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Batch Method Treatment of Landfill Leachate using Charcoal Composite

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Abstract : Landfill leachate can affected the environment by contaminating groundwater and surface water. The composition of landfill leachate is complex, with high concentration of pollutants and chemical variation. Degradation of chemical oxygen demand (COD) and color was investigated by adsorption batch method using mixture of charcoal-graphite-Co-polyvinyl chloride (PVC). In batch studies for adsorbents pellet and powder form of the charcoal mixture were used. The effectiveness of the treatments were compared and evaluated by percentage of colorand COD removal and results indicated that pellet and powder in batch method removed 26 and 33% of color respectively, while pellet and powder in batch method removed 21 and 27% of COD respectively.
Key words: Landfill leachate, batch method, treatment, charcoal.

Introduction

Leachate migration from wastes sites or landfills and the release of pollutants from sediments (under certain conditions) pose a high risk to groundwater resource if not adequately managed. Protection of groundwater is a major environmental issue since the importance of water quality on human health has attracted a great deal of interest lately. Assessing groundwater quality and developing strategies to protect aquifers from contamination are necessary for proper planning and designing water resources[1, 2]. However, the release from a sanitary landfill consists mainly of leachate which has become the subject of recent interest as a heavily polluted wastewater. Leachates are defined as the aqueous effluent generated as a consequence of rainwater percolation through wastes, biochemical processes in waste cells and the inherent water content of the wastes themselves. Leachates may contain large amounts of organic matter (biodegradable, but also refractory to biodegradation), where humic-type constituents make up an important group[3], as well as ammoniacal nitrogen, heavy metals, chlorinated organic and inorganic salts. The removal of organic material based on Chemical Oxygen Demand (COD) and ammonium from leachate is the usual prerequisite before discharging the leachates into natural water have confirmed the potential dangers of landfill leachates and the necessity to treat it so as to meet the standards for discharge in receiving waters[4].

Material and Methods

To study the batch method, a 1 gm adsorbent sample composed of $C_{60}C^{G}_{15}$ Co_{10} PVC_{15} was used[5]. The sample place in a 250 mL conical flask and 50 mL of leachate were added to it. The solution with suspended

sample was mixed at a speed of 300 rpm using a magnetic stirrer for the whole duration of the experiment (120 min.) to keep the solution homogeneous at ambient temperature. After that, the suspension was filtered using a vacuum filtration system with 0.45 µm filter paper and the effluent was analyzed. The effect of different shapes of absorbent sample on removal efficiency was studied with two different sample shapes; powder and pallet[6], both composed C_{60} C^{G}_{15} Co_{10}- PVC_{15} (Figure 1).

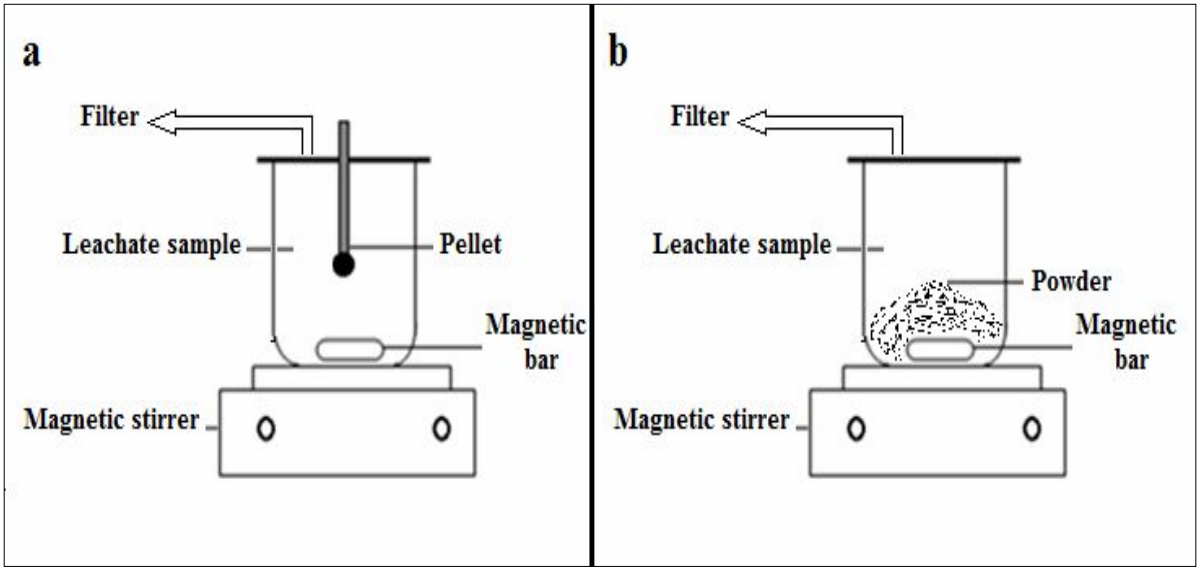

Figure 1 Conceptual diagrams of batch method (A) using $C_{60}C^{G}_{15}$ Co_{10}- PVC_{15} pellet and (B) using $C_{60}C^{G}_{15}$ Co_{10}-PVC_{15} powder

Results and Discussion

The treatment efficiency of color and COD by using batch method

Landfill leachate treatment using batch method was investigated with two different sample forms shapes, powder form and pallet form. Both samples were mixed in 50 mL of leachate for 120 min reaction time. Pallet form adsorbent sample composed of $C_{60}C^{G}_{15}$ Co_{10}-PVC_{15} while powder adsorbent sample composed of weight ratio of charcoal-graphite- Co- PVC (60:15:10:15). Results are as summarized in Figure 2. Removal results of color and COD using batch method with pellet shaped sample were 26 % for color and 21 % for COD. For powder shaped sample, the removal of color and COD were 33 % and 27 % respectively. Results obtained for both samples under the same conditions of 120 min reaction time, 50 mL of leachate sample and $C_{60}C^{G}_{15}Co_{10}PVC_{15}$ adsorbent composition.

It is clear that batch method with powder was more effective in reducing the color and COD percentage from landfill leachate. This is due to the higher surface area to absorb the pollution and to the ability of charcoal powder and other materials to absorb the color and organic component[7, 8, 9].

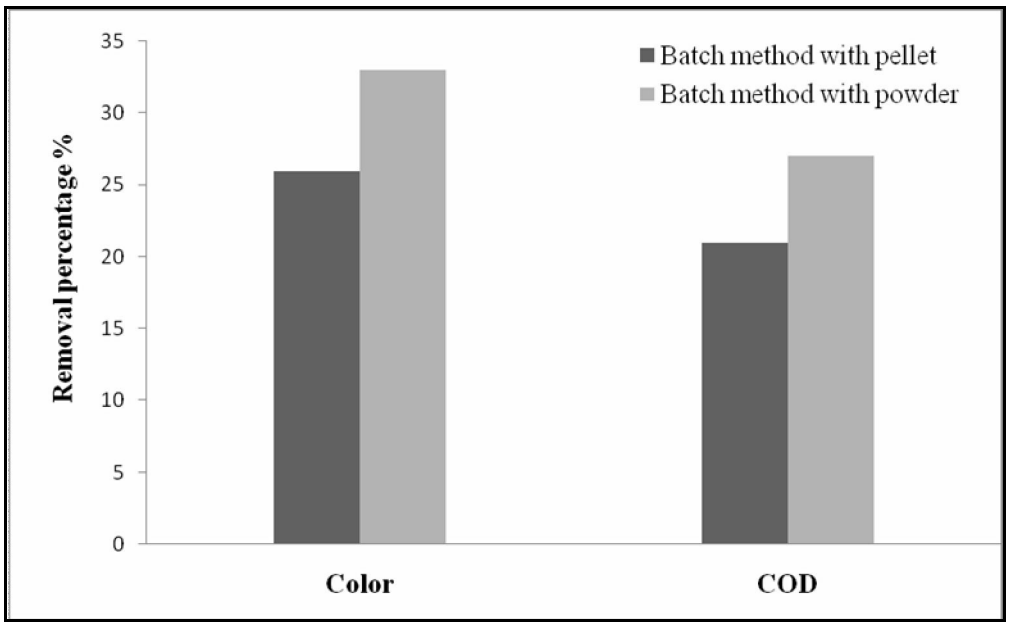

Figure 2. The removal efficiency of color and COD for batch method

Conclusion

Based on the experiment of landfill leachate treatment by batch absorption method, the results indicate batch method can be used for the leachate treatment. Under conditions of $C_{60}C^{G}_{15}Co_{10}PVC_{15}$adsorbent composition, of 120 min reaction time, 50 mL of leachate sample, the results indicated that pellet and powder in batch method removed 26 and 33% of color respectively, while pellet and powder in batch method removed 21 and 27% of COD respectively.

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