Erosion Resistance Performance Comparison Of Natricil, Stabilizer And Envirobond's Organic-Lock

Testing conducted at the Envirobond Test Laboratory, Mississauga, ON Canada

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Introduction

Organic-Lock is a uniquely derived combination of natural products, designed to enhance the gelling strength and overall lifespan of the natural plant fibre. Additionally, Organic-Lock provides an elevated pH to the system in which it is mixed, resulting in an unfavourable growing medium for weeds. This technology was developed through research in association with the Agriculture and Agri-Food Canada research center. This document compares the erosion resistance performance of Natricil, Stabilizer and Organic-Lock binders when combined with decomposed granite aggregates for use in trailway applications. The performance of each material was tested using a rainfall simulator designed to replicate a very heavy rainstorm.

Experimental Procedure

Materials

The aggregate used for this test was a decomposed granite material as supplied by Gail Materials. These samples were labeled as Pyrite Gold Decomposed Granite and Pyrite Tan Decomposed Granite. Classified samples of each aggregate were combined with each binder (Natricil, Stabilizer and Organic-Lock) at a rate of 1.71% of the total mass. The bags from which each of these binders was drawn are shown in Figure 1.

Figure 1. Bags of binder used in comparison test

Gradation and Classification

The gradation analysis was conducted using the standard ASTM C-136 procedure, Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates. Three samples of material were graded and analyzed and the average gradation was determined (see Figure 2). A larger quantity of material was then separated into its individual particle sizes, and then recombined to form the sample aggregate, accurately following the average gradation (see Figure 3). This process ensures that all samples were composed equivalent aggregate mixtures.

Figure 2: Gradation and classification of decomposed granite aggregate

Figure 3: Recombination of classified aggregate to create sample aggregate

Rainfall Simulation

The sample containers used for this experiment consisted of aluminum channel stock cut into 12” sections. The channel used was 1.25” wide and 0.625” deep. Figure 4 shows an empty sample container.

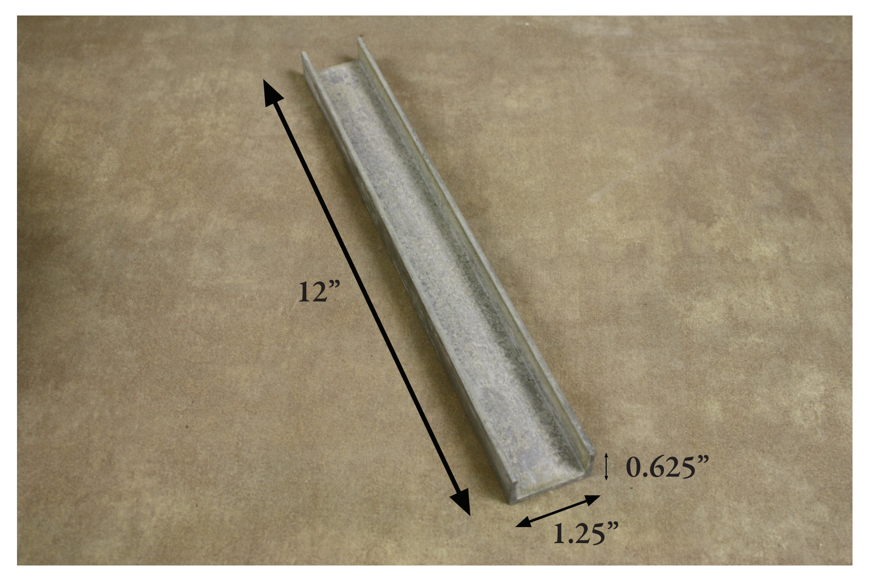

Figure 4: Sample container

Each sample was thoroughly mixed and combined with 12% water by weight and pressed firmly into the sample container. Figure 5 shows the sample material being mixed with water. Excess material was removed, and the samples were compacted with a hand tamper to consolidate the material and ensure binding. The samples after compaction into the sample container can be seen in Figure 6. The samples were then allowed to dry for 24 hours at 30°C (see Figure 7).

Figure 5: Dry sample material mixed by hand with water.

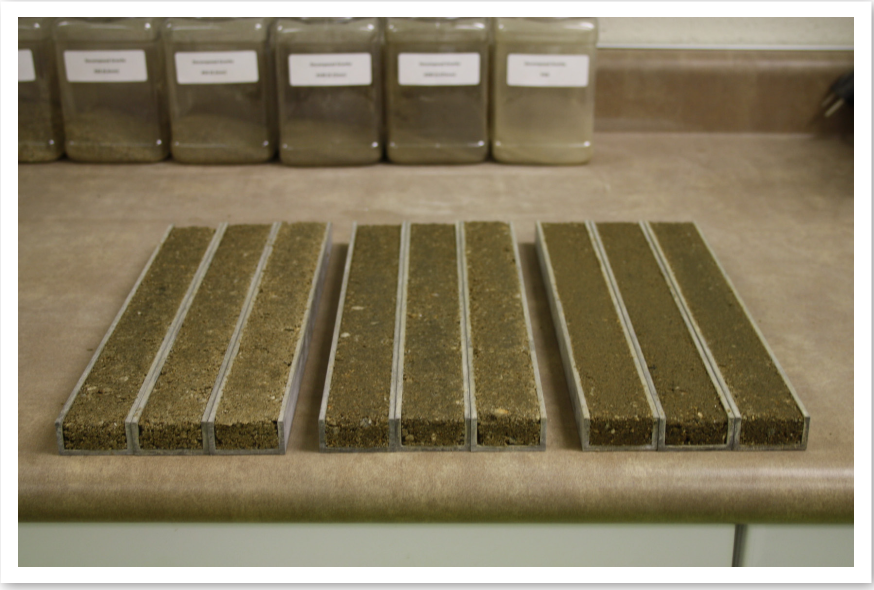

Figure 6: Rainfall simulator samples after compaction

Figure 7: Rainfall simulator samples being placed in incubator for natural drying

The samples were then placed in the rainfall simulator and tested for 120 minutes. Prior to testing, the rainfall simulator was calibrated to ensure that all samples received the same amount of simulated rain. Figure 8 shows the most recent water flow rate profile from the rainfall simulator. Once the simulation was complete, the samples were dried, weighed and the amount of material lost during the simulation was calculated.

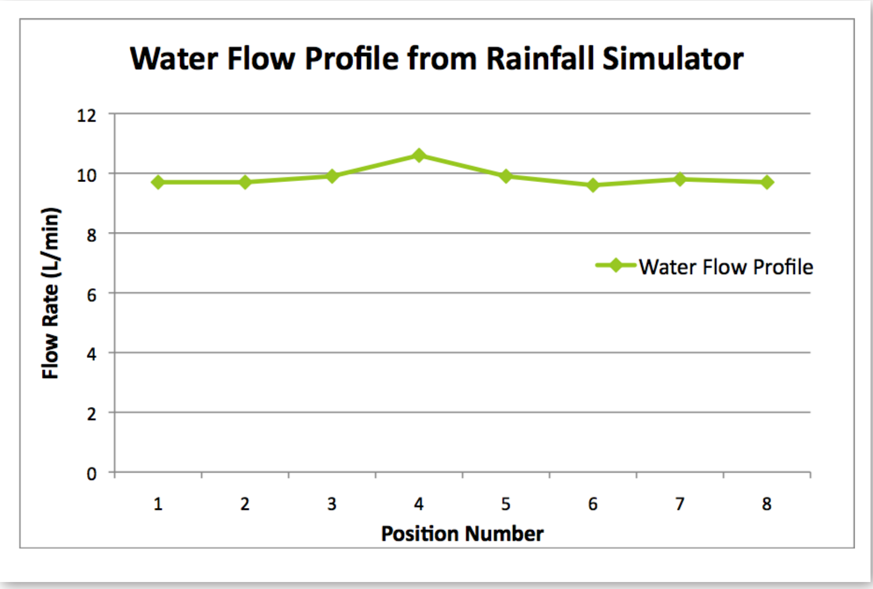

Figure 8: Recent calibration of flow profile from rainfall simulator.

The rainfall simulator works by pumping water from a reservoir up to a tank that is positioned above the samples. The tank has a series of holes in the bottom which allow water through to simulate raindrops. The upper tank is motorized to provide an even distribution of raindrops onto the samples. Figure 9 shows the rainfall simulator while it is operating.

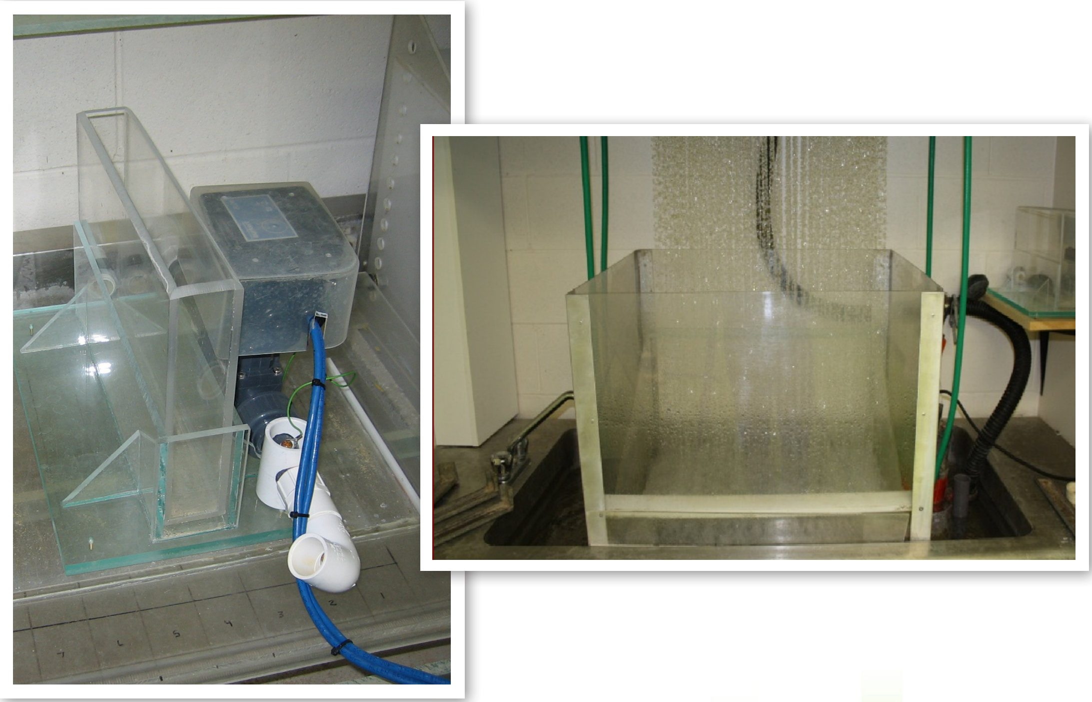

Figure 9: Simulated rain being collected by digital flow meter to determine consistency across the sample area

Results

Gradation

A gradation of the aggregate was conducted before the performance test. Figure 10 shows the average gradation curve for the decomposed granite aggregate.

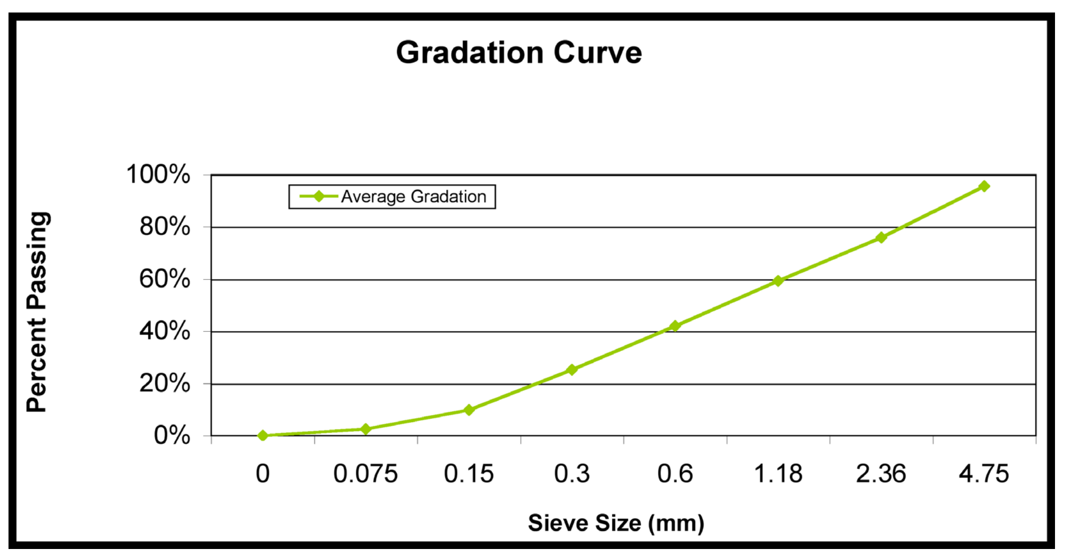

Figure 10: Gradation curves of Pyrite Gold DG

Rainfall Simulation

The rainfall simulator was halted at various intervals so that the material losses could be documented. Figure 11 through Figure 23 show the progression of material loss during the test. As early as 5 minutes into the test, the samples mixed with the Natricil and Stabilizer began to show pitting on the surface of the samples. Significant material losses are seen by 15 minutes and near complete washout by 80 minutes. Samples mixed with Organic-Lock showed no significant losses over the full duration of the test.

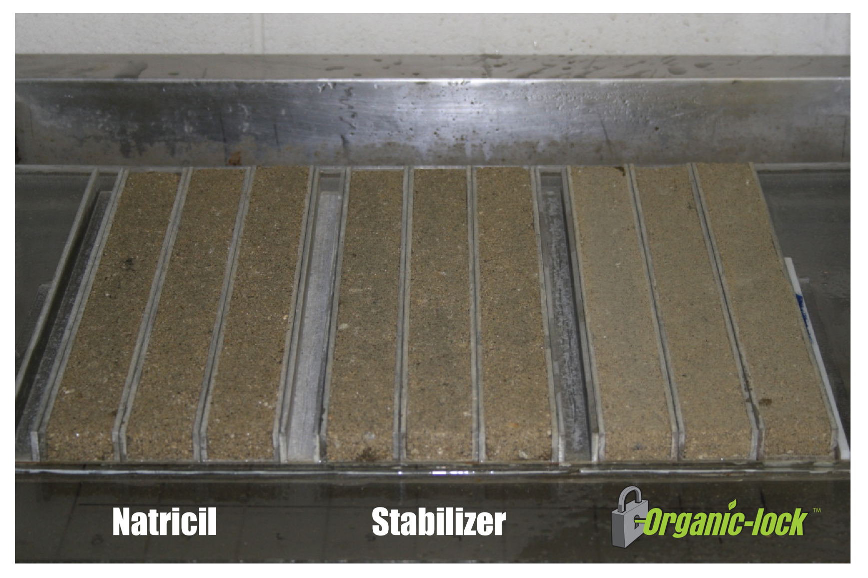

Figure 11: Rainfall simulator samples t = 0 min

Figure 12: t = 5 min

Figure 13: t = 10 min

Figure 14: t = 15 min

Figure 15: t = 20 min

Figure 16: t = 25 min

Figure 17: t = 30 min

Figure 18: t = 40 min

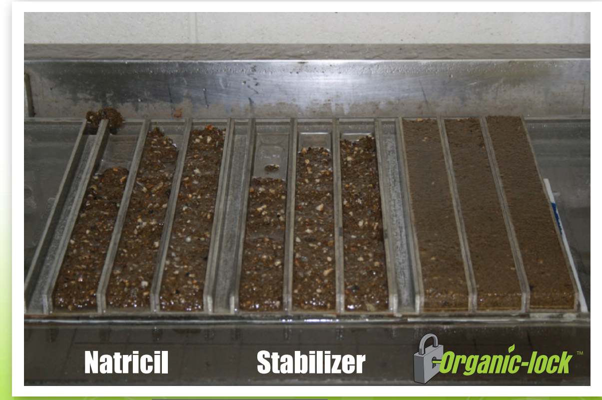

Figure 19: t = 50 min

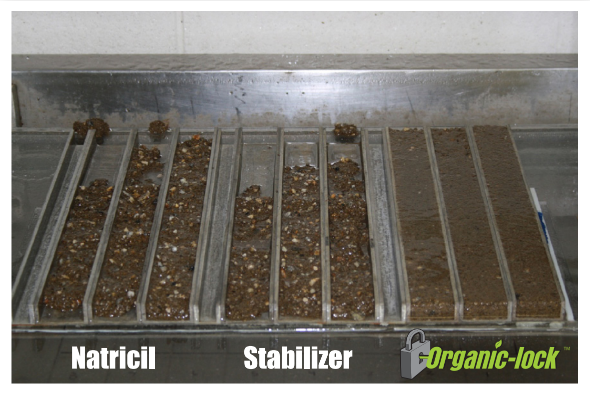

Figure 20: t = 60 min

Figure 21: t = 80 min

Figure 22: t = 100 min

Figure 23: t = 120 min

Figure 24: Dried samples after rainfall simulation

The measured material loss confirms the visual evaluation of material lost during the rainfall simulation (see Figure 25).

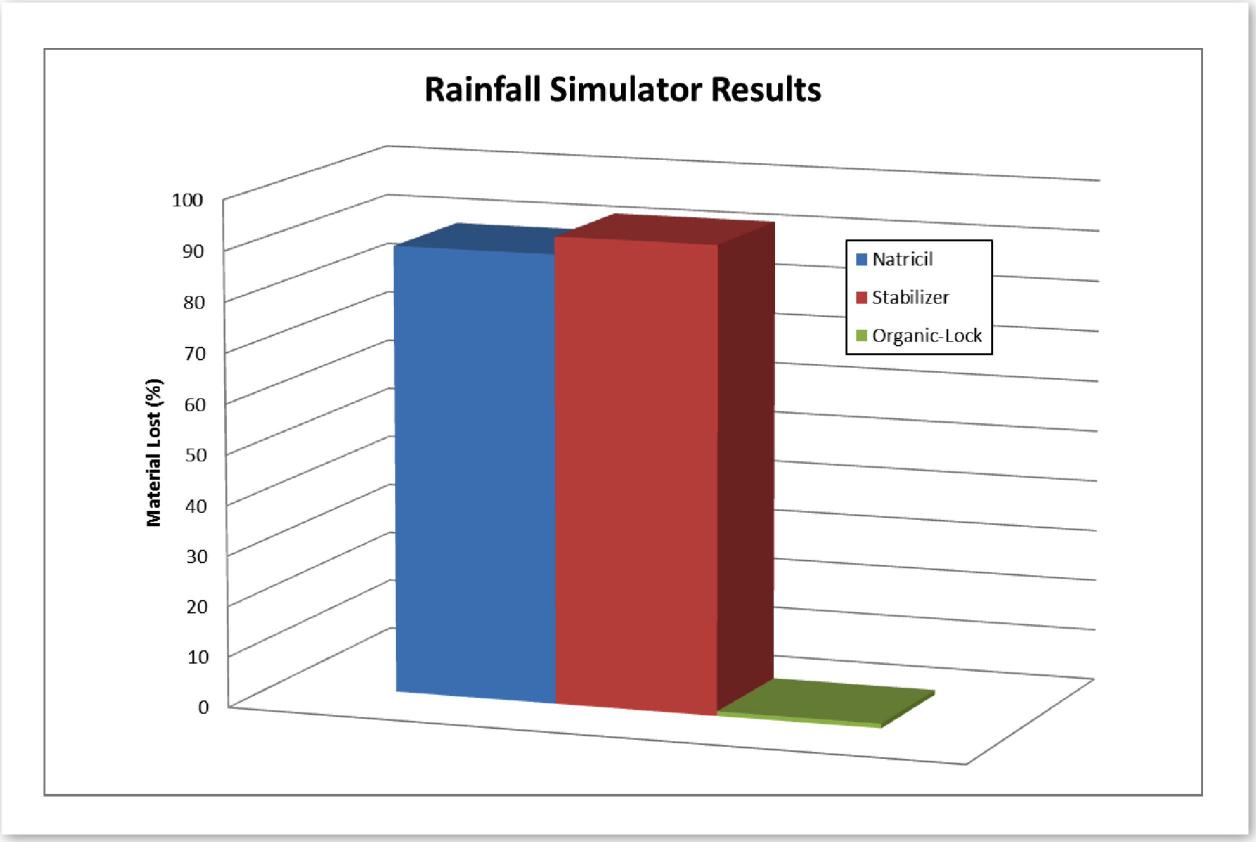

Figure 25: Percent material loss of the three products tested after 120min of testing in the rainfall simulator.

	Percentage loss due to erosion
Natricil	88.8 %
Stabilizer	92.4%
Organic-lock™	0.9%