Journal of Coastal Zone Management
ISSN: 2473-3350
2020
Vol.23 No.2

Mining of Glass Dumps for Recycling

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Abstract

Landfills and dumpsites have been the ultimate end-of-life sinks for various materials. Since the mid-1990s, the Environmental Science and Engineering Group at Linnaeus University has established research in Landfill mining in cooperation waste management companies in Sweden, the Baltic Sea region and Europe. In the 'Kingdom of Crystal' in southeastern Sweden, centuries of crystal glass production have resulted in over 50 contaminated glass dumps with heavy metals leaching to soil, surface and ground water. Unlike re-landfilling of materials in the on-going remedial excavations of the dumps, excavated materials could instead be re-directed into the circular economy. To achieve this, Electrical Resistivity Imaging (ERI) is used before excavations to identify buried glass 'hotspots' for careful excavation to avoid material mixing and ultimate sorting needs. Thereafter, excavated materials are sieved, hand-sorted, scanned with X-ray Fluorescence (XRF) and leached to generate waste composition, particle size distribution, metal contents and leaching potential, which are vital parameters for material handling and metal recovery processes. ERI has successfully identified glass 'hotspots' with waste composition around 90% glass and 30–40% fine fractions (>11.3 mm). The materials are around neutral pH with hazardous concentrations of As (13,000 mg/kg), Cd (400 mg/kg) and Pb (200,000 mg/kg), but with non-hazardous concentrations in leachate (<0.1 mg/l for As and Cd and 8 mg/l for Pb). However, careful handling and storage is recommended to avoid environmental contamination and health hazards. Lastly, metal extraction through reduction-melting has shown high potential for recovery of As (99%), Cd (100%) and Pb (99.9%). The methodologies developed so far in glass mining could achieve landscape restoration, environmental contaminants minimization and contribution to circular economy through provision of potential secondary resources (extracted metals and decontaminated glass) for use in other industrial applications.

Biography:

William Hogland completed his PhD in Water Resources Engineering at Lund University in 1986, after which he established a division in Waste Management and Recovery at Lund University and organised it as an academic subject. In 1999, he got full professorship in Environmental Engineering and Recovery at Linnaeus University in Kalmar, Sweden. In the mid-1990s, he established research in Landfill mining in cooperation waste management companies in Sweden, the Baltic Sea region and Europe. He has also established the subject in some parts of Asia and written manuals on Landfill mining. Furthermore, he has over 500 publications and reports, 150 peer-reviewed scientific papers and has produced about 20 doctors. 2015 he got the Elsevier Atlas Award for "Research for a Better World" and 2017 the honorable Sweden Impact Award 2017 in "Physical Sciences & Engineering". Currently, he heads the Environmental Science and Engineering Group at Linnaeus University. .

Speaker Publications:

1. "Geophysical investigation of glass 'hotspots' in glass dumps as potential secondary raw material sources"; Waste Manag/ 2020 / Apr 30;106:213-225, Epub 2020 Mar 30.
2. "Radiometrical and physico-chemical characterisation of contaminated glass waste from a glass dump in Sweden"; Chemosphere / 2020 / Feb 26;241:124964. Epub 2019 Sep 26.
3. "Radiometrical and physico-chemical characterisation of contaminated glass waste from a glass dump in Sweden"; Chemosphere / 2019 / Dec 10;237:124568. Epub 2019 Aug 10.

12th World Congress and Expo on Recycling; Berlin, Germany- April 20-21, 2020

Abstract Citation:

William Hogland, Mining of Glass Dumps for Recycling, Recycling 2020, 12th World Congress and Expo on Recycling; Berlin, Germany- April 20-21, 2020

(https://recycling.environmentalconferences.org/speaker/2020/william-hogland-linnaeus-university-sweden)