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The Sources of Polycyclic Aromatic Hydrocarbons in Road Dust and Their Potential Hazard

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Abstract: Polycyclic aromatic hydrocarbons (PAHs) are persistent organic pollutants (POPs) found in the environment, posing significant health concerns for the population. This research aimed to assess the PAH levels in road dust near bus stops, identify their sources, and evaluate potential health risks. The analysis involved the use of a gas chromatography–flame ionization detector (GC-FID) to measure PAHs and absolute principal component score-multiple linear regression (APCS-MLR) for source apportionment of PAHs. The results indicated that the measured PAHs concentrations in road dust ranged from 137.8 to 5813 ng g^{-1}, with Indeno[1,2,3-c,d]pyrene having the highest PAHs concentrations. The study identified three main sources of PAHs such as oil spills, fuel combustion, and coal burning, determined through APCS-MLR modeling. Further analysis revealed that the aggregate incremental lifetime cancer risk (ILCR) for children and adults were 2.16×10^{-6} and 2.08×10^{-6}, respectively. Additionally, the hazard index (HI) for children exceeded that of adults, suggesting greater vulnerability to the potential health effects of PAH exposure. The findings indicate that long-term exposure to PAHs may negatively impact lung function and increase the risk of cancer and skin diseases. As a result, it is crucial for the local government to implement effective measures aimed at improving fuel quality and promoting green public transportation within the city. These initiatives may help mitigate PAH emissions and safeguard public health.

Keywords: polycyclic aromatic hydrocarbon (PAH); road dust; bus stands; carcinogens

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1. Introduction

Road dust is a matter of significant apprehension owing to its detrimental effects on human well-being. It can amass in the surroundings through diverse means, including natural, biogenic, and anthropogenic sources. Moreover, it comprises a blend of soil-derived substances and atmospheric particles emitted from both volcanic activities and human-induced factors [1,2]. Effective management of airborne particulate matter is of utmost importance as it can have adverse effects on human health. The presence of fine and coarse particles in the atmosphere is primarily linked to road traffic, arising from both exhaust and non-exhaust particle discharges. Notably, non-exhaust emissions, particularly those from road dust, are now recognized as a substantial source of particle concentrations in numerous countries, surpassing exhaust emissions. Nevertheless, analyzing road dust in the air presents considerable challenges [3]. Road dust contains numerous hazardous