

ASWAT soil aggregate stability test

[ASWAT = Aggregate Stability in WATer]

Source: McKenzie and Koppi, 1997, Australian Journal of Soil Research, Vol. 35, pp 843-852

Preamble: The LFA slake test does not examine the dispersive properties of soils. Dispersion of clays is a much more serious matter than slaking. It can result in hard-setting dense soils and lead to gully and tunnel erosion. The following procedure assesses the dispersion character of soil samples on a 17-point scale, and uses simple equipment.

Procedure:

1. Use air-dry 3-5mm natural soil aggregates. Immerse at least 4 aggregates into rain water contained in a petri dish, by lowering in carefully.
2. Observe the degree of milkiness, which signifies dispersion, around the aggregates after 10 mins. For no milkiness whatever, score 0; for slight milkiness, score 1; for obvious milkiness, score 2; for considerable milkiness, score 3 and for complete dispersion (sand grains in a cloud of clay) score 4. To be sure about detecting dispersion, use a solution of 0.01M calcium chloride as a check (1.47g $\text{CaCl}_2 \cdot 2\text{H}_2\text{O}$ per litre). No soil will disperse in that solution. View and photograph against a dull black background. Note that it is dispersion that we are looking at here, not slaking (see No. 8 below).
3. Retain these samples undisturbed and repeat the observations at 2 hrs, scoring in exactly the same way.
4. For only those samples that scored 0, wet a small soil sample (about 1 teaspoon) slowly with a fine water spray whilst mixing and moulding with a spatula, or do it in a clean, gloved hand, working the soil into a bolus as though doing a standard soil texture assessment. The right water content is when you can roll the just-moist soil into about a 3 mm rod and it falls apart into 10 mm lengths (is, not very plastic). Be careful to wet up slowly. Do not slosh the water in and need to add more soil! The glove is to prevent any sodium from sweat adding to the sample.
5. Test these moist, moulded samples in the same way as steps 1 to 3, scoring in the same way.
6. For the full score:
 - (a) for soils that showed some dispersion in steps 1 to 3, add the 10-min score to the 2-hr score and then add to 8, giving a score ranging from 9 to 16.
 - (b) For soils that scored 0 in steps 1 to 3, add the remoulded scores for 10-min and 2-hr together, giving a score between 0 and 8.
 - (c) The total score for all samples is therefore 0 to 16, a 17-point scoring system.
7. If the samples slake but do not disperse, the soil can be amended by organic matter incorporation alone.
8. The critical threshold value for soil dispersion in the field is 6. There is a good relationship with ESP, but the ASWAT test also integrates other factors associated with soil stability. Gypsum alone is the best ameliorant at pH values of 6 and above. For soils with pH's less than 5.5, lime (calcium carbonate) can have a long-term synergism with gypsum.

The four photographs on the following page illustrate different degrees of soil aggregate dispersion.



Slaked soil, no dispersion



Slight dispersion



Re-moulded soil: Moderate dispersion at 2 minutes



Re-moulded soil: Extensive dispersion at 2 minutes