Environmental toxicity evaluation of PET-Ag new polymeric nanocomposites with multitrophic bioassays batteries

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Abstract:

In the packaging industry, silver NPs have attractive proprieties that make them appropriate for being combined with PET, the most commonly used polymer in this sector. Nevertheless, silver NPs have a potential ecotoxicity that could limit the use of PET-silver composite.

The characteristics of Sivler NPs, freshly made and weathered composite were analyzed. PET-Ag ecotoxicity was evaluated in organisms from different food chain levels and it was compared to Ag NPs ecotoxicity.

The composites possessed around 4 % of NPs stably and uniformly scattered in the polymeric matrix. ZnO NPs turned out to be extremely toxic to Pseudokirchneriella subcapitata and toxic to Daphnia magna and Brachionus plicatilis. PET-Ag was not toxic to any of the organisms, and its weathered form only presented a moderate toxicity to P. subcapitata.

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References

Figures

Table 1. Ecotoxicity test conducted

Compartment	Organism	Endpoint*	Description	Standard
Freshwater	Daphnid *(Daphnia magna)*	LC_{50}	Acute immobilisation test	OECD 202
Freshwater	Algae *(Pseudokirchneriella subcapitata)*	NOEC	Freshwater algae and cyanobacteria, growth inhibition test	OECD 201
Estuarine/ marine water	Rotifier *(Brachionus plicatilis)*	LC_{50}	Acute mortality of the test organisms	ASTM E1440-91
Sediment/ soil	Earthworm *(Eisenia foetida)*	NOEC – EC_{50}	Acute mortality of the test organisms	OECD 2007

Soil	Higher Plants *(Monocotyl Sorgho - Sorghum saccharatum)* *(Dicotyl garden gress - Lepidium sativum)* *(Dicotyl mustard - Sinapis alba)*	Decrease seed germination Growth inhibition	3 day germination and root growth inhibition test	ISO 11269-1, OECD 2008

* LC_{50} = Median lethal dose; NOEC = No Observed Effect Concentration; EC_{50} = Half maximal effective concentration