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# ARCADIA

# LABORATORY TEST REPORT

## RAIN EROSION TEST

**August 14th, 2020**
**DOC-2008-02 Rev. 00**

## 0. Summary

The purpose of this Test is to show that the level of water erosion of samples made of Fine Sand treated with Arcadia is lower than 10% (in weight) under desired conditions.
The Sample was a square shape with size of (L 1.0 x W 1.0 x H 0.1)m.

Using a shower sprinkler-like device located at a fixed height, water was sprayed over the Sample.
The water pressure was also calibrated to reach the desired kinetic energy.

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

Test Date: August 9th, 2020

Test Equipment:

- N.1 Shower Sprinkler
- N.2 Square Containers
- N.1 Weight Scale

Test Materials:

- To produce the Sample with Arcadia:
  - Geomaterial (Sands): 150 kg
  - Urea Concentration: ≥ 0.03 M
  - Protein Source: ≤ 20 g/l
  - Indigenous Ureolytic Bacteria (natural indigenous population)

Test Phases:

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 14 days at a temperature of 45°C
iii. Weight the Sample
iv. Spray the water for 20 minutes
v. 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*


*Fig. 4: Incubator*

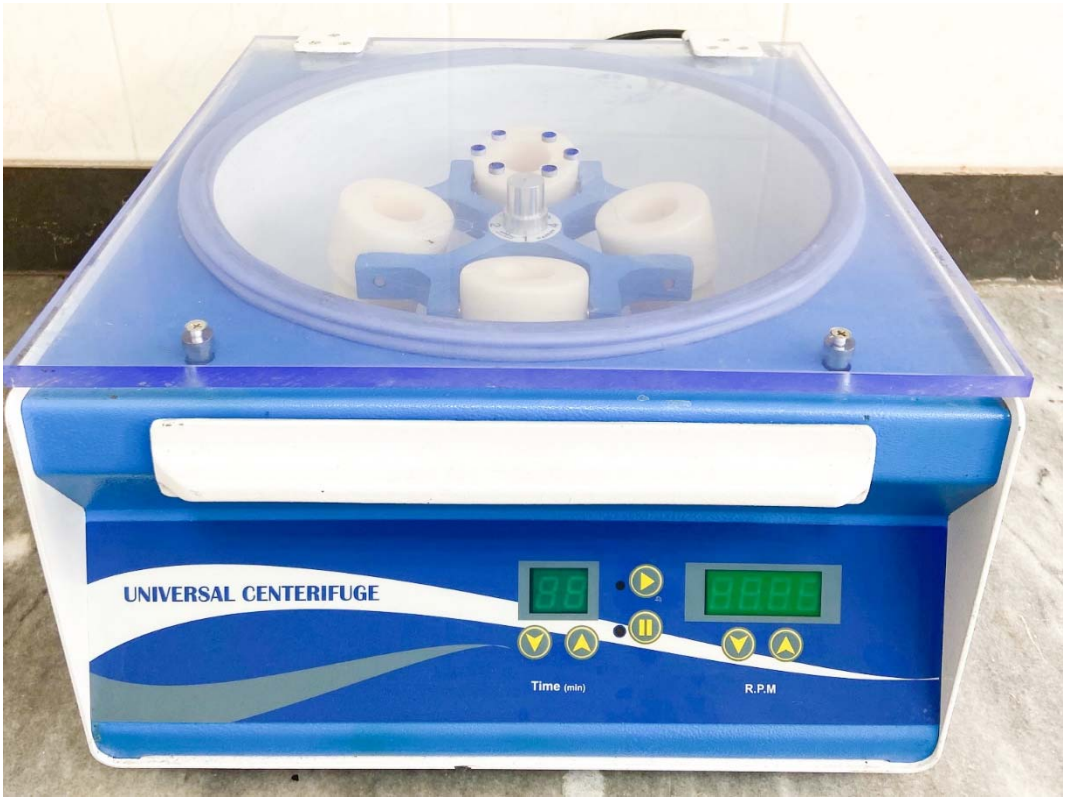


*Fig. 5: Centrifuge*


*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.10 Samples (one for each rain condition) using one type of bacteria only.
Note that all the bacteria were indigenous and already naturally living in the Fine Sand soil.

In this experiment, 10, 20, 30, 40, 50, 60, 70, 80, 90 and 100 mm per hour of precipitation were sprayed for 20 min.
The sprinkle's height was 7.75 meter.
Kinetic energy ranged from 12.24 to 20.95 joules per square meter.

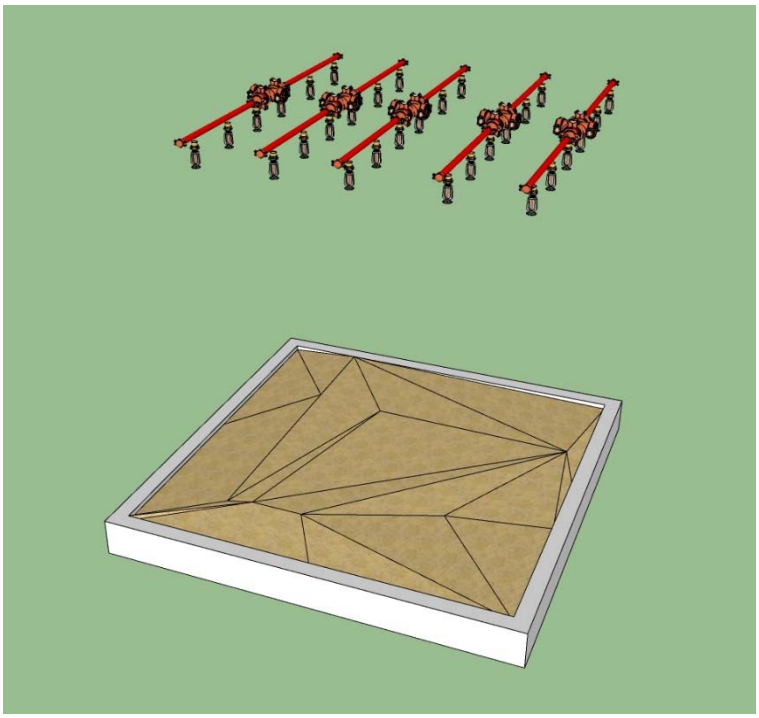

*Fig. 8: Test Set-up*

## 3. Conclusions

The Test was successful: we proved that Fine Sand treated with Arcadia method has been eroded far less than 10%.

At the maximum rain flow (maximum kinetic energy) the erosion was less than 4%.

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

Note that the maximum rainfall in desert areas is reported to be 80 mm per hour and the highest annual rainfall is 150 to 200 mm in desert areas.
Therefore, it can be said that sand stabilization by Arcadia can prevent water erosion up to 96%

per year.

| SAMPLE | 30 mm/h | 40 mm/h | 50 mm/h | 60 mm/h | 70 mm/h | 80 mm/h | 90 mm/h | 100 mm/h |
|---|---|---|---|---|---|---|---|---|
| **UNTREATED SAMPLE** | 48.21% | 59.73% | 74.26% | 86.93% | 99.28% | 100% | 100% | 100% |
| **SAMPLE TREATED WITH ARCADIA** | **0.372%** | **0.529%** | **0.736%** | **1.014%** | **1.239%** | **1.834%** | **2.187%** | **3.591%** |

*Tab. 2: Test Results*

## 4. Attachments

A1 – Rain Test Certificate