

HEAVY METAL CONTENT AND SOIL ACIDITY IN THE MOST TRAFFIC-LOADED AREAS OF UZHGOROD, UKRAINE

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Due to its role in filtering pollutants, supporting vegetation, and maintaining microbial communities, urban soil cover serves as an important environmental indicator. Soils are subjected to significant anthropogenic pressure under urbanization, especially from motor vehicles. Heavy metals (HMs), such as lead (Pb), zinc (Zn), copper (Cu), and manganese (Mn), pose the most serious threat. These metals enter the soil through exhaust emissions, tire and brake wear, and stormwater runoff. These elements are hazardous due to their toxicity and ability to accumulate in living organisms.

Soil acidity is a critical factor that influences the bioavailability of metals. As acidity increases (i.e., as pH decreases), the solubility of heavy metals (HMs) rises, facilitating their entry into trophic chains. Therefore, a comprehensive assessment of urban soil environmental conditions must include analysis of pH levels and toxic element content.

This study aimed to determine the pH levels and heavy metal concentrations in the soil along Uzhhorod's most congested streets and compare them with those in a relatively clean control area: the Botanical Garden of Uzhhorod National University. Soil samples were collected from seven locations, including Mytna Street, Sobranetska Street, Svobody Avenue, Mynaiska Street, and Zankovetska Street, as well as from control points within the Botanical Garden, at a depth of 0–20 cm. pH was measured using the potentiometric method, while heavy metals were determined via atomic

absorption spectrophotometry. A statistical analysis was conducted using a Student's t-test at a significance level of $P < 0.05$.

The results showed that the soils under study exhibited slightly acidic reactions (pH 5.91–6.36). The control sample had the lowest acidity. Concentrations of heavy metals in samples from traffic zones exceeded those in the control area by 1.5 to 3.5 times. The highest lead levels (over 9 mg/kg) were found on Mytna Street and Svobody Avenue. The highest zinc concentration (24.7 mg/kg) was also recorded on Mytna Street. The least contamination was observed at the control site in the Botanical Garden (Shakhta sector).

The most polluted sites were those with heavy traffic and intersections. The data indicate the formation of local contamination hotspots that require the attention of environmental authorities. Regular monitoring of urban soils is essential for maintaining ecological balance and protecting public health.

Keywords: heavy metals, soil acidity, soil pollution, motor vehicles, urban soils