

## Stabilization/Solidification of Waste Containing Heavy Metals and Hydrocarbons Using OPC and Land Trass Cement

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### ABSTRACT

The stabilization/solidification process (S/S) is one of the alternative methods of treating B3 waste, especially heavy metal. The S/S uses cement as the solidification agent. The cement will bind heavy metal pollutants in a monolithic mass with a sturdy structure, thus inhibiting its movement. The presence of hydrocarbons affects the S/S strength. Therefore, it is necessary to add pozzolan material which can absorb hydrocarbon constituting the cement blocking component of pozzolan cement, i.e. Ordinary Portland Cement (OPC) combined with trass soil. This study aims to determine the maximum content of organic materials in the form of hydrocarbons can stabilize/solidify heavy metals contained in wastes containing hydrocarbons. This research is conducted in two steps. Stage I aims to obtain the optimum composition of the mixture. On the other hand, stage II is to determine the maximum content of hydrocarbons in percent weight that can stabilize/solidify organic wastes containing heavy metals – Cu, Cr, and Pb in artificial wastes. The composition of OPC and trass soil was varied at a ratio of 100: 0, 5:25, 50:50, 25:75 and 0: 100. The hydrocarbons used in step II were paraffin, added to the optimum composition of OPC and trass soil with a proportion of 2.5%, 5%, 5% and 10%. The S/S product quality test was performed, involving: compressive strength test, Toxicity Characteristic Leaching Procedure (TCLP) and paint filter test. Strength test was conducted using a compressive strength testing apparatus Toasters Universal Testing Machine Type RAT-200, MFG No. 20380 CAP 200 tf. TCLP test under US-EPA (method 1311). The method of analysis pertaining to heavy metal concentrations involved a colorimetric method for Cr (VI), neocuproine for Cu, and dithizone for Pb. The paint test refers to the US EPA 9095B method. The results showed that the optimum composition of OPC mixture: trass soil was 50:50, which is the composition used in stage II. The results of compressive strength test were 2770 tons/m<sup>2</sup>. The TCLP test results for heavy metals Cu and Pb with hydrocarbon addition on Cu 10% and Pb 2.5% reached 0.076 and 0.076 mg/L, respectively. The result of the paint filter test indicates that there is no remaining free fluid.

**Keywords:** trass soil, heavy metal, ordinary Portland cement (OPC), stabilization/solidification

### INTRODUCTION

Environmental pollution by hazardous toxic waste (B3) is a serious problem that has not been handled properly. The B3 wastes generally contain the heavy metals resulting from industrial activities. The industrial waste containing heavy metals may be inorganic waste that does not contain hydrocarbons, for example including electroplating, metallurgical, and smelting industrial wastes.. The waste generated from the oil and gas industry

can be liquid, solid/mud or gas. Large amounts of oil sludge is generated during tank cleaning, crude oil storage, maintenance of related facilities and processing activities prior to crude oil sales to sea terminals. Oil sludge contains aromatic hydrocarbons (benzene, toluene, ethyl benzene and xylene), poly-aromatic hydrocarbons and heavy metals (Ayotamuno et al, 2007).

Oil-borne waste is a water-in-oil emulsion residue (W/O) containing a hydrocarbon and heavy metal compound. The most commonly

















