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THE REMOVAL OF HEAVY METALS IN SUPERFUND LEACHATE BY SORPTION OF MULCH

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In a bioretention reactor, the soil layer is covered with a thin mulch layer at which the filtration and sorption might mainly occur. Since mulches similar to the leaf litter in a forest are plentiful, inexpensive and readily available, their utilization for the removal of heavy metals is gaining attention as a simple, effective and economical means of superfund leachate treatment. However, there are still questions to be answered regarding removal capacity and efficiency of heavy metal. In order to achieve the development of an effective adsorber, the parameters and mechanisms affecting metal ion capture by mulches must be identified. Therefore, the major interest of this study was to investigate the possibility of the utilization of mulches for the adsorption of heavy metals such as copper, lead and zinc in solution typical of those found at superfund leachate. Laboratory tests consisted of physicochemical test to identify the structure and composition of mulches commercially available in the USA, physicochemical test to identify the characteristic mulch flask-type batch extraction to determine the total content of heavy metal from mulches, and adsorption batch test to compare the capacity of adsorption by means of the different types of mulches. The hardwood bark (H) mulch produced the highest values for the physicochemical properties, which exerts strong influences on adsorption of heavy metal ions. In addition, according to the fast removal rate and the acceptably high capacity for all the heavy metal ions, it is also found that H mulch exhibits better adsorbent for treatment of superfund leachate with amounts of heavy metals. As shown in Fig. 1, the adsorption capacities of H mulch decrease with increasing the weight of the sorbent. It is also found that the order of the initial removal rates was shown as Pb(II)>Cu(II)>Zn(II), indicating that Pb(II) might be easily and rapidly adsorbed by H mulch regardless of the changes of initial pH and metal ion concentrations. In order to investigate the sorption isotherm, two equilibrium models, such as the Freundlich and Langmuir isotherms were analyzed. The sorption of these metals on H mulch conformed to linear form of Langmuir adsorption equation.

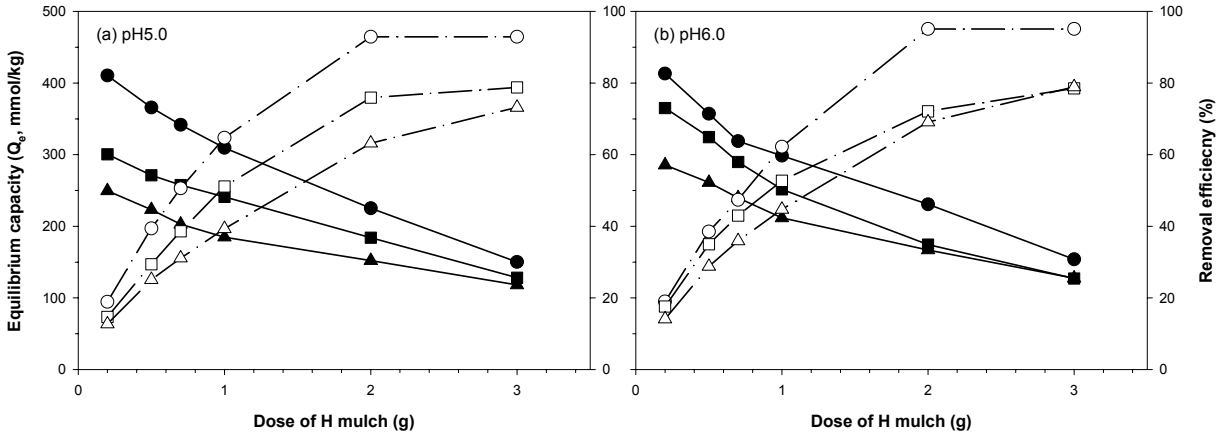

Figure 1. Adsorption capacities of H mulch (solid line) and removal efficiencies of metal ions (dash-dot line) according to the change of adsorbent dose ((■,□) Cu, (●,○) Pb, and (▲,△) Zn).