Biodegradable microplastics are less toxic than conventional ones to *Daphnia magna*

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Production of biodegradable plastics is increasing but degradation of these polymers is slow in non-optimal environments. Faster degradation and fragmentation of bioplastics may therefore become a source of Microplastic particles, which is provoking the need for studies of their effects.

**METHODS**

We conducted 3 experiments to evaluate effects by 3 materials: The plastics Polystyrene and Poly-Lactic Acid (PLA is biodegradable), and Kaolin a naturally occurring clay mineral used as a reference particle.

1. *Daphnia magna* feeding test (72 h exposure):  
   - 6 ind. replicate (≤8 d old)  
   - 4 treatments – Control Algae, Control Kaolin, PS and PLA  
   - 3 Endpoints – Feeding rate, size and mortality

2. *D. magna* reproduction test (~19 d exposure):  
   - 1 ind. replicate (≤8 d old, from the feeding test)  
   - 4 treatments (same as 1)  
   - 1 Endpoint – Population growth rate

3. *Nitocra spinipes* acute toxicity test (96 h):  
   - 10 ind. replicate  
   - 2 Controls (+/- surfactant) and PS leachate

**RESULTS**

- PS exposure resulted in higher average mortality relative to the other treatments, i.e. 17 % compared to Controls: 0 % and PLA: 3 %.
- PS had a negative effect on feeding ($t_{1,13} = -7.4, p < 0.001, ***$).
- PLA and Kaolin did not affect feeding or size.

- Population growth, the intrinsic rate of increase ($r$), was calculated per replicate with the Euler–Lotka equation. PS had a negative effect compared to Control Algae ($t_{1,13} = -4.3, p < 0.001, ***$).
- No effects were observed by PLA or Kaolin.

**CONCLUSIONS**

PLA had no effect on any of the investigated endpoints at this high particle test concentration.  

PS exposure decreased *D. magna* feeding rate, which resulted in a decreased reproductive growth.

The majority of particles were <10 µm, for all materials, still the particle sizes’ contribution to total volume differs much for PS compared to PLA and Kaolin.  

A small difference in size distribution may cause large effects, as for PS. Whether the specific size was responsible for the observed toxicity remains uncertain.

Food dilution is recognized as one cause for negative effects by MP ingestion. It may depend on both number of ingested inert particles and their volume in the gut.

Are equal particle concentrations and continuous resuspension enough for comparable exposures?

**Acknowledgement**

This work is being conducted within projects WEATHER-MIC, iPLAST and MICROPOL, which are supported through the Joint Programming Initiative Healthy and Productive Seas and Oceans (PHO-Oceans), Swedish Research Council for Environment, Agricultural Sciences and Spatial Planning (FORMAS), the joint Baltic Sea research and development programme (BONUS) and the Swedish Innovation Agency VINNOVA.