

Terrestrial ecotoxicity of green concrete containing PET plastic waste

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PROBLEM DEFINITION

Plastic waste, especially PET, has become a major environmental challenge due to its widespread use and persistence. Incorporating waste PET into concrete as a partial aggregate replacement offers a potential recycling pathway, supported by the enormous global scale of concrete production. Even small substitution levels could divert significant PET volumes from landfills and natural ecosystems. However, PET-modified concrete raises important end-of-life concerns, including the possible release of PET fragments or microplastics during degradation or crushing, as well as the leaching of chemical compounds under environmental stress. These uncertainties highlight the need for comprehensive environmental assessment of such materials.

OBJECTIVE

Determination of terrestrial ecotoxicity of green concrete containing PET plastic waste.

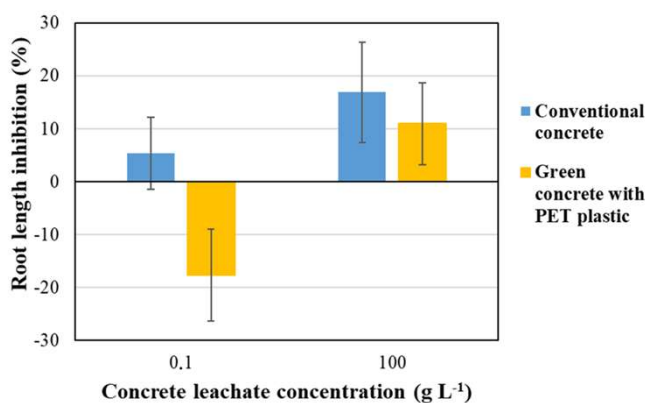
MATERIALS AND METHODS

- Conventional and green concrete with PET plastic waste as 5 vol.% aggregate replacement were prepared.
- Grinded concrete particles were used for leachate preparation.
- Leachates were prepared using growth medium and concrete particle concentrations of 0.1 g L⁻¹ and 100 g L⁻¹ in accordance with the standard EN 12457-4:2002.
- Mustard seeds were placed on the filter paper and 3 mL of concrete leachate was added. The Petri dish was covered and incubated in complete darkness for 72 hours. After incubation, the root lengths of the mustard seedlings were measured.



Leachate preparation.

RESULTS



Results of mustard seed germination test.

- At 0.1 g L⁻¹, conventional concrete caused slight root inhibition, while PET-modified concrete stimulated root growth.
- At 100 g L⁻¹, both leachates indicated toxicity, but PET-containing concrete showed weaker inhibitory effect than conventional concrete.
- Green concrete with PET plastic waste appeared less toxic to mustard seed root development across both concentrations.



Mustard seed roots after germination test in 100 g L⁻¹ concrete leachates.

CONCLUSIONS

- ▶ At low concentrations, PET-concrete stimulated root growth, unlike conventional concrete.
- ▶ Green concrete containing PET plastic waste showed lower phytotoxicity, indicating that PET waste particles did not increase toxicity.
- ▶ PET plastic waste incorporation has environmental potential, but high-dose effects still highlight the need for further assessment.

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