MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 22-463 (project 498) | June 2022

Development of Mixed Media Filtration for Stormwater Runoff Treatment

the ISSUE

Urban stormwater has been recognized as a major source of water contaminants. Conventional stormwater best management practices are generally not effective in removing microorganisms and nutrients. There is a critical need to develop effective treatment technologies that can remove contaminants in stormwater runoff to protect natural water resources.

the RESEARCH

The objectives of this project are to develop a low-maintenance, low-cost mixed-media filtration system for stormwater treatment and perform laboratory and field-scale studies to evaluate the performance of the mixed-media filtration system. A focus of this project is to identify filter materials that can effectively remove Escherichia coli (E. coli), which has been widely used as an indicator microorganism for fecal contamination in stormwater runoff. To achieve these objectives, laboratory batch and column experiments were conducted to evaluate E. coli removal capacities of four filtration materials: limestone, zeolite, steel slag, and recycled steel chips. After the laboratory study, steel chips and steel slag were selected as filtration materials to conduct a field-scale study. A mixed-media filter using steel chips and steel slag was constructed in a stormwater detention pond in the City of Brookings, SD. The removal of E. coli and phosphate by this filter at different storm events were determined.

MOUNTAIN-PLAINS CONSORTIUM REGION 8

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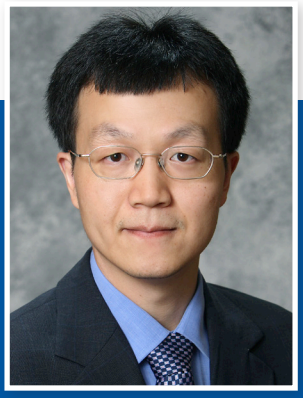

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Project Title

Development of Mixed Media Filtration for Stormwater Runoff Treatment

Sponsors | Partners

East Dakota Water Development District

James River Water Development District

South Dakota State University

City of Brookings, SD

USDOT, Research and Innovative Technology Administration

the FINDINGS

The results of laboratory adsorption experiments showed that the E. coli removal by the four materials were in the order of steel chips > steel slag > limestone and zeolite. The steel chip columns removed more than 90% of the influent E. coli during the continuous flow laboratory column experiments. The mixed media filter using steel chips and steel slag removed an average of 50% of the E. coli and an average of 42% of the phosphate in the stormwater runoff during the field study. The mixed media filter also maintained stable E. coli and phosphate removal efficiencies throughout the three-month field experiment. The results of this project demonstrate that recycled steel chips are highly efficient materials for E. coli removal from stormwater runoff. The mixed media filter using steel chips and steel slag exhibited excellent stormwater treatment capability for E. coli and phosphate removal under real-world field conditions.

the IMPACT

Various contaminants carried by stormwater runoff can deteriorate the quality of surface waters. Bacteria and nutrients in the runoff present a serious risk to aquatic ecosystems and public health. As we continue to expand urbanization, contamination caused by stormwater is likely to worsen in the future. The mixed media filtration using steel chips and steel slag can be used as an effective treatment tool to remove E. coli and phosphate from stormwater runoff. The application of this filtration technology will improve stormwater management and protect natural water resources.

For more information on this project, download the Main report at https://www.ugpti.org/resources/reports/details.php?id=1083

For more information or additional copies, visit the Web site at www.mountain-plains.org, call (701) 231-7767 or write to Mountain-Plains Consortium, Upper Great Plains Transportation Institute, North Dakota State University, Dept. 2880, PO Box 6050, Fargo, ND 58108-6050.