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Abstract

Biomonitoring Chromium Contamination in Urban and Rural Topsoils from Leicestershire, England †

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† Presented at the 1st International Electronic Conference on Toxics, 20–22 March 2024; Available online: https://sciforum.net/event/IECTO2024.

Keywords: chromium mushrooms; presence and distribution; human risks; Leicestershire

A monitoring study was performed to characterise the risks of chromium (Cr) in Leicestershire, England. A total of 106 wild-growing mushrooms were collected from Leicester city and Bradgate Park (a nearby rural park). Cr was monitored via ICP-MS in cleaned/dried/homogenised and appropriately mineralised mushrooms [LoD = 1.012 μg/g dry weight (dw)]. Cr was also monitored in 850 topsoils collected across Leicestershire and processed as composite samples via ICP-MS after acid/microwave digestion (LoD = 3.683 μg/g). Cr was detected in 92.2% of the topsoil samples and 47.1% of the mushroom samples [median and range, in μg/g dw; 0.863 (1.012–19.466)], showing significant distribution across the four ordinal directions in which Leicestershire was divided [SE (1.908) > NW (1.738) > NE (0.987) > SW (LoD); Peto–Prentice test, $\chi^2(2) = 12.4$, p-value = 0.002]. These results might suggest some level of Cr pollution in Leicestershire, as they are higher than the proposed reference interval for wild mushrooms that grow in unpolluted areas (0.5–5 μg/g dw). A similar distribution of Cr was found in the monitored topsoils. The highest concentration was found in those collected in the southeast and the lowest in the southwest quadrant (123.137 vs. 20.947 μg/g). Moreover, significantly higher levels were found in topsoils collected in the urban area (median and range, in μg/g; Peto–Prentice test, $\chi^2(1) = 1.1$, p-value = 9×10^{-4}): 82.542 (3.683–196.795) vs. 32.806 (3.683–265.069). This difference might be attributed to different anthropogenic sources, such as vehicles. All bioconcentration factor values were lower than one, suggesting a low bioaccumulation of Cr in the wild mushrooms species collected in Leicestershire. Toxic risks derived from oral, inhalation, and dermal exposure to Cr from topsoils in the four urban ordinal directions (NW = 1.95×10^{-1}, NE = 1.40×10^{-1}, SW = 2.53×10^{-1}, SE = 4.30×10^{-2}) were lower than one, suggesting a minimal risk for Leicester's population. However, speciation analysis would be needed to rule out carcinogenic risks of exposure to hexavalent Cr.

Supplementary Materials: The following are available online at https://www.mdpi.com/article/10.3390/proceedings2024102050/s1.

Author Contributions: Conceptualization, A.P.-F.; methodology, G.S.J., M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; validation, G.S.J. and A.P.-F.; formal analysis, G.S.J., M.d.C.L.-B. and A.P.-F.; investigation,

check for updates

Citation: Jagdev, G.S.; Lobo-Bedmar, M.d.C.; Peña Fernández, M.Á.; Evans, M.D.; Peña-Fernández, A. Biomonitoring Chromium Contamination in Urban and Rural Topsoils from Leicestershire, England. *Proceedings* **2024**, *102*, 50. https://doi.org/10.3390/proceedings2024102050

Published: 3 April 2024

G.S.J., M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; resources, A.P.-F. and M.d.C.L.-B.; data curation, G.S.J., M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; writing—original draft preparation, A.P.-F.; writing—review and editing, G.S.J., M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; visualization, G.S.J., M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; supervision, M.d.C.L.-B., M.Á.P.F., M.D.E. and A.P.-F.; project administration, M.D.E. and A.P.-F.; funding acquisition, M.d.C.L.-B. and A.P.-F. All authors have read and agreed to the published version of the manuscript.

Funding: This work has been funded through the program EIADES: "Technology Assessment and Remediation of Contaminated Sites" S0505/AMB-0296 and S2009/AMB-1478. Consejería de Educación, Comunidad de Madrid, Spain.

Institutional Review Board Statement: Not applicable.

Informed Consent Statement: Not applicable.

Data Availability Statement: The data presented in this study are available on request from the corresponding author. The data are not publicly available due to further processing for a future submission as a manuscript.

Conflicts of Interest: The authors declare no conflict of interest.