

Passive Sampling as an Attractive Tool for Air Genotoxic Potency Screening Assessment

Pavel Čupr¹, Jana Klánová¹, Tomáš Bartoš¹, Zuzana Flegrová¹, Jiří Kohoutek¹ and Ivan Holoubek¹

Abstract

Epidemiological studies carried out to investigate the health risks related to the air pollution suggest that ambient air pollution may be responsible for increased rates of diseases like a lung cancer. The complexity and potential synergic effects of the airborne toxic compounds cannot be adequately ascertained by the chemical analysis itself and for the purpose of potential public health risk assessment, the bio-monitoring of ambient air in addition to chemical monitoring is receiving increasing attention. These demands require specific and sensitive methods capable of indicating the presence of genotoxic compounds in the environment. Several biological test systems have been developed recently to assess the mutagenic and carcinogenic hazards. Among them, the genotoxicity assessment bioassays are valuable bacterial assays based on the response to DNA damage induced by the genotoxic compounds in cells. The assays based on the transcriptional fusions between DNA-damage inducible promoters and reporter systems have been used to detect a variety of environmental genotoxins. These sensitive tests utilize the gene promoters involved in the SOS response to the DNA damage.

The aim of the study was to investigate the capability of passive air sampling technique to be employed in the evaluation of direct genotoxicity of ambient air samples. Genotoxic effects of the total extracts from the polyurethane foam filters exposed for 28 days during the regional passive air sampling campaign were investigated. Assessment of genotoxic potency of the passive sampling obtained air samples using the screening genotoxicity test (SOS chromotest), was performed in this study. Twenty sampling sites were selected in Brno city on the area of approximately 20x20 km in October and November 2004. Brno is the second largest city of the Czech Republic, highly industrialized with approximately 370 000 of permanent inhabitants. The territory of the city is well ventilated; no climatic calamities have been recorded in Brno over the recent years. The levels of polycyclic aromatic hydrocarbons, polychlorinated biphenyls, and chlorinated pesticides were determined in all samples. In a parallel arrangement a fraction of each extract was assayed in the bacterial genotoxicity test-SOS chromotest using the *Escherichia coli* *sulA::lacZ*. This method is based on the induction of the SOS repair system as a result of the sample interaction with DNA of a genetically modified tester strain. Complete dose-response relationships of the air extracts were determined. The genotoxicity assay revealed direct mutagenicity answers in the samples from eleven sites, minimal genotoxic concentrations (MGC) were $8,57 \pm 2,07$ % PUF ml⁻¹. The statistical analysis showed significant correlation between observed biological effects and PAHs concentrations in samples. Passive air sampling technique coupled with a biological system proved to be a sensitive tool capable of monitoring the air quality. Geographic information system (GIS) was applied to perform the spatial analysis of the results.

¹ RECETOX - Research Centre for Environmental Chemistry and Ecotoxicology, Masaryk University, Kamenice 3/126, 625 00 Brno, Czech Republic Tel.: +420-549493511, Fax: +420-549492840 E-mail address: cupr@recetox.muni.cz