Characterization, fate and in vitro dosimetry of ENMs - Main CIDETEC contributions on RiskGONE project

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Physicochemical characterization, fate and in vitro dosimetry are very important information when using a nanomaterial. In this way, CIDETEC Nanomedicine's main task within WP4 was to contribute to the characterization of ENMs, producing guidance documents and demonstrating their applicability to a wide range of ENMs. The data obtained was then used to estimate in vitro dosimetry using DeLoid DG model. Finally, an assessment of the applicability for ENMs of the OECD methodology for environmental fate of chemicals was performed.

Task 4.1 Characterization of ENMs (LIST, UNIVE, CSIC, CID, NILU)

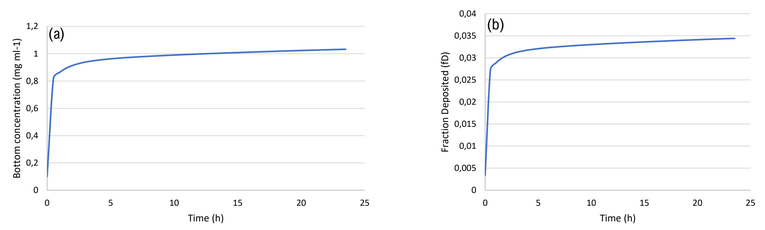
The main contribution of CID in this task include:

Property	Method	Main achievements
Dispersability of ENMs (DLS) and Zeta Potential	DLS	• Evaluation of guidance document and participation on Round Robin exercises • Participation in RR of Malta initiative
Hydrodynamic diameter and size distribution	DLS	• Consolidated pre-validated guidance document on hydrodynamic diameter and size distribution determination **(D4.2)**
Effective density of suspended ENMs	VCM*	• Consolidated pre-validated guidance document on effective density (D4.7) • Participation on RRs exercises

* VCM: volumetric centrifugation method (Deloid GM, et al. Nat Protoc, 2017;12:355–71)

Task 4.3 In vitro dosimetry (CID, LIST)

- Based on distorted grid (DG) model (Deloid GM, et al. Nat Protoc, 2017;12:355–71), which resulted useful to estimate dose metrics of TiO_2 nanoparticles.



Fate and transporting modelling results of TiO2 nanoparticles used in this project. (a) Well-bottom TiO_2 concentration over time of simulation. (b) Fraction of TiO_2 deposited (f_D) over time of simulation.

Task 4.2 Environmental fate of ENMs (CID, LIST, IMI, QSARL)

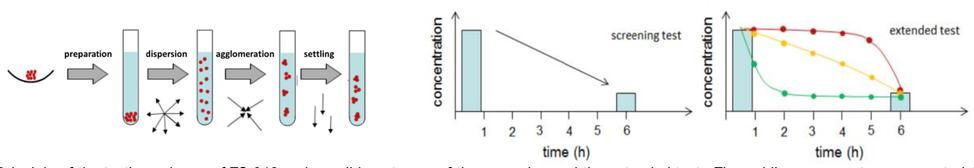
Main achievement: Report on the applicability of OECD TGs for determination of the environmental fate of ENMs (D4.8)

1) **Detailed analysis** of the procedures reported by **OECD TGs** taking into account the OECD regulatory documents, expertise of partners and outcomes of other European initiatives, such as NanoFASE and NanoREG projects.

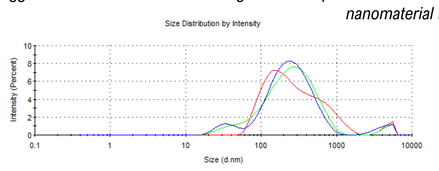
Proposed TGs for the evaluation of applicability of OECD methodology for ENMs.

OECD guideline	Property	Compartment
TG106	Adsorption-desorption using a batch equilibrium method	soil
TG312	Leaching in soil columns	soil
TG116	Fat solubility of solid and liquid substances	fat
TG111	Hydrolysis as a function of pH	water
TG318	Dispersion stability of nanomaterials in simulated environmental media	water

2) **Experimental assessment of the proposed methodology** by testing representative ENMs (Ag, ZnO, CuO)
- Guidelines selected: TG 318 and TG111



Principle of the testing scheme of TG 318 and possible outcome of the screening and the extended test. The red line represents a nanomaterial that agglomerate in contact with simulated environmental media but does not settle. The yellow line represents a nanomaterial that continuously agglomerates and settles out. The green line represents either a nanomaterial that quickly agglomerates and settles (high density) or a heterogeneous nanomaterial that contains two different fractions



Hydrodynamic size distribution of Ag nanoparticles in water obtained by DLS

All selected TGS were applicable to ENMs, but some adaptations of the methods may be required and are being furtherly evaluated by RiskGONE partners to see if they can be translated to OECD.

Task 4.4 Preparation of training material (CSIC, all)

Preparation of training materials, such as:
- SOPs:
  - Measurement of hydrodynamic diameter and size distribution using dynamic light scattering (DLS)
  - Measurement of effective density of ENMs using volumetric centrifugation method (VCM)
- Training video about volumetric centrifugation method (VCM)

This project has received funding from the European Union's Horizon 2020 research and innovation programme under agreement No 814425

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Final Consortium Meeting
Madrid, 15th 06 2023