

## ABSTRACT

### A Preliminary Study into the Use of Oven-Dried Alum Sludge as Filter and Sorption Media to Reduce Phosphate Levels in Septic System Soakaways

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Sludge, containing alum, is a waste product derived from the treatment processes at Caroni Water Treatment Plant (WTP) and has the potential for beneficial reuse as filter and sorption media for phosphate (P), enabling P reduction in waste effluents. Correspondingly, septic system effluent has high concentrations of P that can be toxic to the environment, leading to eutrophication of waterways and phytotoxication of plants. Currently in Trinidad and Tobago, 70% of the population have septic systems installed which rely on soil to uptake P. It is therefore proposed to incorporate (oven-dried) alum sludge into the soakaway of septic systems as additional filter media to improve the P-quality of septic system effluent. This also beneficially reuses the mass-produced alum sludge at Caroni WTP.

Characteristics of Caroni WTP alum sludge include a neutral pH of 7.07, moisture content of  $78 \pm 0.3\%$ , and comprises 50.23% silt, 37.15% sand and 12.62% clay. Also, its total-P-concentration in the oven-dried form was 6.67mg/L per g of sludge. In this study, laboratory prepared P-solutions of 2mg-P/L and 5mg-P/L (Phase 1) as well as 20.1mg-P/L, 30.3mg-P/L and 21.1mg/L wastewater (Phase 2) collected from 3 typical rectangular household septic tanks were filtered through 35 x 3.8 cm columns containing gravel and oven-dried alum sludge of diameters 0.937inch, 0.0331inch and 0.0234inch. Another column containing gravel alone was also set up to mimic a septic system soakaway. It was found that alum sludge successfully reduced P levels (98-99% removal) from both the prepared P-solutions and the three septic wastewater samples over a 48-hour period. Results also confirmed that gravel alone was not sufficient to remove P in soakaways. However,  $< 0.15\text{mg/L}$  leaching of P was found to occur from the alum sludge itself, and the effluent took on a brown colour (1200 – 2000 HU) upon contact with the alum sludge filter bed. This colour was found to decrease over time, however, its impact and cause require more investigation.

Further research is recommended in order to further develop the use of alum sludge as well as to determine its feasibility in soakaways. Such information includes the optimum P-ability or breakpoint of alum sludge, the ideal alum sludge diameter particle size and volume, as well as the cause and impact of leaching of contaminants from alum sludge.

Keywords: Anesha Deonarine; Alum Sludge; Caroni Water Treatment Plant; Septic System; Soakaway; Phosphate.