Characterisation of bioaerosols and evaluation of biological risks at the workplace: recent advances and perspectives

P. Duquenne[1]

[1]Department of Pollutants Metrology, Institut National de Recherche et de Sécurité (INRS), Vandœuvre-Les-Nancy, 54500, France

Keywords: bioaerosol, occupational exposure, method and strategies

Presenting author email: philippe.duquenne@inrs.fr

Microorganisms are microscopic living organisms that are ubiquitous in the environment. These microbial entities, their components and metabolites can get airborne at occupational settings from process they are involved in or during handling of contaminated matters. The aim of the conference is to give a summary of the actual knowledge about occupational bioaerosol exposure including measurement methods and strategies, exposures levels and determinants, main health effects, data interpretation and mitigation.

The presentation quickly browses the technics and strategies at the moment available for the characterisation of bioaerosols at the workplace. The corresponding methods investigate either the biological, physical and biochemical properties of airborne microbial particles. The measurable microbial features include entire cells (isolates and agglomerates) and compounds such as DNA, ergosterol, endotoxins, glucans allergens etc. (Figure 1). The enumeration of cultivable microorganisms is the traditional analytical technic used in most of the published studies. Chemical (GC/MS) or biochemical methods (LAL, ELISA) are used for the measurement of specific microbial compounds. Bioaerosol science also takes advantage of progress in molecular biology increasingly revealing the diversity of airborne microbial agents to which workers are exposed to.

Sampling of the inhalable fraction of the aerosol can be achieved with methods and devices usually used for non-biological aerosols (closed face cassette, impactor etc.) but specific devices were also developed (Biosampler, CIP 10-M, dry and wetted wall cyclones etc.). Both the biological and the physical efficiencies of samplers are studied in laboratory (aerosol and bioaerosol chambers) as well as in field conditions. The use of cascade impactors allowed improving the knowledge about the size distribution of airborne microbial entities at occupational settings.

The overall efficiency of the bioaerosol measurement process is discussed and the presentation tackles the importance of the measurement strategy for the assessment of exposure to bioaerosols.

High exposure levels were measured in numerous occupational situations found in diverse sectors such as health, agriculture, food industry, waste management etc. (Oppliger and Duquenne, 2016). Several studies allow demonstrating that the sector, the contaminated matrix, the process, the working task, its duration and frequency were the main determinants of the occupational exposure. Bioaerosols found at the workplace vary in nature (cells, debris, compounds metabolites etc.), concentration, composition (biodiversity) and size with, sometimes, seasonal fluctuations. These exposures were associated with inflammatory and immuno-allergic symptoms observed among workers (Walser *et al* 2016).

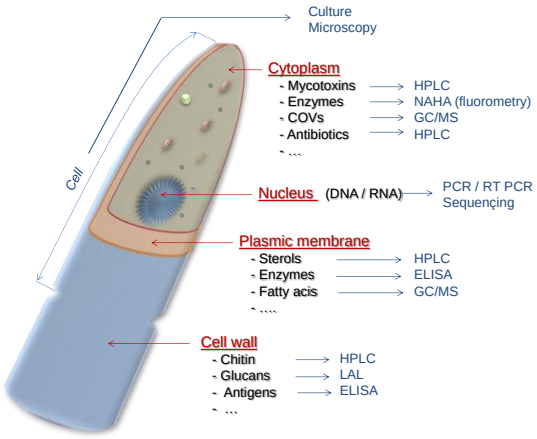

Figure 1. Parameters target for the measurement of fungi in bioaerosols and associated analytical methods.

However, there are still no Occupational Exposure Limit values (OELs) for airborne biological agents. The main reasons are the complex composition of bioaerosols, the invalid dose–response available data, the diversity of measuring strategies used in studies, the heterogeneity and non-specificity of health effects and the insufficient exposure assessment. Thus, the interpretation of bioaerosol exposure in term of biological risks data is still uncertain. The presentation gives an overview tentatives for few health-based OELs and guide values that were proposed. Few examples of bioaerosol exposure reduction are also given.

The lecture finally addresses the future issues and research perspectives dealing with the assessment of occupational exposure to bioaerosols. Further researches are needed about exposure to microbial debris, allergens, toxins, and poorly known microorganisms (viruses, Archae, Actinobacteria etc.). Development of methods and strategies for the measurement entities are required as well as dose–response studies. These researches would improve exposure data for bioaerosol at the workplace and the management of biological risks.

Oppliger A, Duquenne P. (2016). In Viegas *et al* (ed.), *Environmental Mycology in Public Health : Fungi and Mycotoxins Risk Assessment and Management*. Elsevier Inc. p. 79-105.

Reponen, T. (2011) In: Nriagu, J.O. (ed.) *Encyclopedia of Environmental Health*, Burlington: Elsevier, volume 3, pp. 722–730.

Walser *et al* (2015). *Inter. J. Hyg. Environ. Health* **218**: 577-589.