

Toxicological profile of bioaerosols in industrial and urban scenarios – case studies in the framework of worker risk assessment

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Exposure assessment to nanomaterials (NMs) in industrial workplaces shows that the handling of manufactured NMs may give rise to occupational exposure to primary NPs (which have their origin in the emission resulting from industrial activities, or due to background aerosols), but also urban environments are susceptible to present them.

Emerging and Newly Identified Health Risks¹ found that there were proven health hazards associated with a number of manufactured nanomaterials. Not all nanomaterials necessarily have a toxic effect, however, and a case-by-case approach is necessary while ongoing research continues, and the concern about them has been subject of numerous studies.^{2,3} The health impacts deriving from inhalation of NPs results from their capacity to penetrate into the deeper sections of the respiratory tract due to their small size has been established.⁴

The present work aims to assess the toxicological profile of bioaerosols sampled on both industrial and environmental places, focusing in the evaluation of occupational exposure to engineered nanoparticles under real-world operating conditions in the plastic sector. Apart from the toxicological study, the approach also contemplated the characterization of NPs exposure (physical, morphological, chemical) and the characterization of the handled nanomaterial (dustiness), in order to be able to make a better interpretation of the data resulting

Therefore, framing the worker exposure study in a risk assessment approach, the toxicological profile of samples collected in workplaces were assessed. Considering inhalation as the most common route of exposure, cytotoxic assays were developed under the adenocarcinomic human alveolar basal epithelial cell line A549 through the MTT Proliferation Assay. Samples in bioaerosol form were collected in cell culture medium by a BioSampler®.

The trend in the results in toxicity assays showed moderate cytotoxic effect of the bioaerosols, with an average cell viability of 65%. By not discriminating by nanoparticle, the study of bioaerosols does not lead to the conclusion that there is a potential effect for the specific nanomaterials studied here or not, but it is very important to have an idea of the effect that the work environment can have for workers. Proper air quality monitoring to detect the presence of NPs in the environment can be a good starting point for the proper risk assessment and management associated with NMs.

References

- [1] Commission Decision 2008/721/EC of 5 August, OJ 241/21
- [2] Wijnand E., et al. Journal of Environmental Monitoring 14(2), 334, 2012.
- [3] Brouwer D. Toxicology 269 (2-3), 2010, 120-127.
- [4] Oberdöster G. International Archives of Occupational and Environmental Health 74, 2000, 1-8.

Figures

Figure 1: (BioSampler adapted to the BioLite+ Pump sampling bioaerosol during working operations in a graphene-based materials company).

