World Academy of Science, Engineering and Technology
International Journal of Mathematical and Computational Sciences
Vol:14, No:12, 2020

Laboratory Analysis of Stormwater Runoff Hydraulic and Pollutant Removal Performance of Pervious Concrete Based on Seashell By-Products

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Abstract : In order to solve problems associated with stormwater runoff in urban areas and their effects on natural and artificial water bodies, the integration of new technical solutions to the rainwater drainage becomes even more essential. Permeable pavement systems are one of the most widely used techniques. This paper presents a laboratory analysis of stormwater runoff hydraulic and pollutant removal performance of permeable pavement system using pervious pavements based on seashell products. The laboratory prototype is a square column of 25 cm of side and consists of the surface in pervious concrete, a bedding of 3 cm in height, a geotextile and a subbase layer of 50 cm in height. A series of constant simulated rain events using semi-synthetic runoff which varied in intensity and duration were carried out. The initial vertical saturated hydraulic conductivity of the entire pervious pavement system was 0.25 cm/s (148 L/m²/min). The hydraulic functioning was influenced by both the inlet flow rate value and the test duration. The total water losses including evaporation ranged between 9% to 20% for all hydraulic experiments. The temporal and vertical variability of the pollutant removal efficiency (PRE) of the system were studied for total suspended solids (TSS). The results showed that the PRE along the vertical profile was influenced by the size of the suspended solids, and the pervious paver has the highest capacity to trap pollutant than the other porous layers of the permeable pavement system after the geotextile. The TSS removal efficiency was about 80% for the entire system. The first-flush effect of TSS was observed, but it appeared only at the beginning (2 to 6 min) of the experiments. It has been shown that the PPS can capture first-flush. The project in which this study is integrated aims to contribute to both the valorization of shellfish waste and the sustainable management of rainwater.

Keywords : hydraulic, pervious concrete, pollutant removal efficiency, seashell by-products, stormwater runoff
Conference Title : ICSRD 2020 : International Conference on Scientific Research and Development
Conference Location : Chicago, United States
Conference Dates : December 12-13, 2020