

Silicone rubber as a passive sampler for semivolatile contaminants of indoor air

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Semivolatile organic compounds (SVOCs) are mostly man-made chemicals that distribute between the gas and solid phase. Many of them could pose a danger to people exposed to them, and therefore it is important to monitor their concentrations to evaluate the related risks. The gaseous concentrations obtained by passive sampling are an important parameter to assess inhalation exposure in the indoor environment. . In this study, we employed silicone rubber (SR) polymer as a passive sampler for monitoring of polyaromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), organochlorine pesticides (OCPs) and polybrominated diphenyl ethers (PBDEs) in indoor air. It is assumed that silicone rubber samples contaminants mainly from the gaseous phase. We performed a sampler calibration study in which 16 samplers constructed from 0.5 mm thick SR sheets with a surface area of 300 cm² each were exposed to indoor air in a university lecture theatre for up to 56 days and 2 samplers were collected every week. In addition to measurement of the uptake kinetics of listed compounds during exposure, the release kinetics of performance reference compounds (PRCs) that were dosed to the samplers prior to exposure was studied. The PRCs – PCBs not occurring in industrial mixtures - covered a broad range in volatility and, consequently, SR-air partition coefficients. The study allowed proposing a model that can be used to estimate air sampling rate (R_s in m³/day) as a function of compounds' molecular mass. Applying the model, we determined concentration of contaminants in air from passive sampling uptake. These concentrations were compared to data from low-volume active air sampler that ran simultaneously during the entire study. Concentrations measured by passive and active sampling were in good agreement for PCBs and OCPs, whereas in case of PBDEs and PAHs, passive samplers showed lower detection limits.

keywords:

semivolatile organic compounds, passive sampling, silicone rubber, performance reference compounds, sampler calibration