Potential Residues/Wastes for the Remediation of Landfill Leachated Contaminated Sites

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**Abstract**

A great effort is given to the construction of sanitary landfills in the last few decades. However, many older landfills were constructed in the past without proper liner and leachate collection systems. Currently in Turkey, 664 municipalities out of 2894 municipalities are disposing their solid wastes in approximately 60 sanitary landfills. Thus, 60 % of the total annually produced solid wastes are disposed properly. In many developing countries the situation is not better. Landfills are among the potential point sources causing to soil and groundwater pollution. The high number of potentially contaminated sites has put an emphasis on sustainable approaches to remediation. Thus, new low-cost, low energy use remediation systems have emerged for groundwater remediation. Recent lab-scale and field-scale studies have shown that the reuse of natural materials, which are residues or wastes from industrial operations, is possible in simple groundwater treatment systems. These materials can be used as reactive materials in permeable reactive barrier (PRB) systems. PRBs simply consist of treatment zones made up with reactive materials capable of transforming contaminants in a plume into less harmful or immobile species as the contaminated groundwater flows through a reactive zone. Conventional reactive materials used in PRB are granulated active karbon (GAC), zeolites, phosphatic compounds (e.g. apatite), zero valent iron (ZVI) and synthetic resins. Alternative materials are under continuous research. In the present study, we tested volcanic slag (VS), pumice (PU) and sea foam (SE) for their ability to remove specific contaminants from landfill leachate. To achieve this goal, leaching tests were conducted to determine the degree of chemical release from reactive materials and batch tests were performed to determine the removal efficiency of these materials. Complementary to this part, column tests were carried out to mimic possible conditions on site as close as possible. The potential of reactive materials to leach chemical compounds was determined using deionised water in treatments with respect to time. In all other experiments dilute landfill leachate was used as the solute. Reactive materials represented different leaching potentials for different chemicals. It was interesting to notice that VS reflected high ammonium, PU high chloride and SE heavy metal leaching ate different levels. Batch experiments demonstrated that VS removed chemical oxygen demand and phosphate, PU removed ammonium, chemical oxygen demand, phosphate and zinc. SE was found to remove many more parameters including fluoride, chloride and sulphate at relatively higher efficiencies (>90%). Results of the column studies reflected different trends in the breakthrough curves. The initial release of compounds from specific materials was generally followed by substantial recovery of the column capacity.

Keywords: remediation, permeable reactive barriers, re-use of industrial wastes/residues