



ARCADIA

LABORATORY TEST REPORT

WIND EROSION TEST



August 17th, 2020 DOC-2008-05 Rev. 00





0. Summary

The purpose of this Test is to show that the level of wind erosion of samples made of Fine Sand treated with Arcadia is lower than 0.01% per minute (in weight) under desired conditions. The Sample was a square shape with size of (L 0.3 x W 0.3)m with a very smooth slope with height varying from 35mm to 50mm.

We used Samples of Fine Sand not treated with Arcadia and Samples treated with Arcadia. Both the Sample types had the same size as previously introduced. The erosion of the treated and untreated Samples was measured by weighting the samples before and after the test.

We chose to use Fine Sand because it is the easiest material to erode. In fact, if this test is repeated with regular soil, the erosion will be lower.

1. Test Procedure

| <u>Fest Date</u> : | August 24 th , 2020 |
|-------------------------|--|
| <u>Fest Equipment</u> : | N.1 Wind Tunnel N.2 Square Containers N.1 Weight Scale |
| <u>Fest Materials</u> : | ★ To produce the Cylindrical Sample with Arcadia: Geomaterial (Sands): 8 kg Urea Concentration: ≥ 0.03 M Protein Source: ≤ 20 g/l Indigenous Ureolytic Bacteria (natural indigenous population) |
| <u>Fest Phases</u> : | i. Feed the bacteria of the Sample for 14 days in a Container at a temperature of 25°C to 30°C ii. Dry the Sample for 28 days at a temperature of 45°C iii. Weight the Sample iv. Put the Sample in the Wind Tunnel v. Test the Sample at 25 m/s for 10 minutes vi. Weight the Sample and verify the difference in weight |





Geomaterial Characteristics:

| Test | Unit | Fine Sand | |
|------------------|----------------------|-----------|--|
| pH | | 7.9 - 9.6 | |
| Ca ²⁺ | ppm 120 - 380 | | |
| Clay | % 6% - 11% | | |
| Silt | % | 10% - 14% | |
| Sand | % | 80% - 86% | |
| Particle Size | mm | 0.002 | |
| EC | m mho/cm 0.86 – 0.92 | | |

Tab. 1: Geomaterial composition



Fig. 1: Geomaterial (Fine Sand)







Fig. 2: Arcadia Culture in Laboratory



Fig. 3: Autoclave

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Fig. 4: Incubator



Fig. 5: Centrifuge







Fig. 6: Glassware



Fig. 7: Laboratory Substances used for Arcadia





2. Test Execution

The Test, as described in the previous chapter was conducted for N.2 Samples using one type of bacteria only.

We prepared N.2 types of Sample and, for each one, we took the same Test three times. The first Sample is the one that we stabilized with Arcadia method.

Feed with Arcadia treatment was performed for 14 days and drying was done for 28 days; after, Wind Erosion Test was performed.

The second Sample of Sand untreated with Arcadia, was soaked in water. We considered this Sample as a Control Sample.

Note that, in the Sample prepared with Arcadia, all the bacteria were indigenous and already naturally living in the Ultra-Fine Sand soil.



Fig. 8: Wind Tunnel Set-up

Samples were weighed before and after Wind Erosion Test.

The Sample stabilized with Arcadia was inserted inside a Wind Tunnel and we tested its behavior with a speed of 25 m/s (90 km/h) for 10 minutes.

Due to the severity of the erosion in the Sand not stabilized with Arcadia, the not treated Sample was tested in the Wind Tunnel at a speed of 25 m/s for only 1 minute.





The Test was repeated N.3 times with three identical Samples (treated and untreated) to calculate the average result.



Fig. 9: Sample stabilized with Arcadia – Weight before wind test



Fig. 10: Sample not stabilized – Weight before wind test







Fig. 11: Sample stabilized with Arcadia during Wind Test



Fig. 12: Sample not stabilized during Wind Test







Fig. 13: Sample stabilized with Arcadia – Weight after Wind Test



Fig. 14: Sample not stabilized – Weight after Wind Test





3. Conclusions

The Test was successful: we proved that Fine Sand treated with Arcadia method has been eroded far less than 0.01% per minute at the maximum wind speed.

The result of Wind Erosion Test shows that with the intensification of rain, slight erosion was observed on the surface of stabilized Sand.

The results of Wind Erosion Test (Tab. 2) showed that the Sample not stabilized with Arcadia erodes at a rate of 7.68% per minute exposed to wind at a speed of 25 m/s (90 km/h). But, when the Sand is stabilized with Arcadia, it erodes at a rate of 0.0097% per minute, exposed to the same wind conditions.

| Sample Sand | Weight Before Test (WBT) [g] | Weight After Test (WAT) [g] | WBT – WAT [g/10 min] | WBT – WAT [g/min] | Wind Erosion Percentage [g/min] |
|-----------------------------------|------------------------------------|-----------------------------------|-------------------------|----------------------|---------------------------------------|
| UNTREATED SAMPLE | 3,670 | 3,388 | - | 282 | 7.683 % |
| SAMPLE TREATED WITH ARCADIA | 10,278 | 10,268 | 10 | 1 | 0.0097 % |

Tab. 2: Test Results

4. Attachments

A1 – Wind Test Certificate