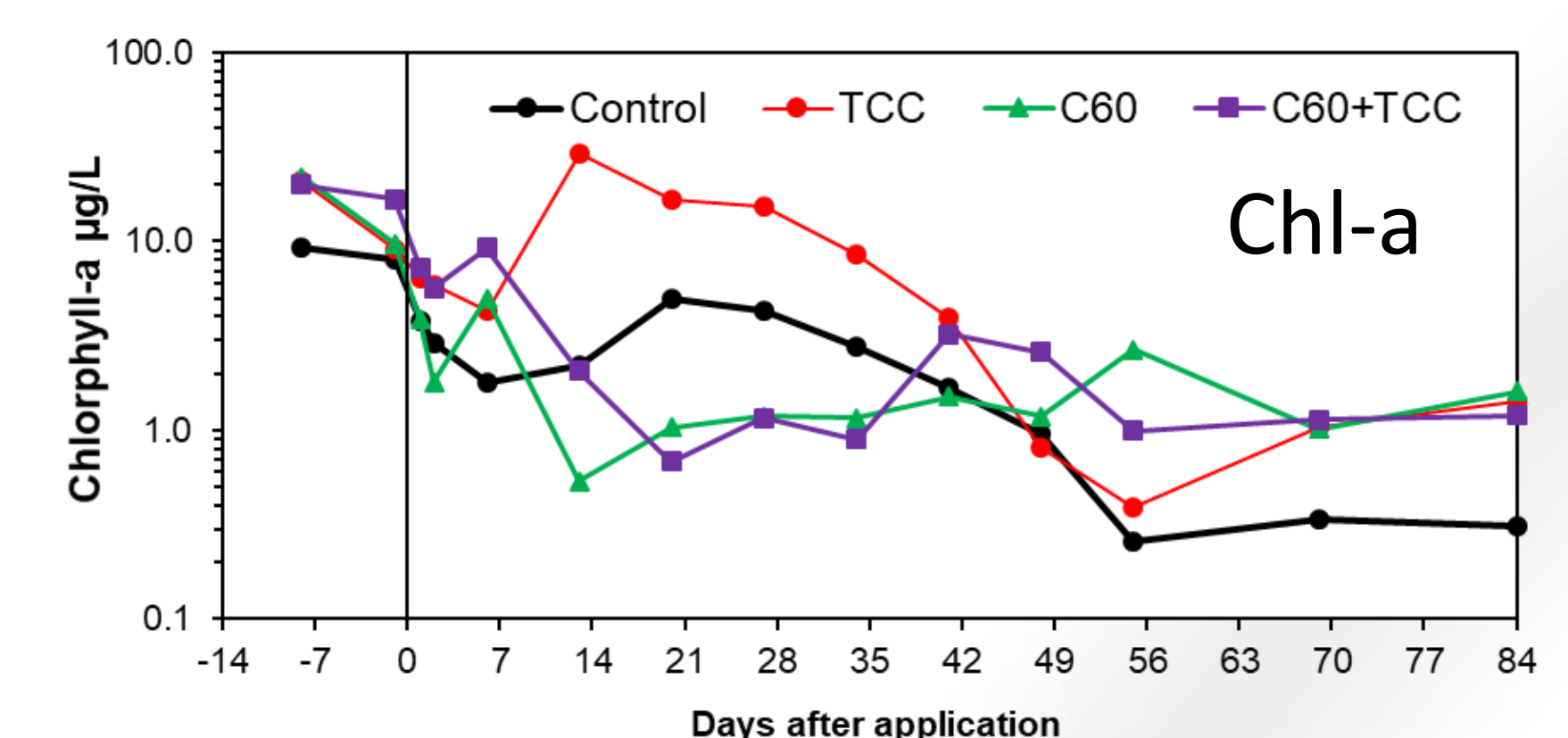


Figure 2: Mean chlorophyll-a concentrations during the study as a surrogate parameter for phytoplankton biomass.

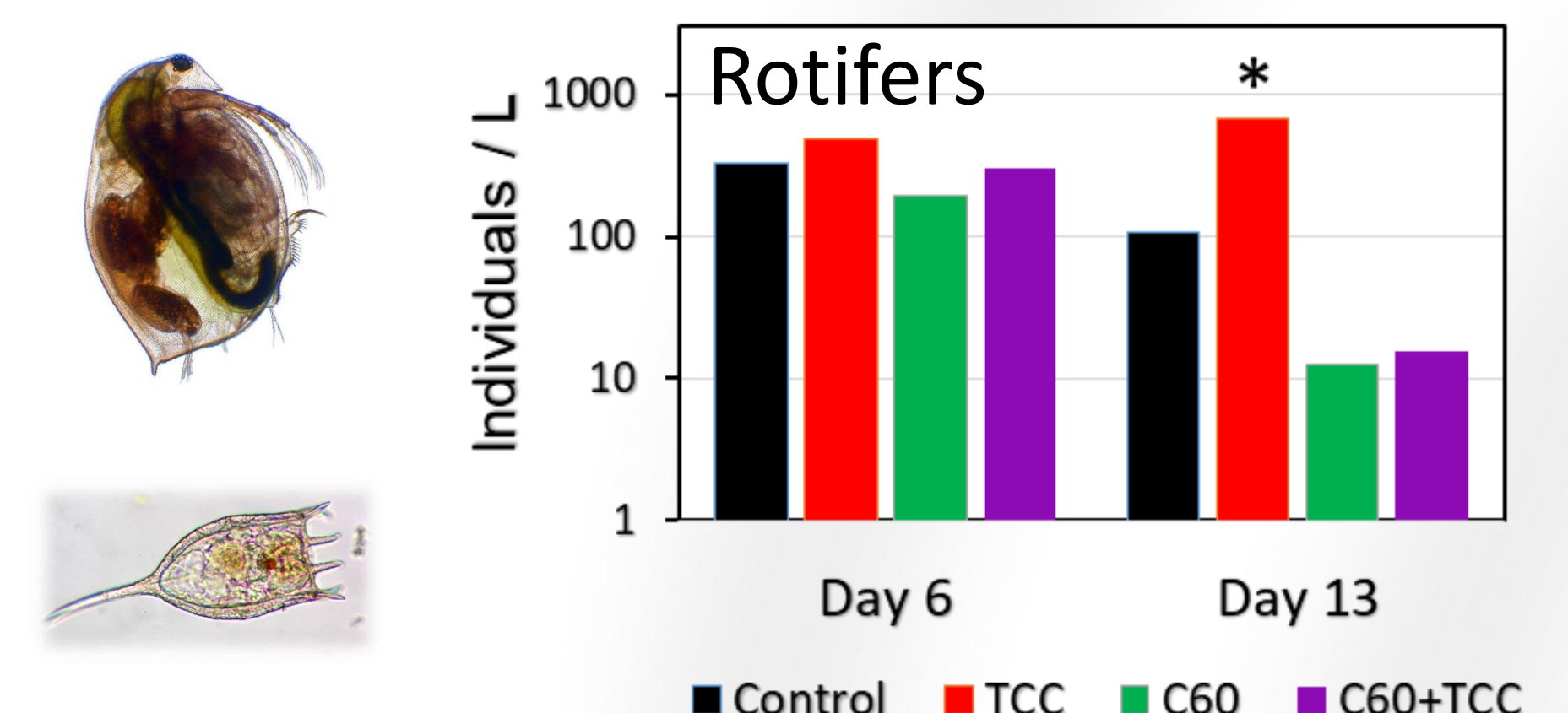


Figure 3: Mean rotifer densities 6 and 13 days after the application for the tested treatments. *: significant difference (p<0.05)

The fate of the test compounds, the benthic macroinvertebrates and the emerged insects are under evaluation.

Preliminary conclusions

- The presence of fullerenes might reduce the direct effects of TCC
- A negative impact of fullerenes on phytoplankton can not be excluded