Effect of microplastics as vectors of emerging contaminants in plant development

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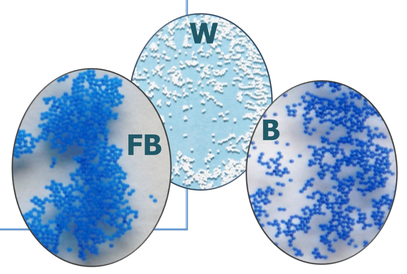
INTRODUCTION

MPs potential impacts in terrestrial ecosystems remain largely unexplored despite numerous reported effects on marine organisms. It is estimated that roughly 32% of plastic waste might find its first receptacle in soils or continental aquatic ecosystems. In fact, approximately 80% of plastic waste have accumulated in landfills and the natural environment.

Sewage treatment plants might also be significant sources for continental systems because the untreated domestic sewage is rich in fibers from clothing and microplastic beads from personal care products, among others.

The presence of MPs in the terrestrial system can have harmful effects on different processes, not only their presence but their capacity to carry other contaminants, affecting indigenous organisms of the soil / water system.
This makes them vectors of contamination with the consequent risk of dispersion of emerging pollutants.



Emerging Contaminants

(Simazine, Ibuprofen….)

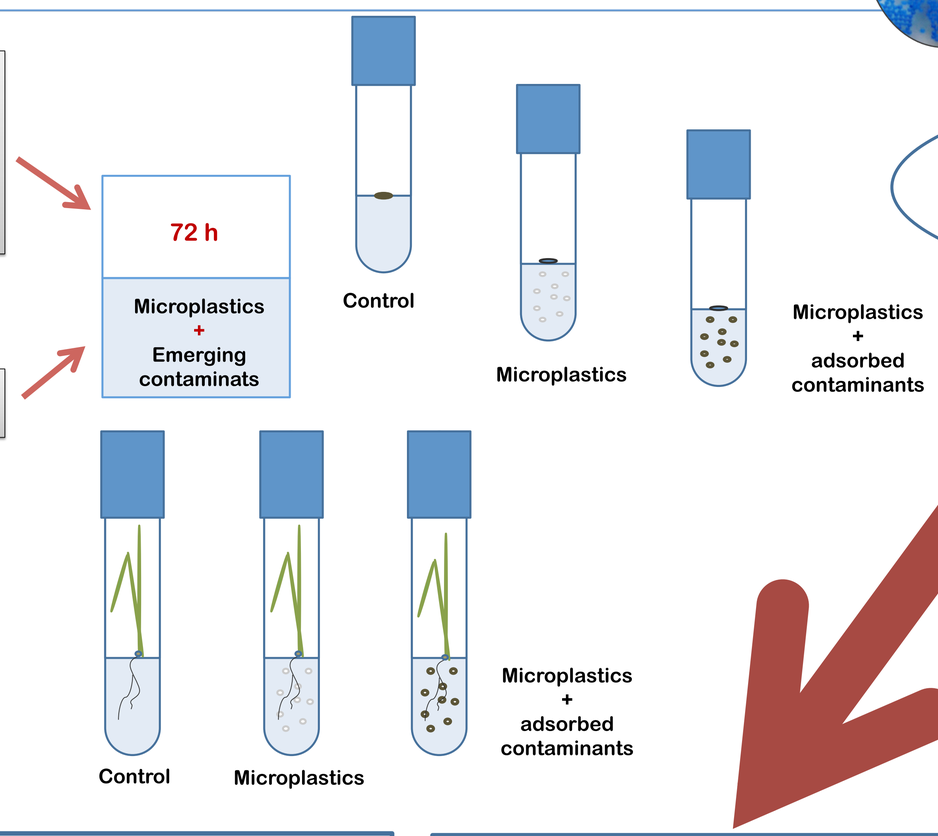
Could microplastics adsorbe emerging contaminants and carry them to plants?

MICROPLASTICS

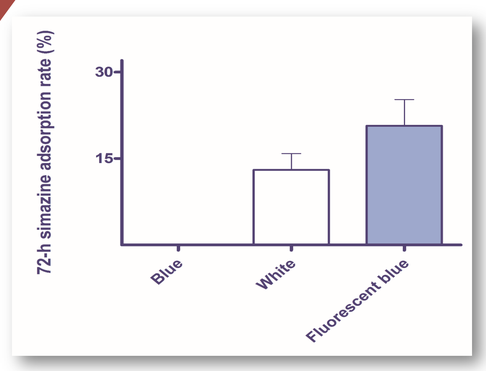
- (B) Blue polyethylene microspheres (212-250 µm)
- (FB) Fluorescent blue polyethylene microspheres (250-300 µm)
- (W) White polyethylene microspheres (250-300 µm)

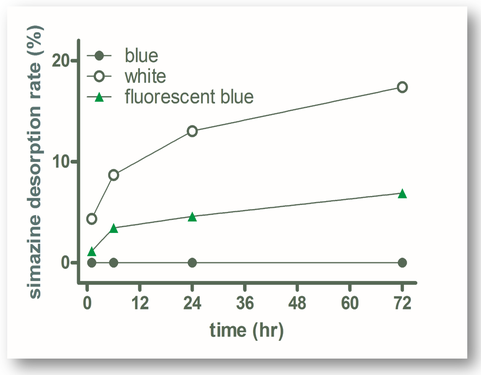
EMERGING CONTAMINANTS

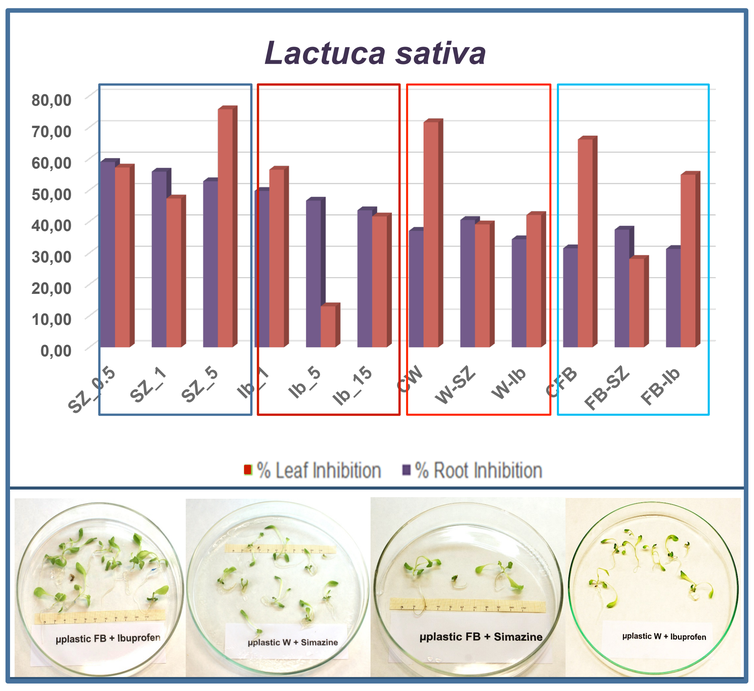
- Simazine (0, 0.5, 1.0, 5.0 µM)
- Ibuprofen (1.0, 5.0, 15.0 µM)

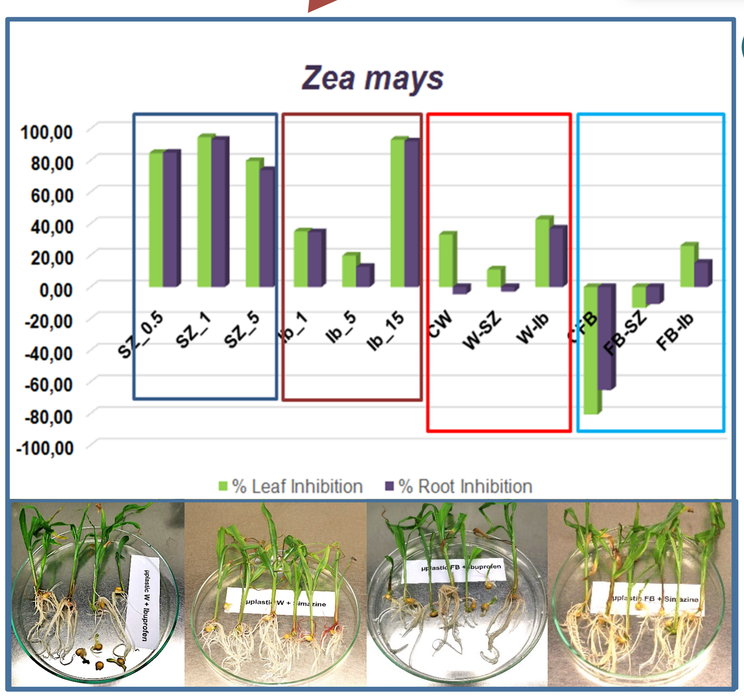


MPs as vectors of emerging contaminants





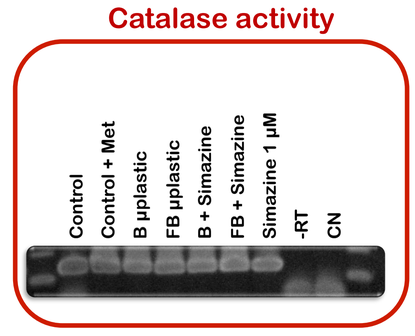




Which could be the toxicity mechanisms?

Reactive oxygen species (**ROS**) is the main molecular initiating event associated to toxic environments, as microplastic contamination. ROS appearance may results in increased mortality, decreased growth and reproduction failure.

Catalase activity

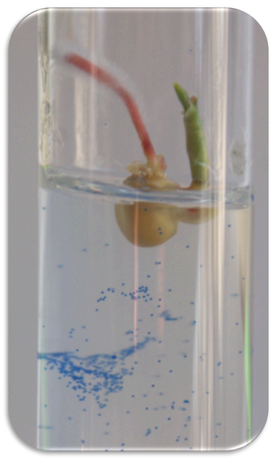


Our first analyses did not show significant differences among treatments. Further analyses are required.

Influence of µplastics on growth of leaves and roots from *Zea mays* and *Lactuca sativa* germinating seeds was evaluated.

In *L. sativa*, root growth was more sensitive to the chemicals tested (Simazine and Ibuprofen) than to the µplastics, alone or combined with the chemicals. Leaf development inhibition was mainly observed in µplastics (whithout chemicals) and the highest Simazine concentration tested.
In *Zea mays*, different responses were observed for each treatment. Inhibition of root and leaf length due to Simazine effect was similar to the observed in *L. sativa.*

Z. mays was less sensitive to Ibuprofen than *L. sativa*, except for the highest concentration tested. And was also considerably less sensitive to the effect of µplastics (alone or combined with the chemicals), specially when fluorescent-blue µplastics were used.
In most of the treatments, the inhibitory responses of root and leave growth were similar.



Conclusions

- ✓ **The bioassay-set used in this study was an efficient monitoring tool to assess the MPs toxicity in terrestrial plants**
- ✓ **The observed toxicity is mainly due to the presence of emerging contaminants, rather than to the effect of the MPs**

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