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Effect of Environment-Like Amount and Environment-Like Shaped PET-microparticles (3-7 μm) on Chlamydomonas reinhardtii and Chlorella vulgaris

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Extended Abstract

The amount of plastic particles in the environment is constantly increasing, with the amount of deposition being highest in terrestrial ecosystems [1], from where the plastics then flow into the world's oceans [2]. *Chlamydomonas reinhardtii* is an important photosynthetic model organism for ecotoxicological purposes. Recently, the importance of this alga in biotechnology and green industry has begun to grow. *Chlorella vulgaris*, on the other hand, is a very interesting dietary supplement. Here we describe the data obtained by exposing these algae to PET microparticles (1-5 μm in diameter).

At the same time, research into plastic micro/nano-particles is increasingly emphasizing the analysis of 'natural' particles (i.e. not industrial templates in the shape of a perfect sphere – especially polystyrene templates), [3]. In addition, many studies use non-physiological amounts of particles that are not found in the environment [4]. In this work, we focus on the effect of environment-like amount and environmental-like shape of PET (polyethylene terephthalate) microparticles on *Chlamydomonas reinhardtii* and *Chlorella vulgaris.*

The synthesis of the particles (3-7 μm) was carried out according to article [5] from particles with a size of 125-500 μm in trifluoroacetic acid. The result was a solution of microparticles (0.05 g/ml) with dimensions of 1-5 μm (thus a 100-fold reduction), which were homodisperse. Zeta potential was -25, indicating stability in water solution. The results of EDS analyses showed the absence of fluorine. After washing three times with ddH_2O, the pH was 1. The particles had to be washed 10 times before the pH reached values between 6-7. The initial tested amount of particles was 2.5 mg, which corresponds to the lower plastic concentration found in oceanic gyri (2.5 kg/km^2), [6]. This was followed by 5 mg/l (2x more than in oceanic gyri), 10 (4x more), 20 (8x more), 40 (16x more), 60 (32x more), 80 mg/l (64x more). Based on the growth curves, 10 and 20 mg/l appear to be stimulating the growth of both *Chlorella* and *Chlamydomonas*. On the other hand, a concentration of 80 mg/l is probably harmful. To prove this hypothesis, we performed visualization of DNA damage, lipid peroxidation and ROS generation and it has not shown significant difference between treatments (5 mg vs. 80 mg). However, the CRYO-SEM results indicated damage to the *Chlamydomonas* cell wall even at low and high concentrations (5 mg and 80 mg).

These results are interesting in the context of oceanic and freshwater plastic pollution. Low concentrations of plastics, which are close or equal to current values in ocean gyri, seems to be at least stimulating for eukaryotic algae. However, this does not mean that these particles do not pose a risk to higher organisms. Due to the fact that algae are based on the food chain, this risk is even higher due to the possibility of particle attachment and accumulation on their surface.

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