

GEOCHEMICAL ANALYSIS OF MANGANESE TAILINGS FROM ŠIBENIK BAY (CROATIA) AND THEIR ENVIRONMENTAL IMPACT

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On the eastern Adriatic coast, manganese tailings from a historic ferroalloy plant (TEF) were left in (sometimes very harsh) atmospheric conditions after the plant closed in the late 1990s. These tailings near the old town of Šibenik are sometimes exposed to winds of up to 130 km/h and pose a health and environmental risk. Production at the plant began in 1900, and there has been an input of different contaminants in the surrounding area ever since. To determine the environmental impact of the tailings and dust and to assess whether there was potential for reuse detailed phase and geochemical analyses were carried out. These included X-ray powder diffraction (XRD), mass spectrometry (BCR sequential analysis and lithium borate fusion followed by ICP-MS) and SEM-EDS analysis. The analyses were carried out on sediment samples from two coves: a nearby cove (Mala Martinska Cove) and a more distant cove on the island of Žirje (Mala Stupica Cove), as well as on tailings and dust samples from factory roofs. Phase analysis revealed various manganese phases in tailings and dust (bustamite - $(\text{Ca, Mn})_3\text{Si}_3\text{O}_9$; and manganese oxides), and manganese phases were also detected in the sediments of Mala Martinska Cove. Geochemical analyses revealed 256 g/kg Mn in the dust sample, 1 g/kg Zn and 100 mg/kg REE. These values are lower than those currently required for reuse, but could become promising with advances in technology. About 500 mg/kg Mn was detected in the sediments of Mala Martinska Cove, while the Mn concentration in Mala Stupica Cove reaches ≈ 45 mg/kg, indicating the environmental impact of the tailings. Manganese is known to have several negative effects on organisms in different environments – one being changes in the regular functions of some immune parameters in organisms. Manganese becomes bioavailable through eutrophication and remains so for a long time if reducing conditions persist. Therefore, the concentrations of Mn and some other elements of interest determined in this study were compared with Norwegian and Australian sediment limit value legislation, as none exist in the European Union. Most of the values were found to be within the permissible limits.

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