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MAPPING AND RESOURCE RECOVERY PROCESS FROM HEAVY METAL CONTAMINATED GLASS WASTE DUMPS

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Abstract

Ancient crystal glass waste contains different metals and metalloids that are toxic to human health and the environment, such as arsenic, cadmium and lead. Due to lack of sustainable waste management in the past, factory glass waste was disposed in open dumps. Consequently, soil and ground water around glass waste dumps are highly contaminated in many ancient glass-producing countries like Sweden and Italy. The waste requires decontamination while considering the potential to obtain the extracted metals for use as secondary resources, thereby reducing the need for primary resources. Recently, different techniques have been developed for extraction of metals from crystal glass as secondary resources. The challenge, however, is to excavate good quality glass waste for use in the metal extraction processes. This study, therefore, investigates the potential to identify glass hotspots in a glass waste dump as a pre-excavation step. The geophysical method, Electrical Resistivity Tomography (ERT), was used as the pre-excavation mapping tool that uses electric current passed in the dump to map different sub-surface materials based on their individual resistivity. ERT produced 2D resistivity profiles of dump sections indicating the actual depth or location of each buried material. Due to its exceptionally high resistivity, glass waste was clearly mapped on the profiles as regions of high resistivity (> 8000 Ωm). Materials such as demolition waste and decomposed waste were also identified as resistivity regions ranging within 300 – 2000 Ωm and 1 – 40 Ωm respectively. The identified glass hotspots indicated a glass composition ranging between 87 – 99%, which was excavated carefully to avoid mixing with other waste fractions. The results showed that ERT is a useful pre-excavation tool that can complement glass waste dump decontamination processes by contributing good quality glass waste to metal extraction processes. This could achieve the dual goal of environmental contaminants reduction and secondary resource recovery.

Keywords: Geophysical mapping, glass waste, landfill mining, secondary resources

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