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Iron Contamination Challenges Trophic Cascades and Public Health Risks

Dina Nevi*

Department of Analytical Chemistry, Stockholm University, Frescativägen, Sweden

Introduction

Southern Russia's floodplains and seacoasts are characterised by urbanisation, developed agriculture, and rapidly developing industries. Anthropogenic activity causes the long-term release of pollutants into the environment, endangering ecosystem stability and public health. The study sought to assess the ecological and human health risks posed by potentially toxic elements (PTEs) and polycyclic aromatic hydrocarbons (PAHs) in the Taganrog Bay coast and Lower Don floodplain topsoils. PTE and PAH concentrations were determined using X-ray fluorescence and high-performance liquid chromatography, respectively. Environmental risk factors indicated a low risk for PTEs, with the exception of the comparatively most toxic Cd, which ranged from low to moderate [1].

The region's non-carcinogenic risk for adults was negligible, while the risk for children was low. Dermal contact with PTEs and PAHs increased the risk of non-carcinogenicity significantly. Only the cumulative intake of pollutants poses a significant risk to children. Over the majority of the study area, total carcinogenic risk exceeds the threshold, indicating a low risk, with As being the most significant contributor. The study's findings revealed that PAHs pose a greater potential ecological risk than PTEs, with the opposite trend observed in terms of the risk of negative effects on human health. Taking into account the combined influence of different types of components allows for more comprehensive risk assessments in this regard [2].

Description

Southern Russia is primarily agricultural due to relatively favourable climatic conditions. As a result, the Rostov and Krasnodar regions account for 11.6% of Russia's agricultural production value. Agriculture's development laid the groundwork for the growth of industry in cities, particularly the metallurgy, metalworking, and agricultural engineering industries [3]. There is also an electrical and thermal power industry, a chemical and chemical product manufacturing industry, a consumer industry, and food processing. Traditional urban areas in the region are located along rivers, the largest of which is the Don, and on the coast of the Sea of Azov. There are seaports in the coastal cities of Taganrog, Azov, and Yeysk, as well as Rostov-on-Don.

Which is one of the main sources of pollution of surface water and bottom sediments. The development of coastal areas for tourism and recreation has become increasingly important in recent decades. The landscapes of the Lower Don and the coast of Taganrog Bay are under the most significant anthropogenic pressure, with the main negative consequences being soil and vegetation cover degradation, including that caused by chemical pollution.

***Address for Correspondence:** Dina Nevi, Department of Analytical Chemistry, Stockholm University, Frescativägen, Sweden, E-mail: dinanevi43@gmail.com*

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For several reasons, the latter is of particular interest. First, soils in floodplains and riparian zones are critical for ecosystem sustainability and biodiversity conservation. It is widely acknowledged that aquatic landscapes such as floodplains, deltas, and riparian zones serve as a strong barrier that regulates terrestrial geochemical flux. Second, they are extremely fertile, and as a result, they have been intensively used for agricultural production in most of the world's populated regions since antiquity. Finally, hydromorphic soils are extremely dynamic. They are subjected to periodic flooding events as well as regular fluctuations in redox conditions, which complicate their role in the accumulation and potential remobilization of pollutants. In the case of deltaic and riparian soils, their ecological and geochemical roles.

Soil pollution is one of the most serious environmental hazards and threats to public health. Some metals and metalloids, such as Cr, Mn, Ni, Cu, Zn, As, Cd, and Pb, are classified as potentially toxic elements (PTEs) in terms of environmental and human health protection. Because of their toxic and carcinogenic properties, as well as their ability to bioaccumulate, polycyclic aromatic hydrocarbons (PAHs) receive special attention in international hazardous pollutant regulation. It has previously been demonstrated that the soils of the Lower Don floodplain and the coast of the Sea of Azov are heavily contaminated with PTEs and PAHs. The studies mentioned above examine the levels and fluxes of elements and compounds in soils, as well as their sources and spatial distribution.

The study area's sampling points were chosen at random, taking into account differences in landscape conditions in the following areas: the lower reaches of the Don River; the Don Delta; the Taganrog Bay coast; and the floodplains of small rivers flowing into the bay (the rivers Kigali, Minus, Sukhaya Chubbuck, and Moray Chubbuck). During the summer of 2020, during the steady low water period, samples of the surface horizon of riverine and coastal soils (n = 86) were collected. Topsoil samples (0-20 cm deep) were collected with a stainless-steel spade from five surface subsamples. 1 kg of mixed topsoil was stored in clean, hermetically sealed polythene bags. Soil samples were collected, air-dried, cleaned by removing visible residues, homogenised, and sieved through a sieve [4].

The current study's findings revealed that urbanisation is the primary cause of soil pollution and a source of risk within the studied coastal and riverine landscapes. The concentrations of PAHs and PTEs in soils, as well as the associated ecological and human health risks, are strongly linked to densely populated areas near the industrial and transportation hubs of Rostov-on-Don, Taganrog, and Azov, with much less attention paid to the geomorphological and fluvial features of riverine and coastal landscapes. PTE levels were slightly higher in southern Russian coastal and riverine soils than in the global geochemical background. Nonetheless, individual and integrated assessments show that the level of soil pollution caused by PTEs poses a low ecological risk. The general toxicity and carcinogenic risks are of concern [5].

Conclusion

Because of the potential adverse effects of As and, to a lesser extent, Pb, general toxic and carcinogenic risks are of the utmost importance. It is important to note that children are more likely than adults to experience non-carcinogenic effects from PTE exposure. The spatial distribution of non-carcinogenic and carcinogenic risks revealed that the majority of the study area is low risk. It should be noted that high soil pollution hotspots, which

pose significant environmental and human health risks, are mostly found in suburban areas. In this regard, increased urbanisation necessitates additional monitoring of the levels of PAHs and PTEs in these territories' soils, as well as continuous monitoring of potential anthropogenic sources of pollutants.

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Conflict of Interest

There is no conflict of interest by author.

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