Experimental study on soil washing for pesticide-contaminated soil remediation

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Abstract - *Chemical waste from pesticides is disposed of, resulting in contamination of soil, groundwater, and surface water. Contaminants released or capable of being released from such websites may threaten human health, welfare, and the environment. Because to absorption of airborne contaminants, direct contact with soil/sediment, and consumption of contaminated ground water, human fitness will be jeopardised. As a result, it is critical to remediate polluted soil by using appropriate procedures. The purpose of this study is to determine how effective soil washing generation is at removing pesticide waste that has become adsorbent on soils. We present our experimental work on soil remediation, which includes a soil washing technique, in this publication.*

Key Words: *Soil, pesticide, chemical waste, ground water*

1. Introduction

Heavy metals, radionuclides, cyanides, polynuclear aromatic compounds, pesticides, and PCBs are among the inorganic and organic contaminants for which soil washing is deemed practical. Soil washing is most effective when the soil contains at least 50 to 70 percent sand. Soil cleaning is usually no longer worthwhile for soils with fines (silt/clay) content material of greater than 30 to 50 percent (see Section three for further information). In most cases, onsite soil treatment with soil washing isn't cost efficient until the site has at least 5000 tonnes of polluted soil. The layout of the dirt washing device, machine throughput charge, and placement logistics may all influence space needs. A 20 tonne, in accordance with our unit, might be placed on around a half-acre of land, for example, as staging for untreated and managed soils. Depending on the device layout, some systems may require additional space.

2. Experimental Section

The current research focused on the use of an ex-situ soil washing approach to remove pesticides from various types of soils. Only a few experiments have been done to see how much pesticide remains in different fractions of soil after washing. Black cotton soil samples, as well as a

pesticide. A cotton field's excavation material was used to make the test soil. The dirt was sieved at 4.75mm with a No.4 sieve. Rock sand, as well as other big materials that did not pass through the sieve, were eliminated. After that, the soil was properly mixed to maintain consistency before being stored in a plastic barrel at room temperature for use in studies. The volatile organic content of the soil sample was estimated from the mass differential before and after evaporation at 103oC in a vented oven. After being heated to 550°C in a muffle furnace using the Standard Method The total pore volume was estimated by N2 adsorption, and the specific surface area was determined by three-point BETN2 adsorption using a Quanta orb surface analyzer. Sieve analysis, specific gravity testing, and soil categorization were done according to Bowles' techniques.

2.1 Preparation of a Pesticide T-HCH-Contaminated Soil Sample (lindane)

To generate a pesticide-contaminated soil sample, 100 gm of each portion of the soil was placed in disposal boxes, and 100 mg/kg lindane was applied to the soil fraction.

2.2 Soil washing

Using the jar test apparatus, the following technique was followed for cleaning Lindane-contaminated soil. Initially, 100gm of soil sample from all fractions was collected in separate beakers, with 500ml water serving as a washing medium. In a jar test device, all soil fractions were then rinsed for 10 minutes at 60 rpm. Washing for 10 minutes at 60 rpm was discovered by trial and error, because increasing the washing duration and rotation speed increased the risk of soil particle attachments, thus it is critical to determine the rotation per minute and proper washing time. Individual fractions of washed soil were dried for 24 hours in the oven and then analysed. They were sieved with the proper sieves. After washing, the decant water was collected in little bottles with a volume of 100ml. Small fine soil particles were found in bottles, and because these particles could cause problems during gas chromatography, they were removed with a separating funnel. The decanted water was mixed with

100ml of solvent, which was a mixture of hexane and acetone (80:20) in the separating funnel. This combination was properly mixed for 5 minutes and then placed in a quiet environment for 5 minutes. This revealed two layers of solvent and water, with the bottom layer containing minute dirt particles and the upper layer containing solvent. The nozzle trap was gently opened by hand, allowing the water containing soil particles to flow freely. The solvent was gathered in bottles once again to allow it to drain. These solvent and sieved soils (soil that had been washed, dried, and sieved) were employed in the Soxhlet extractor for further treatment.

3. Results and discussion

The findings of an examination of black cotton soil will be presented. The black cotton soil had fractions less than 0.15mm, as can be seen from the numbers presented in the tables. The influence of surfactant concentration, soil solution ratio, and pH on the removal of heavy metals from contaminated soil samples was investigated in batch washing trials. The experimental circumstances are described in detail in At room temperature (240C), a series of batch tests were performed in a 125 mL conical flask over a rotary shaker at around 200 rpm for a defined contact period; then samples were collected and centrifuged at 7000g for 15 minutes. Hydrochloric acid or sodium hydroxide were used to change the pH of the surfactant solution at the start. The supernatants were taken away Whatman 41 filter paper was used for filtration. The samples were preserved with nitric acid drops and kept for a year.ICP OES analysis (inductively coupled plasma optical emission spectrometry). Distilled As a control, water was utilised for washing. The reaction was calculated as a copper percentage. extracted from the washing experiment and computed using the equation

Percentage of heavy metal removal (%) = C_1V_1/C_SMS

X 100

where C1 (mg/l) and CS (mg/kg) are the metal concentrations in the supernatant and soil, respectively; V1 is the supernatant volume (litres), and MS is the dry mass of the soil (kg). The pH of the solutions before and after washing, as well as the pH of the supernatants, were recorded. All of the tests were run three times to assure precision, and the results were given as averages.

Table-1: Values for increasing pH level to decreasing heavy metal percentage

Factors	Level			
ph.	3	4	5	6
Soil-solution ratio	1:2	1:3	1:4	1:5
Surfactant Concentration ratio	0	1	2	3
Shaking Time (hr)	3	4	5	6
Removal %	30	40	50	60
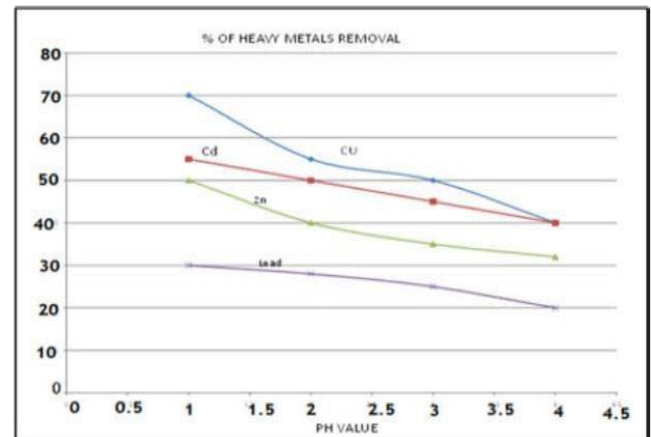
Figure-1: % of heavy metal removal

4. Conclusion

In laboratory batch operations, the operational variables in soil washing with SN and SH for the removal of heavy metals from heavily polluted soil were investigated. The surfactants utilised were successful in removing Cu, Cd, Zn, and Pb from the spiked soil, according to the removal efficiencies obtained in this investigation. In general, the removal effectiveness of the two surfactants improved as the surfactant concentration, duration, and soil-solution ratio increased, but declined when the pH of the washing solution increased. The surfactant concentration that worked best was 3%. When the pH of the washing solution was 4, the soil-solution ratio was 40, and the washing time was 48 hours for SN, the maximum removal effectiveness was found. The maximum removal efficiency, however, was found when the pH of the washing solution was increased. For SH, the washing period was 24 hours and the soilsolution ratio was 3. The effectiveness of the removal of For both surfactants, heavy metals were Cu > Cd>, Zn > Pb. The use of both surfactant indicated that heavy metals treatment of polluted soil has a lot of promise.

5. References

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