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SVOC-Emissions from Materials into Indoor Air

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Introduction

The emission of volatile organic compounds (VOC) from materials used indoors is an important parameter for the chemical impact on the indoor air quality. Especially materials used on large areas and/or elevated temperatures are of importance. Although a lot of research is done on VOC-emission measurements, poor data exist about the emission behaviour of semi volatile organic compounds (SVOC), due to the fact that they are not caught with the common tests and analytical methods for VOCs.

Materials

A variety of different materials (building materials such as wood, wood-based products, insulation materials, paints and floor coverings or consumer products like IT devices) were tested. The investigations focussed on several SVOC which might affect indoor air quality. Interesting volatile organic compounds were plasticizers, such as diisobutylphthalate, flame retardants such as organophosphorus and polybrominated compounds, and different fungicides like lindane, DDT, pentachlorophenol and others. Certain compounds are lipophilic and bioaccumulative and exhibit a certain persistence. Analytical studies show that some compounds are increasingly found in the biosphere and in the built environment. In some cases, there has not yet been a systematic examination of potential contamination pathways which lead to this impairment.

Experimental

For emission measurements 1.0-L glass cells, 20-L glass dessicators, and 1000-L standard stainless steel emission test chambers are used. Climate conditions were 23 °C and 50% RH. In order to simulate operating conditions under elevated temperature, the 20-L emission test chamber is heated up to 60 °C for instance. Furthermore it is

possible to run electronic systems (e.g. PC's) continuously at standard temperature and humidity. For SVOCs sink effects play an important role, therefore it is better to use small chambers with high loading and high air exchange rates to get a faster equilibrium inside the chamber between wall, sample and air. For extremely low-volatile compounds (often belonging to so called POM: particulate organic matter or organic compounds associated to particulates) this still last about 125 days. Active air sampling is done using glass tubes equipped with pre-purified polyurethane foam (PUF) plugs (12mm diameter). The sample volume drawn through the plugs varies between 2.5 and 40 mˆ3 with an air flow between 15 and 100 L/h. The PUR foam plugs were extracted in the ultrasonic bath or in soxhlets with appropriate solvents and processed by GC/MS for the purpose of identification and quantification. Components that cannot be analysed by GC/MS due to their physicochemical characteristics were chromatographically separated by means of HPLC and consecutive UV detection.

Results and discussion

The results of chamber measurements of SVOC suggest that the use of different additives such as plasticizer, flame retardants or fungicides added to products may affect indoor air quality. The emission of these compounds could be a possible route of exposure for humans, and ultimate damage to the natural environment. However, the experiments carried out in emission test chambers of different sizes and materials reflect the substantial problem of SVOC analysis: a strong influence of the analysis results from sink effects is to be expected due to polarity and low volatility. Experimental findings that about 25% of the emitted substances (e.g. several flame retardants) are absorbed on the chamber walls, confirm this expectation. Non- or low- volatile compounds tend to bond to surfaces and particles; under actual indoor environment conditions those compounds would likely be concentrated in indoor dust, and their prolonged indoor lifetime could increase human exposure to these chemicals. All in all, more data on emission behaviour and physical properties of numerous substances are required for a comprehensive evaluation of possible risks. It appears desirable to extend the investigations to long-term measurements over 1 year test periods for example, and to determine the influence of material ageing (e.g. secondary emission).

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References

Hahn, O., Kemmlein, S., Jann, O., Kalus, S., Stolle, D., "Emissions of flame retardants

from selected consumer products and building materials", Proceedings of the Flame Retardants 2004 Conference, London, Interscience Communications Limited, ISBN 0954121627, 27-36 (2004).

Horn, W., Jann, O., Wilke, O., "Suitability of small environmental chambers to test the emission of biocides from treated materials into the air", Atmospheric Environment, Vol. 37, Issue 39-40, 5477-5483 (2003).

Kemmlein, S., Hahn, O., and Jann, O., "Emission of phosphorus organic and poly-brominated flame retardants from selected consumer products and building materials", Atmospheric Environment, Vol. 37, Issue 39-40, 5485-5493 (2003).

Wilke, O., Jann, O., Brödner, D., "VOC- and SVOC-Emissions from Adhesives, Floor Coverings and Complete Floor Structures", Indoor Air Vol. 14, 96-105 (2004).

Schoknecht, U., Wegner, R., Horn, W. und Jann, O., "Emissions of Biocides from Treated Materials", Environmental Science & Pollution Research 10: 154-161 (2003).