

The effect of building products on indoor air quality in a test house

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Introduction

The indoor built environment is composed of building materials, such as stone, wood, mineral wool, paint, adhesives and plastics. Moreover, furniture and daily life accessories are more or less used. In order to improve indoor air quality, manufacturers, architects and occupants should be aware of which materials can be used for construction. Thus, estimating the expected indoor air concentrations of volatile organics emitted from building products and furniture may be a useful and important pre-information for providing a healthy indoor environment.

In this study the effect of insulation material, carpet and furniture on the indoor air quality was investigated in a custom-made test house. This test house represented a normal, common living space in miniature and was placed into a climate-controlled chamber.

Materials and Methods

A test house (2 x 3 x 2 m) was constructed using wood, gypsum-board, foil, mineral wool, wallpaper, certified floor coverings and adhesive and decorated with furniture (lacquered sideboard). The house was located into a 48 m³ chamber made of stainless steel. Prior to the experiments, the emission profiles of all used materials were determined. Formaldehyde and VOC air samples were collected daily from both chamber and test house. TVOC_{PAS} and particle concentrations (CPC) were also measured. During the experiment, air exchange rate (chamber: 2 h⁻¹, test house: 0.3 h⁻¹), temperature (23 °C) and relative humidity (50 %) were kept constant.

Formaldehyde was analyzed by both acetyl acetone and DNPH methods. VOC samples,

adsorbed on Tenax TA, were analyzed by GC/MS-TD system.

Results

The formaldehyde concentrations in test house and chamber are presented in Figure 1. While the concentration in the chamber was < 5 µg/m³ throughout, clear differences can be seen in the test house. Inserting the mineral wool has no significant effect, but the formaldehyde concentration increased from 23 µg/m³ up to 69 µg/m³ when carpet and furniture were installed. Analogous results were obtained for the VOC and TVOC_{PAS} concentrations.

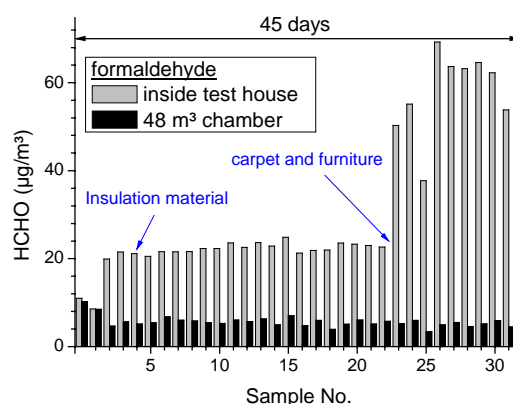


Figure 1. Formaldehyde concentrations in test house and chamber over time.

Conclusion

The results show that there was no measurable diffusion of formaldehyde from the mineral wool inside the walls into the test house. However, higher formaldehyde and VOC concentrations resulted from the application of materials for interior fixtures and furniture.

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