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BOOK OF ABSTRACTS

ASSOCIATION OF CHEMISTRY AND THE ENVIRONMENT

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Health Risk Assessment for Residents and Workers Based on Toxic and Carcinogenic Element Content from $PM_{2.5}$ in Belgrade Suburban Area

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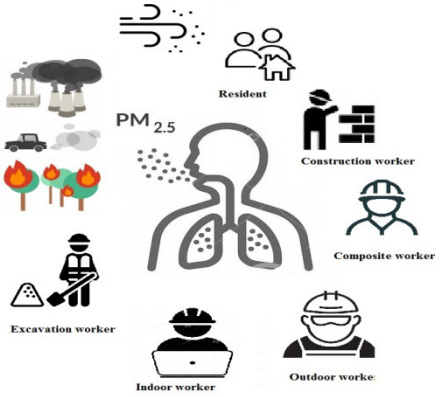

Particulate matter of diametar <2.5 μm ($PM_{2.5}$) pollution is recognized as one of primary pollution contaminant which directly affect human health. Toxic and carcinogenic elements originating from different pollution sources can be constituents of $PM_{2.5}$. Because of their small size, particles can penetrate deeper into the lungs and enter the bloodstream causing different disorders and threats to human health [1].

We performed elemental characterization of $PM_{2.5}$ samples collected during the spring/summer season 2019 in a suburban part of Belgrade (in the inner courtyard of Institute of Physics Belgrade). The spring/summer period was characterized by the industrial or different outdoor activities with several Saharan dust episodes. In addition, April and October were partly characterized by heating sources.

The quartz filters with $PM_{2.5}$ were digested by the microwave digestion system using 7 mL 65% HNO_3 and 1 mL 30% H_2O_2. The concentrations of Al, B, Ba, Bi, Ca, K, Fe, Mn, Ni, P, S and Sr were measured using inductively coupled plasma-optical emission spectrometry (ICP-OES), while concentrations of Ag, As, Be, Cd, Co, Cu, Cr, Hg, Pb, Se, Sb and Tl were measured using inductively coupled plasma mass spectrometry (ICP-MS).

The non-carcinogenic and carcinogenic risks for residents and for five different types of workers (outdoor, indoor, composite, construction and excavation workers) in this ambient were assessed by equations provided by The Risk Assessment Information System – RAIS [2].

Comparing the investigated scenarios, the highest non-carcinogenic and carcinogenic risks were observed for the residents. There were observed non-carcinogenic (HI>1) and carcinogenic ($R \geq 1 \times 10^{-5}$) risks for the residents from this area. The residents spent the most of their time in this ambient and they are most at the risk caused by the measured $PM_{2.5}$ pollution ($HI_{median:}$ 2.28; R_{median}: 1.25×10^{-4}). Observing the scenarios for workers, the risk mostly depends on the time that workers spent outside during working hours. Similar non-carcinogenic risks were observed for outdoor, indoor and composite workers, slightly higher risk was observed for construction workers, while the lowest risk was obtained for an excavation worker who is less exposed to the $PM_{2.5}$ atmospheric deposition than soil dust resuspension. The same was observed for the carcinogenic risk, while the similar risks were observed for all workers. Only for an excavation worker, the carcinogenic risk was significantly lower than for other workers. The most significant contributor to the non-carcinogenic risk in all scenarios was the concentration of Mn, and then the concentration of Be, while the most significant contributor to the carcinogenic risk was Cr^{6+}.

Observing the risks among the investigated period the highest non-carcinogenic and carcinogenic risks were observed in April and October based on the toxic and carcinogenic elements in $PM_{2.5}$. In these months beside the influence of the industrial activities, dust episodes or activity of heating sorces possibly caused the increase of the toxic and carcinogenic elements in $PM_{2.5}$.

Acknowledgements

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[1] World Health Organization (WHO) 2021, www.who.int; 22.9.2021.

[2] Oak Ridge National Laboratory, Risk Assessment Information System (RAIS) http://rais.ornl.gov; 20.9.2021.