

ASSESSMENT OF HEAVY METAL CONTAMINATION IN URBAN SNOW: A CASE STUDY OF NICKEL AND COPPER IN JELGAVA, LATVIA

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ABSTRACT

Snow water pollution, especially from heavy metals, is a growing global environmental concern, as urbanization and industrial activities increasingly contribute to the contamination of precipitation. Snow, acting as a natural filter, accumulates atmospheric pollutants, which are subsequently released during snowmelt, entering stormwater systems and surface water bodies. This issue has been observed across Europe, North America, and other industrialized regions, where heavy metals such as nickel (Ni) and copper (Cu) are prevalent contaminants. In Latvia, studies on snow pollution remain limited, making it crucial to understand how urbanization impacts snow water quality, particularly in cities like Jelgava. This study, conducted during the winters of 2023 and 2024, focuses on the accumulation of heavy metals in snow samples from Jelgava city. A total of 177 snow samples were collected each year from various urban locations, alongside 3 samples from outside the city as controls. The aim is to identify areas with the highest pollution levels and assess their potential contribution to stormwater pollution. The results revealed that nickel concentrations in the urban snow samples had an average of 0.124 mg/L, with values ranging from 0.033 mg/L to a maximum of 0.393 mg/L. Copper concentrations, however, showed greater variability, with an average of 0.906 mg/L, a minimum of 0.000 mg/L, and a maximum of 4.427 mg/L. Pollution areas were identified using Arc GIS and using the IDW method. These findings indicate that urban snowmelt in Jelgava could be a significant source of heavy metal pollution, particularly copper, to the city's drainage systems and natural water bodies.

Keywords: Waste burning, metal industry, pollution accumulation, food chains, toxicity

INTRODUCTION

Heavy metals such as nickel (Ni) and copper (Cu) are common pollutants in urban environments, primarily caused by anthropogenic activities [1]. However, the natural process of precipitation—rain and snow—plays a crucial role in the transport and redistribution of these heavy metals in urban areas [2]. Snow, in particular, acts as a temporary reservoir for atmospheric pollutants, including metal particles. These metals are accumulated in snow during winter and are then released into urban stormwater systems during snowmelt, significantly increasing the pollution of water bodies. Similarly, nickel and copper particles are washed from urban surfaces by precipitation, delivering them to drainage systems and natural water bodies [2], [3]. Nickel pollution in urban environments is associated mainly with industrial emissions, particularly from