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Abstract

Rain harvesting has been a principal source of potable water for the residents in the United States Virgin Islands (USVIs). It should be noted that rainwater is not contaminant-free. Engineered pervious layer (EPL) to be developed and tested in this proposed study would benefit many communities that rely on rainwater as their potable water source (e.g., USVIs). EPL has two-fold benefits. First, the pervious property of EPL will be served as rainwater drainage with additional potential for the reduction of large particles and organic and inorganic contaminants. Second, pathogens potentially present in rainwater will be removed and inactivated with the topical photocatalytic reactions of nano-titanium dioxide embedded in EPL with sunlight in daytime and the antimicrobial inactivation by nano-zinc oxide even in nighttime in depth of EPL. This first-year research specifically aims to develop and evaluate a proof-of-concept of EPL. Its structural and mechanical properties will be evaluated as a construction material. Hydraulic properties of EPL will also be tested to quantify the effectiveness of rain harvesting. The removal and inactivation of pathogens will be assessed with the model indicator microorganism, Escherichia coli. The PI has strong background and previous experience related to the proposed work. A graduate student in pursuit of a master degree in Environmental Engineering and more than three undergraduate students will get hands-on experience in the proposed study. Results will be disseminated at a professional conference and an on-site seminar at the USVIs and eventually in a peer-reviewed journal article and a Master thesis. The PI will pursue additional funding for the second-year project for field demonstration and recalibration of the developed EPL. The PI expects full technology transfer during the third-year project with implementation of the demonstrated EPL at sites in both Puerto Rico and the USVIs.