INDUSTRIAL SLAGS AS A LOW COST ADSORBENTS TO REFINE HEAVY METAL CONTAMINATED WASTEWATER

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There are many different industries containing heavy metals that at present significantly contribute to environmental pollution. The metal working industry and surface finishing of metals, is an important sector producing enormous amounts of wastewaters containing heavy metals. Among the different methods of removing heavy metals such as coagulation, flocculation, reverse osmosis, membrane separation, and ion exchange, adsorption is considered as a versatile technique due to its cost effectiveness and user friendliness. Geo and bio-sorbents are well known sorbents, and researchers have done many experiments to identify the adsorption capacity of those materials. According to concept of waste material for refine waste, recently, scientists have been studying construction and demolition waste (CDW) as low cost and abundant adsorbents to remove heavy metals in wastewater instead of bio and geo adsorbents. Industrial slags such as steel slag (SS) and municipal solid waste slag (MSW) are categorized under CDW waste material and it is timely important to give added value for these waste materials. Therefore objective of this study is to investigate heavy metal adsorption capacity of SS and MSW from wastewater.

Pb and Cd were considered as target heavy metals due to commonly available metals in wastewater. Materials (SS and MSW) were cursed and passed through 2 mm sieve and obtained 2<x>0.106 mm particle size. Standard batch adsorption study was conducted with solid liquid ratio of 1:10 for MSW (for both Pb and Cd) and 1:10 for Pb and 1:60 for Cd on SS to investigate effect of initial metal concentration (25-5000 mg/L) for Pb and Cd adsorption. Due to low adsorption capacity of Pb and Cd for MSW, further experiments such as effect of pH (3-11), ionic strength (0, 0.1, 0.01, and 0.001 M) and effect of competitive metals (Cu, Zn and Ni) were investigated only for SS under 1:60 solid liquid ratio for both metals.

This study quantified MSW have low adsorption capacity for Pb (Q_m=4.0 mg/g) as well as Cd (Q_m=2.1 mg/g) with respect to SS. Steel slag showed great affinity for Cd (Q_m=243 mg/g) than Pb (Q_m=16 mg/g) adsorption which is contradict with bio and geo sorbents. Because of Pb always showed great affinity with bio and geo sorbents than Cd. Freundlich model performed well with R^2>0.98 for Pb by indicating multilayer adsorption is predominant and Langmuir model well fitted with R^2>0.99 for Cd by showing monolayer adsorption as a governing process. Cadmium adsorption was independent from pH and ionic strength of the solution and Pb showed slight dependency with pH and ionic strength which is low adsorption in higher pH and low ionic strength. The selectivity sequence for adsorption of these metals were Cd>Cu>Ni>Pb>Zn in single metal system while it noticeably changed for multi-metal solution by alternating it as Pb>Cu>Ni>Zn>Cd. Importantly disappearance of Cd adsorption edges and developing edges for Pb adsorption is interesting phenomena. Therefore SS can recommend as a low cost adsorbent to remove Pb from multi-metal solutions and Cd from single metal solutions.

Keywords: Construction and demolition waste, multi layer adsorption, selectivity sequence

