Florida Department of Transportation Research

Comparative Nitrogen and Pesticide Removal with Sorption Media in Linear Ditch for Groundwater and Stormwater Treatment

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Current Situation

The abundant rain in Florida can produce significant runoff from urban and agricultural areas that can carry pollutants and fertilizers into water bodies and groundwater. This runoff is generally high in nitrogen, which then leads to an overabundance of nitrogen in groundwater. Roadside ditches and storm drains are a major conduit or runoff and a means of controlling it. Therefore, they present opportunities for treatment.

Research Objectives

Researchers at the University of Central Florida studied the use of bio-absorption activated media (BAM) in linear ditches as a method of removing dissolved organics nitrogen (DON) from runoff.

Treating runoff is essential to protecting the beauty and health of Florida's lakes.

Project Activities

The researchers tested the nitrogen removal effectiveness of two BAMs in laboratory and field setups: wood chips and Bold & Gold, a commercial product composed of sand, clay, and tire crumb. Nitrogen removal effectiveness for both BAMs was tested with and without the addition of carbon and/or copper to help further understand the chemistry of the removal process. Field-scale total nitrogen removal data were collected and compared with laboratory results. A cost-benefit analysis was also conducted for both BAMs.

In the laboratory, BAMs were tested in 6-in diameter, 4-ft-tall columns, which allowed precise control of the amount of nitrogen, carbon, and copper applied, as well as precise measurement of the amount of nitrogen removed by BAM. Because nitrogen may be present in many different chemical forms in runoff, measuring the total nitrogen that would be available for bacterial or algal growth can be difficult. The researchers worked with Florida State University to access special equipment that made the necessary measurements possible.

In field studies, 300 feet of a roadside ditch was lined with Bold and Gold. Another 300 ft were lined with wood chips. The wood chip section was divided 100-ft sections of 2-ft, 3-ft, and 4-ft depth, respectively. The Bold and Gold section was divided into 1-ft deep and 2-ft deep sections. The BAMs were kept continuously moist by a low-volume pumped water supply powered by a solar panel when there was no rain, thus preserving the bacteria that are important for nitrogen removal.

Bold and Gold effectively removed nitrogen in the laboratory. Bold and Gold was also effective in the field, but wood chips did not. Specific removal rates depended on flow rates and other factors. In a cost analysis, the cost to remove a pound of nitrogen was 2% cheaper with wood chips. But Bold and Gold had the advantage of lasting longer than woodchips, 20 vs. 8 years, respectively, and therefore, it would require much less maintenance. Bold and Gold supported more bacterial communities and performed better in overall nitrogen removal.

Project Benefits

A better means of removing excess nitrogen from water runoff can help protect Florida's water resources.

For more information, please see www.fdot.gov/research/.