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Determination of Volatile Organic Compounds for a Systematic Evaluation of Third-Hand Smoking

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Third-hand smoking was quantitatively evaluated with a polymer-packed sample preparation needle and subsequent gas chromatography–mass spectroscopy analysis. The extraction needle was prepared with polymeric particles as the extraction medium, and successful extraction of typical gaseous volatile organic compounds (VOCs) was accomplished with the extraction needle. For an evaluation of this new cigarette hazard, several types of clothing fabrics were exposed to sidestream smoke, and the smoking-related VOCs evaporated from the fabrics to the environmental air were preconcentrated with the extraction needle. Smoking-related VOCs in smokers' breath were also measured using the extraction needle, and the effect of the breath VOCs on third-hand smoking pollution was evaluated. The results demonstrated that a trace amount of smoking-related VOCs was successfully determined by the proposed method. The adsorption and desorption behaviors of smoking-related VOCs were clearly different for each fabric material, and the time variations of these VOCs concentrations were quantitatively evaluated. The VOCs in the smokers' breath were clearly higher than that of nonsmokers'; however, the results suggested that no significant effect of the smokers' breath on the potential pollution occurred in the typical life space. The method was further applied to the determination of the actual third-hand smoking pollution in an automobile, and a future possibility of the proposed method to the analysis of trace amounts of VOCs in environmental air samples was suggested.

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