

MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 24-543 (project 597) | August 2024

Bacteria Removal from Stormwater Runoff Using Steel Byproduct Filters



the **ISSUE**

Escherichia Coli in stormwater runoff can cause serious health risks in natural waters. Conventional stormwater management practices are generally not effective at removing E. Coli from stormwater. There is a critical need to develop effective filtration technologies that can be applied in long-term field applications for E. Coli removal.

the **RESEARCH**

The objectives of this project are to determine the long-term capability of steel chips and steel slag to remove E. Coli from stormwater and provide recommendations on using these steel byproducts for field stormwater filtration applications. Laboratory batch and column experiments were conducted to evaluate the impact of material aging and mixing ratios on the E. coli removal capabilities of steel chips and steel slag. After the laboratory study, a three-year field study was performed to determine the long-term performance of a steel byproduct filter. The field study was conducted using an existing steel byproduct filter installed at a residential stormwater detention pond in the City of Brookings. The field filter was composed of 50% steel slag and 50% steel chips during the first two years, and this ratio was modified to 70% steel slag and 30% steel chips during the last year of the field study. The steel byproduct filter's efficiency at removing E. Coli and phosphate during different storm events was determined.

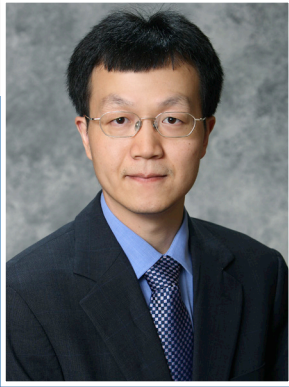


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Lead Investigator(s)

Guanghui Hua
Guanghui.hua@sdsstate.edu

Co-investigator(s)

Kyungnan Min
kyungnan.min@sdsstate.edu

Christopher Schmit
christopher.schmit@sdsstate.edu

Research Assistant(s)

Brenden Olevson, GRA MS
Peng Dai, GRA PhD
Abdoul Kouanda, PhD

Project Title

Bacteria Removal from
Stormwater Runoff Using
Steel Byproduct Filters

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the FINDINGS

The laboratory and field study results demonstrate that recycled steel byproducts are effective filter materials for E. Coli removal. The average E. Coli removal efficiencies ranged from 30% to 50% during the three-year field study. The steel byproduct filter is also capable of removing phosphate from stormwater. Steel chips showed higher E. Coli removal capacity than steel slag. Higher ratios of steel chips in the steel byproduct filter resulted in higher E. Coli removal. However, more quantities of steel chips in the filter may cause material agglomeration during field filter operation. The filter operation experience indicates that substantial material agglomeration occurred when the steel chips ratios exceeded 50%. When the steel chips ratio was adjusted to 30%, the material agglomeration issue was significantly improved. Therefore, we recommend that steel chips to steel slag ratios should not exceed 30% for field scale applications.

the IMPACT

E. Coli in stormwater runoff presents a serious risk to aquatic ecosystems and public health. Conventional stormwater management practices are generally not effective at removing E. Coli. Cost-effective and highly efficient filtration technologies are critically needed to reduce the E. Coli contamination from stormwater runoff. This project demonstrates that steel chips and slag are effective filter media for long-term field applications. The media mixing ratios recommended from this project will facilitate the design of full-scale stormwater filters. The application of this filtration technology will reduce the E. Coli contamination from stormwater runoff, protect natural water resources, and improve public health.

For more information on this project, download the Main report at <https://www.ugpti.org/resources/reports/details.php?id=1185>

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.



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