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Estimation of inhalation risks associated with exposure to volatile organic compounds from construction materials used in an indoor environment

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The risk to human health associated with the inhalation of volatile organic compounds (VOCs) is of growing concern. Typical examples of VOCs which represent a range of different molecular weights and are found in the indoor environment include toluene, limonene and dodecane. The interaction of these VOCs with a control specimen of medium density fiberboard (MDF), laminated-MDF, Tradical® décor lime render and sheep wool insulation was performed by estimating the associated non-carcinogenic health risk (metric = hazard quotient, i.e., ratio of average daily dose to acceptable daily dose) using the U.S. EPA risk assessment methodology. Average daily dose (ADD) values were estimated using literature-reported information related to emission of VOCs from panels (indoor air concentrations: 2.169 mg/m³, 2.397 mg/m³ and 2.754 mg/m³ for toluene, limonene and dodecane, respectively), air inhalation rate, exposure frequency and exposure duration, and body weight and found to be 14.9 mg/kg-day, 16.4 mg/kg-day and 18.9 mg/kg-day for adults and 69.4 mg/kg-day, 76.7 mg/kg-day and 88.1 mg/kg-day for children for toluene, limonene and dodecane, respectively. The reference concentration of toluene was found to be 5 mg/m³. Hence, the hazard quotient associated with toluene was found to be 2.98 for adults and 13.88 for children (i.e. >1). This reveals that toluene possesses the greatest inhalation risk to the human health, specifically to the children. Future efforts are required to develop a structured framework for incorporating this approach in the decision-making process of selecting health-protective construction materials used in an indoor environment.

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