FACTORIAL DESIGN STUDY OF THE STABILISATION/SOLIDIFICATION (S/S) OF PETROLEUM DRILL CUTTINGS USING CEMENT AND HIGH CARBON PULVERISED FLY ASH

Sunday Augustine Leonard*
Julia A. Stegemann
University College London
Department of Civil and Environmental Engineering
Chadwick Building
Gower Street, London, UK WC1E 6BT
Voice: +44 (0)2076792898
Fax: +44(0)2073800986
sunday.leonard@ucl.ac.uk

Management of drill cuttings generated from exploration and production (E&P) of crude oil is a problem for the petroleum industry due to the volumes generated and their content of organic contaminants. Current management methods are expensive and environmentally unsustainable because the end products are not reusable. In this work, the management of drill cuttings by stabilization/solidification (S/S) using cement and high carbon pulverised fly ash (HCPFA) was studied. HCPFA was chosen as it is in itself a waste requiring disposal and contains carbon which could serve as a sorbent site for organic contaminants. A 22 full factorial design of experiment was adopted to investigate the main and interactive effect of the waste-to-binder ratio and binder formulation on the unconfined compressive strength (UCS), acid neutralisation capacity (ANC), hydraulic conductivity, and leachable chlorides and organics of the stabilized/solidified (s/s) products at a constant solid-to-liquid ratio of 0.45. Minitab® 15 statistic software was used to analyse the results obtained.

Results show that the two factors studied had significant main and interaction effects on the UCS, ANC, and leachable chlorides and organics, but not on the hydraulic conductivity. Samples treated with cement leached out up to 80% organic contaminants than samples treated with cement/HCPFA. Leachable chlorides from the s/s products ranged between 280 and 1110 mg/kg. Results suggest that the s/s products could be used for several construction scenarios, including in pavement (concrete paving, sub-base, and sub-grade), landfill (basement and daily cover) and controlled low strength materials such as flowable and structural fills although the chloride content however needs to be taken into consideration. It can be concluded that S/S with cement and HCPFA is an effective and sustainable method for management of drill cuttings.

###