



Characterization, risk assessment, and source estimation of PM₁₀-bound polycyclic aromatic hydrocarbons during wintertime in the ambient air of Basrah City, Iraq

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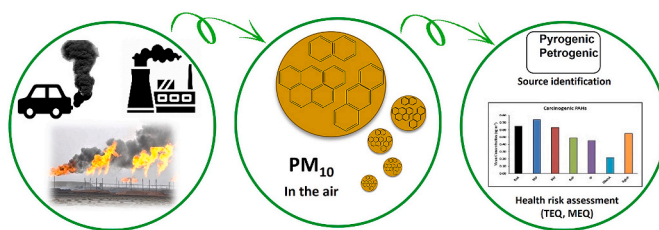
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HIGHLIGHTS

- Chrysene and fluoranthene were the most abundant PAHs in PM₁₀ of Basrah.
- Petrogenic and pyrogenic sources dominated over biomass and coal combustion.
- PM₁₀ bound-PAHs in Basrah City were dominated by 4-5 aromatic rings species.
- Benzo[a]pyrene accounts for >50% of the total carcinogenic power of PAHs.

GRAPHICAL ABSTRACT



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ABSTRACT

In this study, the concentration and structure of polycyclic aromatic hydrocarbons (PAHs) associated with the ambient PM₁₀ in Basrah City, Iraq have been investigated for the first time. From December 2021 to February 2022, PM₁₀ samples were collected on quartz fiber filters, extracted using an optimized extraction protocol, and analyzed for the sixteen US EPA priority PAHs. The results indicated that 4- and 5-ring PAHs represent 52% of the total detected PAHs. The most abundant PAHs over the study period were chrysene ($1.2 \pm 1.5 \text{ ng m}^{-3}$), fluorene ($0.9 \pm 1.4 \text{ ng m}^{-3}$), and benzo[b]fluoranthene ($0.7 \pm 0.9 \text{ ng m}^{-3}$). Source identification suggested that PM₁₀-bound PAHs primarily originated from pyrogenic and petrogenic activities in Basrah City. In addition, the cancer risk associated to PAH exposure was assessed based on benzo[a]pyrene equivalent concentration and was found ranging from 0.07 to 6.32 ng m^{-3} ; hence, it exceeded the threshold limit of 1.0 ng m^{-3} established by the European legislation (EU, 2014). Benzo[a]pyrene was determined to be main contributor to total carcinogenic power of the detected PAHs, accounting for 50.3%, followed by dibenz[a,h]anthracene (22.3%). Similarly, benzo[a]pyrene represented a major contributor to PAH associated mutagenicity, accounting for 43.5% of the total.

1. Introduction

Over the last few decades, air pollution has become a serious threat to humans, with seven million annual premature deaths estimated

worldwide (WHO, 2014). Both natural and man-made sources contribute to air pollution (Saxena and Srivastava, 2020). However, emissions from fossil fuel consumption alone account for 65% of the air pollution-linked access death (Lelieveld et al., 2019), considering that

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