Recovery potential of metals and rare Earth elements from landfills

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Metals and rare Earth elements (REEs) are fundamental to economy and growth as well as often are essential for maintaining and improving technological processes. Securing reliable, sustainable and undistorted access of certain raw materials is of growing concern within the EU and across the globe. In the case of critical raw materials, supply from the EU sources is even more limited [1]. Landfills and dumpsites can be specifically significant sources of pollution due to the presence of hazardous waste including heavy metals, but also can be counted as potential storages of valuables and scarce resources buried in past. Landfill mining (LFM) can be described as "a process for extracting minerals or other solid natural resources from waste materials that have been previously disposed of by burying into the ground" [2]. The process involves the excavation, screening, and separation of material from older landfills [3] [4]. The aim of this study was to determine elemental content of colloidal, clayey and silty aggregates from excavated waste during landfill mining (LFM) projects in order to provide science-based information for recovery potential of metals and REEs. The comparison of pilot results from two LFM sites in Estonia and Sweden is given. Analytical research was performed by using acid digestion and sequential extraction procedures followed by ICP-MS measurements. Research provides results on fine fraction of landfill waste containing potentially recoverable scarce metal resources. Studies on speciation of metals and metalloids comprehensively indicate that part of them are bound to residual fraction and much less to water-soluble or acid-soluble fraction. Residual part of metals is hardly extractable and potential recovery of metals and REEs from landfills can be studied further with hydrometallurgical methods. This pilot study is extending the knowledge on sustainable and justified planning for future recovery of metals and REEs from landfills.

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[1] *Report on critical raw materials for the EU*, May 2014. [2] Krook *et al*. (2012) *Waste Manage*. **32**, 513-520. [3] Hogland (2002) *Environ. Sci. Pollut. Res*. **1**, 49-54 [4] Burlakovs *et al*. (2015) *Int. J. Environ. Anal. Chem*. Accepted for publishing.