

1 Test Objective:

Given the prevalence of arid and semi-arid regions with extreme climatic variations, particularly periodic ground frosts, the objective was to evaluate GR42's resilience to freezing conditions.

1.1 Test setup:

Test cube dimensions: Approximately 50x50x30mm.

Fill the cube to maximum capacity with water.

Subject the cube to freezing at -18°C for a minimum of 4 hours.

Thaw the cube at 30°C for a minimum duration of 3 hours.

Repeat the entire process for a total of 10 cycles.

Conduct a final assessment to determine the duration required for complete water disappearance at 30°C.

1.2 Parameters Monitored;

Weight of the GR42 test sample throughout the testing procedure.

Dimensional changes.

Photographic documentation.

1.3 Containment Specifications:

The containment is not hermetically sealed, allowing for some air exchange with the interior while retaining most moisture during freezing and thawing.

1.4 Sample Preparation:

Due to GR42's capillary structure and buoyancy, the product floats on water. To ensure proper filling, the product is submerged under water for a minimum of 24 hours.

2 Test equipment

Freezer maintained at -18°C.

Climatic chamber with temperatures set to 24°C and 40°C.

Ruler for measurements.

Glass bowl for containment.

Saucer used as a lid for the glass dish.

Digital material scale for precise measurements.

Camera for documentation purposes.

3 Test Results

3.1 Tabulated Results:

Step

1	Size Cube without water	5,1 x 5,0 x 3,3 cm = 84,15 cm ³			
2	Weight without water		1,00 g		
3	Start			20.06.2023	09:35
4	Cube full with water			21.06.2023	09:23
5	Size Cube with water	5,1 x 5,0 x 3,3 cm = 84,15 cm ³			
6	Weight with Water		61,38 g		
7	1.Start freeze by -18°C			21.06.2023	09:45
8	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,87 g	21.06.2023	13:03
9	Defrost by 24°C		59,83 g	21.06.2023	14:58
10	2. Freeze			21.06.2023	14:59
11	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,23 g	21.06.2023	18:51
12	Defrost		59,74 g	21.06.2023	21:10
13	3. Freeze			21.06.2023	21:11
14	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,02 g	22.06.2023	00:57
15	Defrost		59,60 g	22.06.2023	09:00
16	4. Freeze			22.06.2023	09:01
17	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	58,89 g	22.06.2023	12:57
18	Defrost		59,71 g	22.06.2023	15:03
19	5. Freeze			22.06.2023	15:04
20	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,36 g	22.06.2023	18:58
21	Defrost		59,54 g	22.06.2023	21:01
22	6. Freeze			22.06.2023	21:02
23	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	58,83 g	23.06.2023	00:50
24	Defrost		59,51 g	23.06.2023	08:46
25	7. Freeze			23.06.2023	08:47
26	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	58,61 g	23.06.2023	12:55
27	Defrost		59,79 g	23.06.2023	15:03
28	8. Freeze			23.06.2023	15:04
29	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,39 g	23.06.2023	19:07
30	Defrost		59,69 g	23.06.2023	21:20
31	9. Freeze			23.06.2023	21:21
32	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,08 g	24.06.2023	01:28
33	Defrost		59,66 g	24.06.2023	08:59
34	10. Freeze			24.06.2023	09:00
35	Frozen	5,2 x 5,0 x 3,4 cm = 88,40 cm ³	59,07 g	24.06.2023	13:12
36	Defrost		59,65 g	24.06.2023	15:23
37	Drying with 40°C air			24.06.2023	15:24
38	Dry	5,0 x 4,9 x 3,2 cm = 78,40 cm ³	0,97 g	27.06.2023	15:12

3.2 Photographic Documentation of Test Preparation and Initial Parameters:



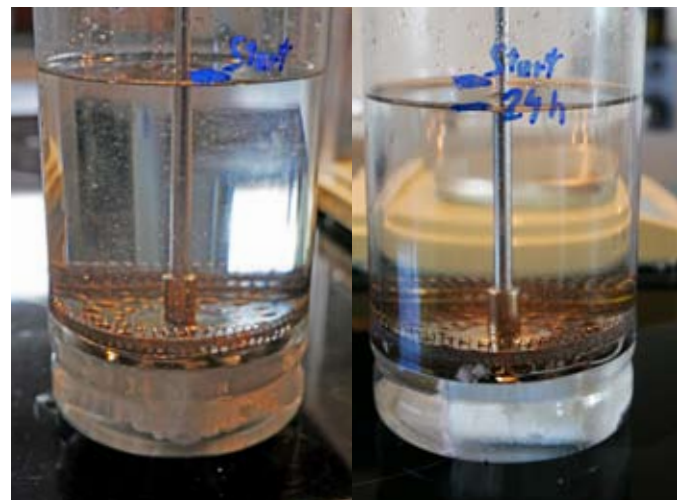
Dimension check



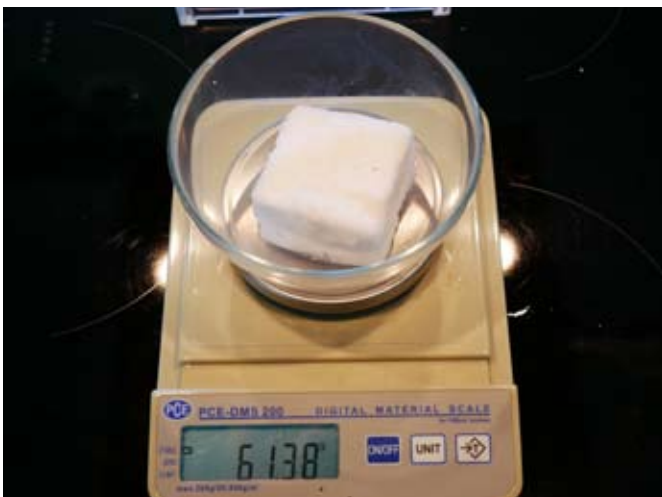
Dry weight



Dry cube



Cube fully submerged and filled with water after 24 hours



Weight filled with water

3.3 Pictures for Step 7-9. Frost and Defrost Cycle 1



Weight frozen



1. Frozen cube



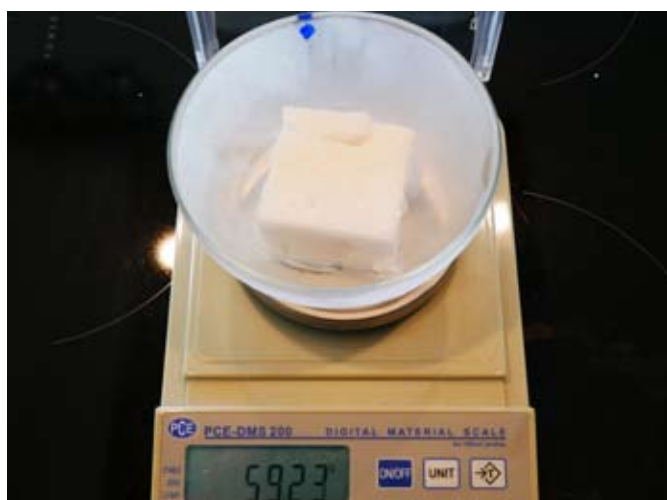
Weight defrosted



1. Defrosted cube

The cracking observed along the top edge is unrelated to frost exposure; it occurred during the lifting of the cube to examine potential frozen water beneath. However, despite the absence of visible frozen water, moderate force was required to remove the cube from the glass bowl.

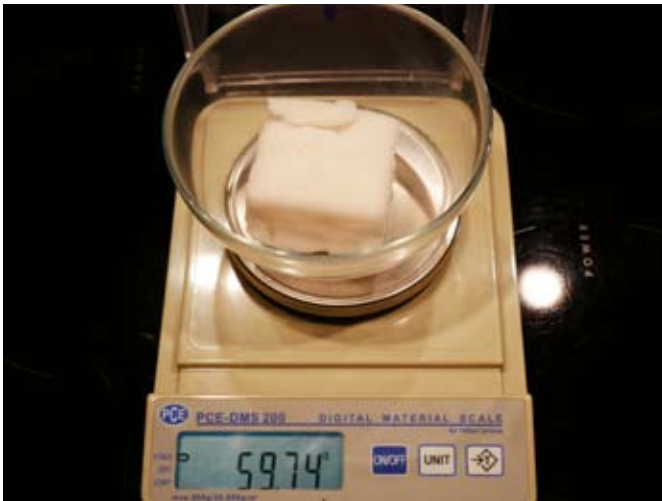
3.4 Pictures for Step 10-12. Frost and Defrost Cycle 2



Weight frozen



2. Frozen cube



Weight defrosted



2. Defrosted cube

3.5 Pictures for Step 13-15. Frost and Defrost Cycle 3



Weight frozen



3. Frozen cube

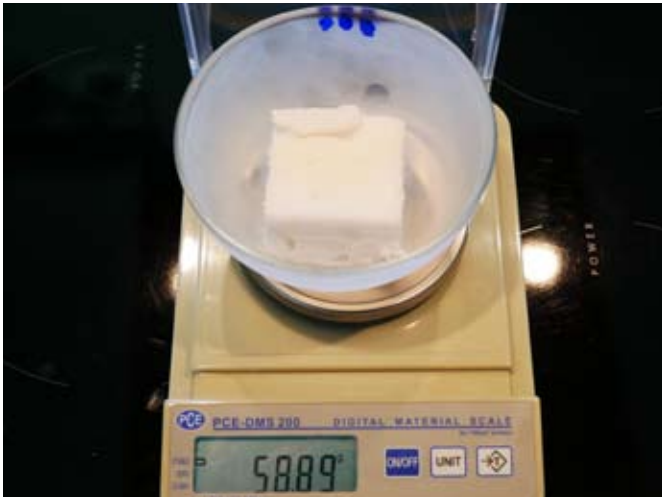


Weight defrosted



3. Defrosted cube

3.6 Pictures for Step 16-18. Frost and Defrost Cycle 4



Weight frozen



4. Frozen cube



Weight defrosted



4. Defrosted cube

3.7 Pictures for Step 19-21. Frost and Defrost Cycle 5



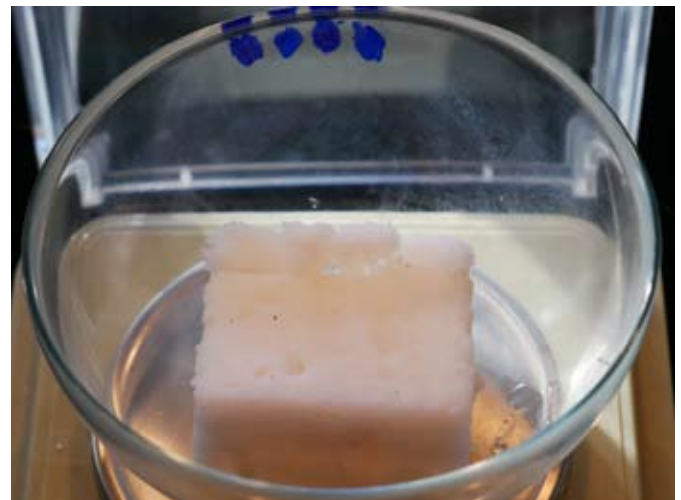
Weight frozen



5. Frozen cube



Weight defrosted



5. Defrosted cube

3.8 Pictures for Step 22-24. Frost and Defrost Cycle 6



Weight frozen



6. Frozen cube



Weight defrosted



6. Defrosted Cube

3.9 Pictures for Step 25-27. Frost and Defrost Cycle 7



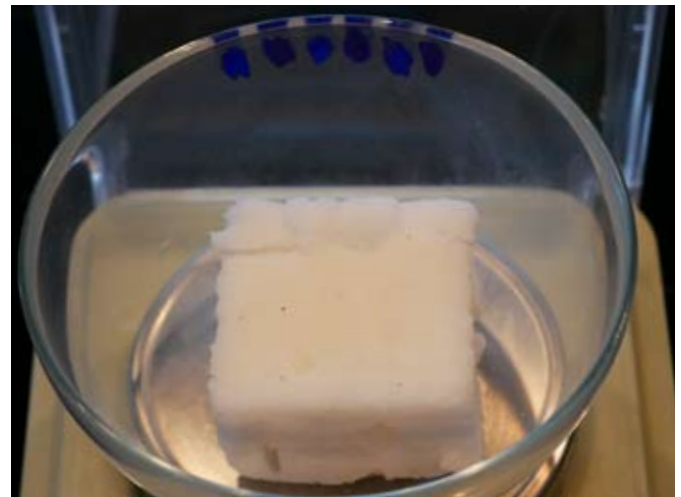
Weight frozen



7. Frozen cube



Weight defrosted



7. Defrosted cube

3.10 Pictures for Step 28-30. Frost and Defrost Cycle 8



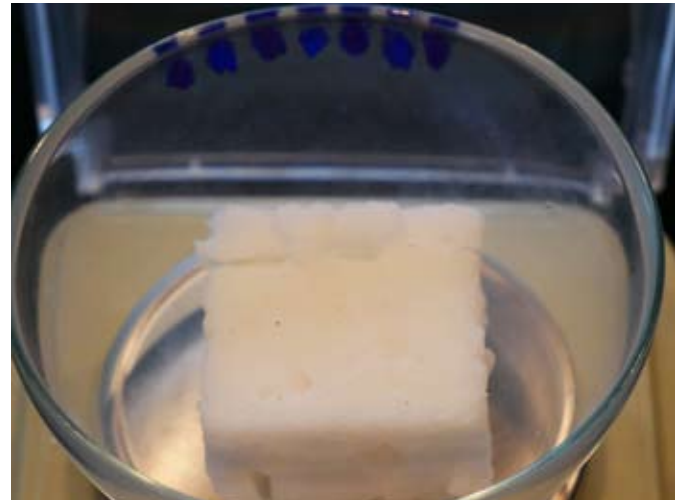
Weight frozen



8. Frozen cube



Weight defrosted



8. Defrosted cube

3.11 Pictures for Step 31-33. Frost and Defrost Cycle 9



Weight frozen



9. Frozen Cube



Weight defrosted



9. Defrosted cube

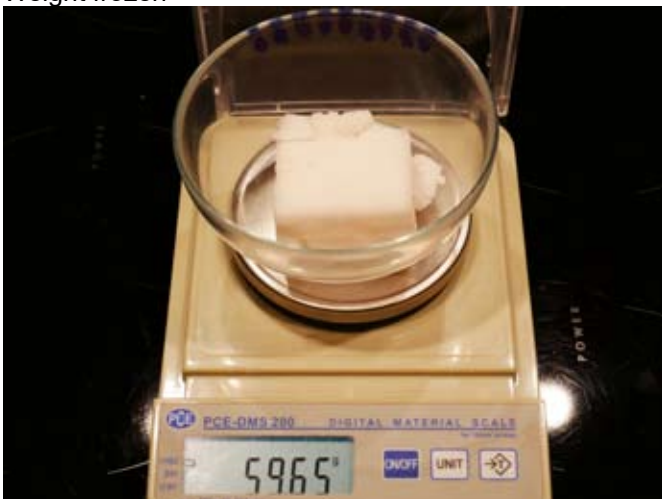
3.12 Pictures for Step 34-36. Frost and Defrost Cycle 10



Weight frozen



10. Frozen cube



Weight defrosted



10. Defrosted cube

3.13 Cube drying in a climate chamber at 40°C until reaching minimum weight.



Dry weight



Completely dry with minor handling-related bits fallen off.

4. Observations

Throughout the test, we only observed structural damage caused by our handling, which had no impact on GR42. During the final step of drying the cube, the temperature accidentally spiked to 140°C for 15 minutes, causing slight deformation. This occurred six hours before the cube was fully dry.

Overall, water loss from the cube during freezing and thawing was minimal, less than 2 grams. We attributed this to condensing air due to the container not being airtight.

5. Conclusion

The product exhibited the expected behaviour throughout the test, showing no frost effect. Even if elements break off, the product's performance remains unaffected.

Small fibres act as water reservoirs in sandy soil, and the fibre structure remains intact. GR42 does not undergo significant dimensional changes; it neither expands nor shrinks dramatically as water exits the product.

Testing with a 50% sand and 50% GR42 mixture is unlikely to yield different results.