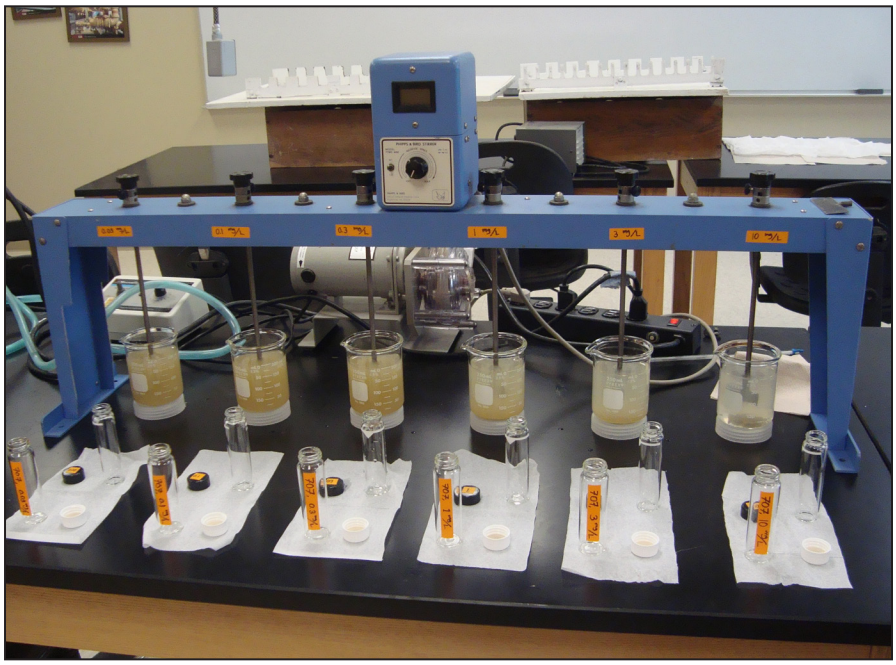
MOUNTAIN-PLAINS CONSORTIUM

RESEARCH BRIEF | MPC 20-418 (project 436) | June 2020

Using Flocculation to Reduce Turbidity of Construction Site Runoff



the ISSUE

Highway construction usually requires large areas of land disturbance, which may result in accelerated soil erosion. The stormwater runoff from highway construction sites typically contains a large amount of fine particles that are difficult to remove using conventional best management practices. Stormwater with high turbidity levels can negatively affect the water quality of receiving waters and natural habitats of rivers, lakes, and streams. Effective treatment technologies are needed to reduce turbidity levels in the runoff to protect natural water resources.

the RESEARCH

Polyacrylamide (PAM) flocculation, a process that uses PAM, a highly absorbent polymer, to cause particles in solutions to clump together, (flocculation). The process has been demonstrated to be an effective technology for erosion and sediment control. The effectiveness of the PAM treatment is affected by soil types, treatment system conditions, and environmental factors. It is important to investigate the flocculation effectiveness for specific soil types and environmental conditions to determine the optimum PAM treatment conditions to achieve low effluent turbidity. Turbidity is cloudiness caused by suspended particles; it is a key indicator of water quality and measured by the nephelometric turbidity unit (NTU). The objectives of this study were to determine the effectiveness of different PAMs in reducing turbidity of construction site runoff in South Dakota, and provide recommendations on PAM applications for construction site runoff treatment. In this study, four different soils were collected from active construction sites. Synthetic runoff was created for each soil, and laboratory flocculation experiments were conducted to develop an understanding of PAM's ability to promote soil particle flocculation. The flocculation experiments were conducted using different PAM

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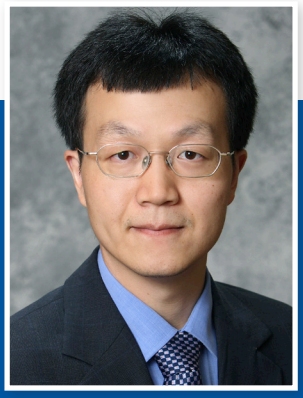

Lead Investigator(s)

Guanghui Hua

South Dakota State University
guanghui.hua@sdstate.edu

Research Assistant(s)

Jacob Humburg, GRA, MS

Project Title

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the **RESEARCH** (cont.)

types and doses, temperatures, pH levels, calcium concentrations, and organic matter contents to simulate a wide range of treatment conditions. In addition, mixing intensity, mixing time, and settling time were also varied during the experiments to determine the required operating conditions for successful PAM flocculation systems.

the **FINDINGS**

PAM flocculation reduced turbidity from simulated construction site runoff during this study. PAMs with higher charge densities and molecular weight performed better than PAMs with lower charge densities and molecular weight. Flocculation with the anionic PAMs at the optimal dose of 1 mg/L was able to reduce the runoff solution turbidity from an initial value of 1,500 NTU to less than 200 NTU. Further increasing PAM doses beyond the optimal dose deteriorated the PAM flocculation performance. Cold temperatures negatively affected the PAM flocculation of soil solutions, especially at low dosages. For stormwater runoff treatment under cold temperatures, the PAM dose can be increased to compensate for the loss of flocculation efficiency. High calcium and low pH conditions improved PAM flocculation. PAM flocculation efficiency increased with increasing mixing intensity, mixing time, and settling time. Adequate mixing and settling conditions should be provided when using PAM for construction site runoff treatment.

the **IMPACT**

The results showed that PAM flocculation is an effective treatment technology to reduce turbidity in the runoff from highway construction sites. Improved water quality of the runoff will help maintain the quality of surface waters, promote environmental sustainability, and reduce the need for costly dredging of the water systems. The use of PAM flocculation will also improve the erosion and sediment control of the construction sites and reduce the sediment loss.

For more information on this project, download the entire report at https://www.ugpti.org/resources/reports/details.php?id=991

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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