

**The increasing impact of micro- and nanoplastics (MNPs) on soils is a major environmental concern. These pollutants, which originate from a variety of sources such as waste and agriculture, are causing widespread contamination at increasing concentrations. However, the precise effects of this contamination on soil ecosystems remain largely unknown, raising significant difficulties in assessing ecological risks.**

## 1. Selection of test materials for micro- and nanoplastics

Research into the ecotoxicological effects of MNPs in soils requires test materials that accurately reflect environmental conditions. Currently, studies mainly use pristine spherical MNP, but these do not always represent the diversity of MNPs present in soils, which can lead to biased conclusions. To obtain more accurate assessments, it is crucial to prioritize the most important particle types in terms of exposure and hazard, taking into account the dominant sources of MNP pollution in soils. The preparation of these test materials requires a considered approach to reproducing environmental conditions, such as the fragmentation of plastics to reflect natural processes. In addition, thorough characterization of MNPs is essential, including size, shape, chemical composition and presence of additives, for accurate interpretation of ecotoxicological results. International collaboration is

needed to harmonize methods for the production and characterization of MNP test materials, and to develop protocols for the production and certification of reference materials. In addition, the transparent communication of information on MNPs used in ecotoxicological studies and the conservation of these materials for future testing are recommended to ensure reproducibility of results. Further efforts are needed to establish more robust characterization protocols, including the detection and identification of additives present in MNPs, to better understand their interactions with organisms and ecosystems.

## 2. Testing the hazards of MNPs

Research into the hazards of MNPs highlights the critical importance of accurately selecting the exposure concentrations used in ecotoxicity tests. To achieve this, we need to account for:

- Variability of MNPs concentration

in real environments;

- Homogeneity of the MNP enriched-soil preparation to ensure the reproducibility of tests;
- Careful selection of doping and mixing methods to minimize experimental bias.

With regard to the mode of exposure of organisms, it is crucial to determine the most relevant tests based on the biology of the organisms being studied and the specific objectives of the study. Although exposure by ingestion is often preferred, other modes of exposure must also be considered.

For more accurate environmental assessments, more realistic testing approaches, such as mesocosm or field experiments, are recommended. In addition, it is important to consider interactions with other stress factors present in the soil, such as pesticides, as well as the effects of climate change on plastic pollution in soils..

### 3. Biota and soil analysis

Assessing the ecotoxicological risks of MNPs in soils requires extraction and analytical methods that cover all particle sizes present. However, the accurate detection of MNPs is often limited by technical constraints, particularly for the smallest particles. It is recommended to check for:

- Contamination of the soil or food;
- Assess the homogeneity of the MNP distribution;
- Analyse the ingested MNPs to assess the potential for trophic transfer, crucial to differentiate between toxic effects associated with plastic particles and those associated with PAs;
- Analyse of soil physico-chemical properties is essential, as MNPs can alter these properties, which can have an indirect effect on the health of soil organisms;
- Perform Quality assurance/quality control to ensure the reliability of data generated during ecotoxicity testing.

### 4. Conclusion

Research on MNPs in agricultural soils requires precise strategies for assessing environmental hazard.

It is crucial to select test materials representative of real-life conditions, making sure samples are homogeneous, and establish proper assessing methods. This will help analysing the real impact of MNPs on health and on the environment.



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