Human exposure to endocrine disruptors by inhalation: contamination characterization of indoor air by chemical and biological analyses

Stéphanie Laborie[1], Lucie Oziol[2], Fabrice Alliot[1], Annie Desportes[1], Elodie Moreau-Guigon[1], Marc Chevreuil[1]

[1] EPHE, UMR 7619, METIS (UPMC/CNRS/EPHE).
[2] Université Paris Sud, CNRS, AgroParisTech, UMR 8079, ESE.

Contact: stephanie.laborie@upmc.fr

Résumé:

Humans are exposed to low levels of environmental compounds through several exposure pathways. Many of them are known or presumed endocrine-disrupting compounds (EDCs) that may interact in mixture with other contaminants under environmental exposure conditions. Inhalation represents a chronic and passive exposure route to these contaminants. Moreover, it is assumed that adults spend at least 80 % of their lifetime indoors, where the air is often more contaminated than outdoors.

In this context, our purpose was to develop robust multi-residue analytical methods to identify and quantify the exposure to a wide range of EDCs in indoor air. In order to characterize the health hazard inherent to this multi-contamination, a two-track approach was carried out, by combination of chemical and biological analyses.

Four dwelling places were compared for their indoor air contamination and with outdoor air, during two different seasons: an office, an apartment and a house to study the general population exposure, and a day nursery to consider a sensitive sub-population. The broadest range of contaminants was extracted from the two atmospheric phases (gas and particulate) of indoor and outdoor air. Liquid or gas chromatography-mass spectrometry analyses were developed for the quantification of 71 molecules, known or suspected to be EDCs, both in the two air phases. These compounds belong to several families with contrasted properties: pesticides, dielectrics, flame-retardants, plasticizers, preservatives, synthetic musks, surfactants or compounds from combustion processes.

Along with their chemical analysis, the endocrine-disrupting potential of indoor air extracts was performed using in vitro bioassays, i.e. two cellular transactivation tests: MELN and PC-DR-LUC cells respectively for estrogenic- and thyroid-disrupting effects assessment.

Our data showed the indoor prevalence of EDCs, and especially in the gas phase. The endocrine-disrupting potential and the contamination by target EDCs of the indoor air extracts were in accordance, except for seasonal variations. This suggests the presence of non-studied EDCs in air extracts or interactive effects between air contaminants. In this context, an effect-directed analysis approach will be carried out on biologically active air extracts. The objective will be to identify the target compounds responsible for the observed biological responses, while integrating interactions effects between contaminants in mixture.