PATROLS
Advanced Tools for NanoSafety Testing

LEVITATT (LED Vertical Illumination Table for Algal Toxicity Test)

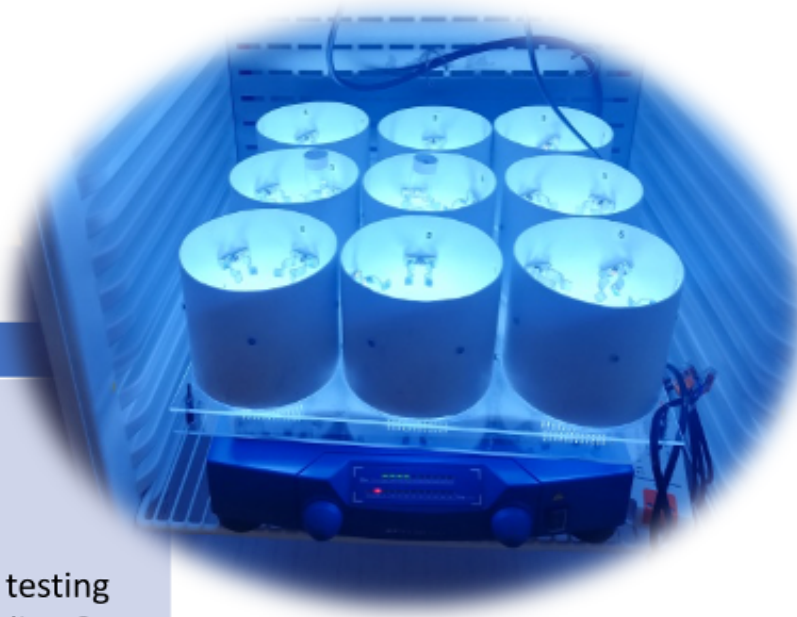
A small-scale setup for testing algal toxicity of nanomaterials and other difficult substances

Background

Ecotoxicity data is a requirement for pre- and post-market registration of chemicals by European and international regulations e.g. REACH. The algal toxicity test is one of three mandatory tests under these regulations, and international guidelines have been developed for this test to ensure highly reliable results.

Challenge

Maintaining stable and uniform conditions during algal testing (e.g., in terms of pH, temperature, carbon dioxide levels and light intensity) is generally challenging and specifically difficult for nanomaterials as well as for other so-called difficult substances that interfere with e.g. light. This causes a large variation in results obtained when carrying out algal test, hampering the reliability and reproducibility for nanomaterials and hence their regulatory acceptance.



Features of LEVITATT

- Compact size
- Homogenous light field
- Ease of increasing/decreasing light intensity
- Temperature easily controlled
- Constant CO_2 influx enable pH stability during testing
- Sufficient sample volume for destructive sampling & biomass determination
- Testing of volatile compounds
- Easy to implement in regular laboratories

This project has received €12.7M in funding from the European Union's Horizon 2020 research and innovation programme under grant agreement 760813

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Solution

To address these challenges, we have developed a testing platform, LEVITATT (LED Vertical Illumination Table for Algal Toxicity Tests), that counters issues of intra-sample shading and ensures a homogeneous distribution of light for all samples using LED illumination from below. Furthermore, LEVITATT enables pH control during the incubation by a steady influx of atmospheric CO_2 as well as the use of a fixed CO_2 concentration in vial headspace (e.g. for volatile substances), versatile biomass determination methods and choice of test container material, well-defined defined light conditions which can be varied according to needs, and sufficient replicate volume to allow sampling for characterization and quantification of nanomaterials before, during and after testing. Additionally, the setup allows for determination of advanced sub-chronic endpoints such as changes in algal pigmentation.

The LEVITATT testing setup was name as an "Excellent Innovation" by the European Innovation Radar

Performance

LEVITATT has a compact design enabling transferability to a wide range of laboratories due to the limited resource and equipment required to implement the test setup. The test setup complies with ISO standard and OECD guidelines for algal toxicity testing and has been successfully validated with reference toxicants as well as applied for testing of nanomaterials - TiO_2, ZnO, CeO_2 and $BaSO_4$.

Documentation:
Skjolding, L.M., Kruse, S., Sørensen, S.N., Hjorth, R., Baun, A. (2020) A Small-Scale Setup forAlgal Toxicity Testing of Nanomaterials and Other Difficult Substances. J.Vis.Exp.,e61209, doi:10.3791/61209.

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