

Stabilization of Firing Range Soil Using Cuttlefish Bone

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Firing range soil is seriously contaminated with lead (Pb) and copper (Cu) because of bullet fragments generated during range operation which are mainly composed of Pb and Cu. The firing range was operated for many years without remediation and therefore high levels of Pb and Cu could be accumulated in the range soils. Lead (Pb) and copper (Cu) are known to be very toxic to the human body and caused serious health problems. Therefore, in this study the remediation of firing range soil was conducted to reduce the risk of Pb and Cu effects in contaminated soil.

As a remediation process, the stabilization technique was applied to the contaminated soil. The stabilization process is widely used to immobilize heavy metals/metalloids in contaminated soil.

In the past, cement, hydrated lime, quicklime, cement kiln dust and fly ash, etc. have been widely used as stabilizing agents. However, recently natural waste has received great attention.

In this study, pulverized cuttlefish bone (-#10 mesh materials) (CFB) was used to immobilize Pb and Cu in contaminated soil. Moreover, calcined cuttlefish bone (CCFB) was used as a stabilizing agent in order to compare its effectiveness to the natural state of cuttlefish bone. The dosages of CFB ranged between 2wt% and 10wt% while the CCFB ranged from 1wt% to 5wt%. The stabilized samples were cured for 1 week. Following the curing period, stabilization effectiveness was evaluated with a 0.1N HCl extraction for both Pb and Cu.

The stabilization results showed that the leachability of Pb and Cu decreased with increasing dosages of CFB and CCFB. A reduction of approximately 94% and 97% in Pb leachability was obtained with the 8wt% CFB and the 3wt% CCFB treatments, respectively. Moreover, a reduction of approximately 97% and 99% in Cu leachability were attained upon 6wt% CFB and 2wt% CCFB treatments, respectively.

Overall, the stabilization results indicated that the CFB and CCFB can be beneficially used for the simultaneous immobilization of Pb and Cu in contaminated soil.