A common European approach to the regulatory testing of nanomaterials

Methods for the use of simulation approaches – Deliverable 3.3

Introduction

During the lifecycle of nanomaterials, workers, consumers and the environment are exposed to these materials because of all kinds of activities and processes like, for example, production, handling and packaging, washing out (textiles containing nanomaterials), aging (plastics with nanomaterials in surface water), sanding (paint with nanomaterials) etc. To be able to assess the effects and risks of human- and environmental exposure to these "released nanomaterials", it is necessary to quantify these releases.

Task 3.2 of the NANoREG project is aimed at establishing and describing methods to quantify the release as mentioned above for selected processes and nanomaterials (so called exposure scenarios). Deliverable 3.3 reports the results of this task by providing a compendium of protocols for applying the test methods. The actual application of the methods to generate data for risk assessment will be done by Task 3.3 and reported in Deliverable 3.2 (for dustiness tests) and 3.7 (other tests).

Description of the work carried out.

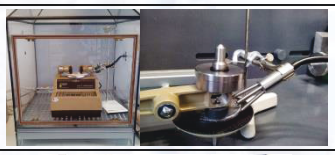
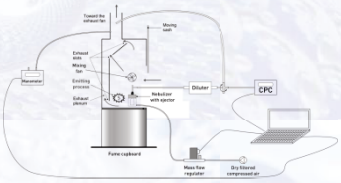
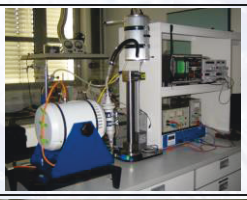
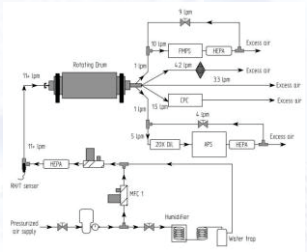
A selection has been made of available Standard Operating Procedures (SOPs) that could be used to simulate, in controlled conditions, the release of nanoparticles in the main compartments where exposure is more likely to occur: i.e. indoor air, outdoor air, environmental waters. Furthermore several procedures for reproducing processes where dry powders are handled, which are known to generate aerosols, have been identified for incorporation in the compendium mentioned before (e.g. Dustiness testing strategies).

For practical reasons the selection has been limited to SOPs available to partners contributing to this task and that could be evaluated during the project (i.e. having the required equipments in the consortium). Some of the selected protocols and methods have been partially developed and evaluated within other projects like CEN Dustinano (harmonized approach for evaluating dustiness for nanopowders), the NanoRelease initiative and MARINA (test rig for particle release during a process simulating high-energy abrasion -sanding- of solid composite materials). The protocols were written as generic as possible in order to by applied to various products and materials and to cover a wide range of activities without being focused on a specific critical exposure scenario.

Materials have been selected for evaluating the protocols (e.g. paints containing TiO_2 nanoparticles, wood stain containing CeO_2, cement doped with TiO_2, …). The results of this evaluation will be reported in D3.7.

Main Results

The table below gives an overview of the methods for which protocols have been described in the deliverable including information on the field of application.

Method	To be applied on	
Nanoparticle release from textiles to the water compartment during washing cycles	Textiles impregnated with: - Mixture of TiO_2 nanoparticles and AgCl, - two different sized Ag nanoparticles.	
Nanoparticle release from polymers to the water compartment during accelerated aging.	Polypropylene, polyamide, poly urethane doped with nanosilica and clays (Montmorillonite)	
Nanoparticle release during sanding processes.	Nano enabled paints, coatings and nanocomposites with nanofillers such as SiO_2, TiO_2, ZnO	
Nanoparticle release during environmental aging.	Nano enabled paints, coatings and nanocomposites with nanofillers such as SiO_2, TiO_2, ZnO	
Release rate for processes placed under fume cupboards.	Processes placed in fume cupboards (or equivalent) emitting ultrafine or nano-sized particles (Chemical vapor deposition reactors, flame spray pyrolysis, weathering processes, lab grinders, spray drying, weighing or transferring of powders, cleaning…)	
Controlled generation of aerosols from nanomaterials (carbon nanotubes and fibers) using the Shaker-Method.	Carbon nano tubes and fibers in a test chamber to determine dustiness behaviour or to compare measurement instruments. This Standard Operating Procedure (SOP) is not valid for granular biopersistant particle (GBP).	
Controlled generation of aerosols from nanomaterials (granular biopersistent particles) using the Shaker-Method.	Dry/powder nanomaterials, more specific GBP – granular biopersistent particles, to determine dustiness behaviour or to compare measurement instruments. This Standard Operating Procedure (SOP) is not valid for fibrous nanomaterials.	
Agitation method to test dustiness: small rotating drum (SD) method.	The method is used to characterize nanomaterial powders in order to determine their dustiness indexes. The small rotating drum (Figure 24) was designed as a downscaled version of the EN 15051 rotating drum while maintaining important test parameters. This enabled testing of smaller material amounts (~6g).	
Agitation method to test dustiness: vortex shaker (VS) method.	The vortex shaker method is used to characterize nanomaterial powders in order to determine their dustiness indexes with supposedly higher energy than SD which participates to de-agglomeration processes. This method enabled testing of very small material amounts (~0.5 cm^3).	

For more details about NANoREG please visit the official website www.nanoreg.eu.

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