FACTORIAL DESIGN STUDY OF THE STABILIZATION/SOLIDIFICATION (S/S) OF PETROLEUM ACID TAR USING CEMENT AND HIGH CARBON PULVERIZED FLY ASH

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Management of acid tar; an historical waste generated during the processing of coal, petroleum, and petrochemicals is a problem for the petroleum industry due to their organic content and complexity. Common remediation methods such as bioremediation and thermal desorption are not effective because of the acidity and type of contaminants present in acid tar.

In this work, the management of acid tar by stabilization/solidification (S/S) using cement and high carbon pulverized 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 2X3 factorial design of experiment was adopted to investigate the effects of organic concentration, cement-to-(HCPFA + acid tar) ratio, and initial acid tar pH on the physical and chemical characteristics such as unconfined compressive strength (UCS), hydraulic conductivity, acid neutralization capacity (ANC), and leachable organics of the stabilized/solidified (s/s) product at a constant solid-to-liquid ratio of 0.5. The changes in the properties of the s/s products with increasing curing time were also studied. Minitab® 15 statistic software was used to analyze the results obtained.

Results show that the organic content and cement-to-(HCPFA + acid tar) ratio had significant effects on the UCS and ANC but not on hydraulic conductivity and leachable organics. Leaching of organics from the treated samples ranges from 4 to 55 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 (e.g. flowable and structural fills) as the 28 days UCS values ranges between 4.5 and 15 MPa, although the acceptability needs to be taken into consideration. It can be concluded that S/S with cement and HCPFA is an effective and sustainable option for management of acid tar.

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