Soil, Sediment, Bedrock and Sludge

Soil Washing

Introduction:

Contaminants sorbed to fine soil particles that are separated from bulk soil in an aqueous-based system on the principle of particle size. The wash water can be improved with a leaching agent, surfactant, pH adjustment, or chelating agent to assist in the removal of organics and heavy metals.

Description:

Ex situ soil separation is primarily established on mineral processing techniques, and is broadly used in Northern Europe and America for treating contaminated soil. Soil washing is a water-based process for scrubbing soils *ex situ* to remove contaminants where removal of contaminants from the soil occurs through dissolving or suspending the contaminant in the wash solution or by concentrating them into a lesser volume of soil by particle size separation, gravity separation and attrition scrubbing.

Commercialisation of soil washing is not yet widespread. The idea of reducing soil contamination through particle size separation is based on most organic and inorganic contaminants tendency to bind, either chemically or physically, to clay, silt, and organic soil particles. The silt and clay are drawn to sand and gravel particles by physical processes, primarily compaction and adhesion. Washing processes that separate the fine clay and silt particles from coarser sand and gravel particles successfully separate and concentrate the contaminants into smaller volumes of soil that can be treated more or disposed of appropriately. Gravity separation is best for removing high or low specific gravity particles such as heavy metal-containing compounds (lead etc). Attrition scrubbing removes contaminant films from coarser particles. However, attrition washing may increase the fines in soils processed. The clean, larger fraction can be returned to the site for continual use.

Multifaceted mixtures of contaminants in the soil, namely a combination of metals, non-volatile organics, and SVOCs as well as the heterogeneous contaminant compositions throughout the soil mixture, make it hard to formulate a single washing solution that will constantly and dependably remove all of the different types of contaminants. For cases like this, sequential washing, using different wash formulations and/or different soil to wash fluid ratios, may be necessary.

Applicability:

The contaminant groups applicable to the soil washing process are SVOCs, fuels, and heavy metals and may be effective on certain VOCs and pesticides. The technology enables the recovery of metals and can treat a range of organic and inorganic contaminants from coarse-grained soils.

Limitations:

- Complex waste mixtures such as metals with organics can make formulating washing fluid difficult.
- High humic content in soil could require a pre-treatment step.
- Aqueous stream will require treatment at demobilisation.
- Supplementary treatment steps may be needed to address hazardous levels of washing solvent outstanding in the treated residuals.
- May be hard to remove organics adsorbed onto clay-size particles.

Data Needs:

Particle size distribution with an optimal range of 0.24 to 2 mm is desirable. Soil type, moisture content; contaminant type and concentration; texture; organic content; cation

exchange capacity; pH and buffering capacity are all also important considerations. A bench scale treatability study should be undertaken prior to applying this technology as a suitable option.

Performance Data:

Soil washing is used considerably throughout Europe but has had limited use in the United States.

Cost:

The quantity of soil that requires treatment has a large bearing on costs.

Processor speed may also be impacted depending on the quantity of soil being treated.