

A Dual-Chamber Experimental Method for Determining the Transport Properties of Building Materials

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A dual-chamber experimental method is developed to determine the similarity relationship between moisture transport and volatile organic compound (VOC) transport through porous media. By establishing the similarity relationship, VOC transport properties (diffusion coefficient) can be determined from already widely available moisture properties, and be incorporated in research and design tools for combined heat, air, moisture and pollutant simulation (CHAMPS) in buildings. To better understand the similarity and difference between VOC and moisture transport, a calcium silicate that has already been well characterized for moisture transport is selected as the reference material. Tests are conducted for water vapor, formaldehyde, toluene individually under constant temperature conditions. Future tests will include the effects of humidity on VOC transport, and be extended to materials with significant VOC emissions and transport used in building wall, floor and furniture assemblies.



Figure 1 Photograph of the dual chamber system



Figure 2 Calcium silicate(left) and particleboard(right)

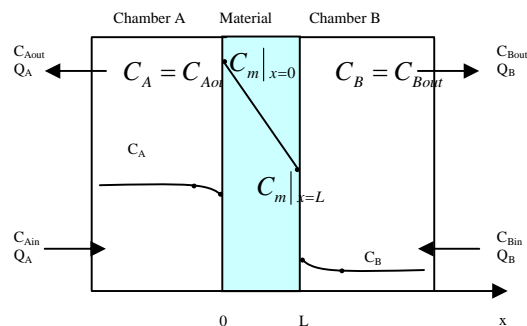


Figure 3 Physical process and expected concentration profile at steady state

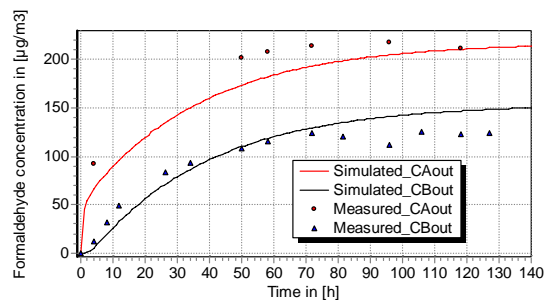


Figure 4 Measured and simulated concentrations in chambers A and B

Conclusions: A similarity coefficient is proposed to correlate the pore diffusion coefficient of VOCs with that of water vapor. Use of the similarity coefficient in CHAMPS simulation showed reasonable agreement with the measured data.

References:

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