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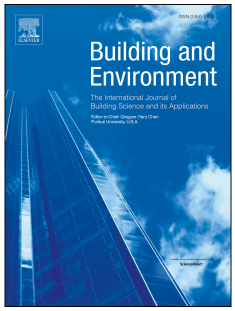


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# Quantitative Source Apportionment and Human Toxicity of Indoor Trace Metals at University Buildings

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ABSTRACT

This study focuses on the source apportionment principal component analysis of indoor particulate matter ($PM_{10}$) composition in two university buildings with different ventilation systems. A low volume sampler using Teflon filter paper was used to collect the $PM_{10}$ samples and inductively coupled plasma mass spectrometry was used to determine the concentration of heavy metals. The potential human health damage due to the inhalation of carcinogenic and non-carcinogenic elements was also determined based on the USEPA standard. The results showed $PM_{10}$ concentrations recorded in Building 1 and Building 2 ranged between 19.1 to 237 µg $m^{-3}$ and 23.4 to 159 µg $m^{-3}$, respectively. In Building 1, the principal component analysis (PCA) and multiple linear regression (MLR) showed that the main sources of pollutants in $PM_{10}$ were the crustal source (20%), indoor-induced (8%), urban origin (7%) and the Earth's crust (6%). The main sources of pollutants in Building 2 were combustion (21%), biogenic (6%), anthropogenic (4%) and crustal (3%). The effective lifetime carcinogenic risks (ELCR) in Buildings 1 and 2 were 1.90E-3 and 1.65E-4, respectively. The hazard quotient (HQ) represents the non-carcinogenic risk, with 7.73 and 6.46 in Building 1 and Building 2, respectively. These ECLR and HQ values exceed the acceptable limit and are higher compared to the standard from the United States Environmental Protection Agency's Guidelines for the assessment of carcinogen risk. It was suggested that different types of ventilation influence the $PM_{10}$ distribution in buildings and associated risks towards the occupant's health and indoor air quality.

Keywords: Indoor Air Quality, Particulate Matter, Human Health Risk, Source Apportionment, Carcinogenic, Non-carcinogenic.

## 1.0 Introduction

Despite the potential impact from the outdoor environment, indoor-induced pollutants are mainly produced from various sources such as building materials, smoking, cooking, furniture, organic products and consumer products and these sources affect indoor air quality [1-3]. The temperature and humidity of the building tend to trigger the formation of certain pollutants such