

THE POROSITY OF SEDIMENT

Purpose

To determine the porosity of loose sediment.

To determine how grain size, sorting, roundness and sphericity affect porosity.

Activity

1. Measure the grain size if not given.
2. Record the volume of sand in the beaker (V)
3. Put exactly 250ml of water into the measuring cylinder.
4. Pour the water slowly and gently into the beaker until the water is level with the top of the sediment. If the sediment is < 1mm or if it is poorly sorted allow the beaker to stand for five minutes to let all the air escape. Check the water level.
5. Record the volume of water left in the measuring cylinder (A) and work out the volume of water in the beaker (=250-A). Empty the measuring cylinder.
6. Pour the water from the sediment very slowly and carefully back into the measuring cylinder without letting any grains escape from the beaker by using the piece of plywood. Record the volume of water now in the measuring cylinder (B).
7. Draw up a table like this.

volume of water between the grains	250 - A	
volume occupied by the grains	V	
volume of water that will drain out the sediment	B	

8. Calculate the porosity
$$\frac{=(250-A) \times 100}{V}$$
9. Calculate the specific retention
$$\frac{=(250-A -B) \times 100}{V}$$
10. Calculate the specific yield
$$\frac{=B \times 100}{V}$$

11 Repeat with a second beaker

Teacher's Section

Requirements

250ml measuring cylinders

Piece of wood 10cm by 10cm

Beakers 200g coffee jars make ideal beakers because they are clear, robust and free. Each one should be marked at 500ml level by pouring in 500ml of water and marking the top level on the outside with a permanent marker pen. It is wise to make a small scratch with a flint or quartz because the pen mark may be rubbed off. It is then easy to see that the sediment is at the correct level.

Well sorted sediment of different sizes or small marbles or glass beads.

For sorting: one jar of well sorted and one of poorly sediment.

For rounding: one jar of angular pebbles and one jar of rounded pebbles.

For sphericity: one jar of marbles and one jar of pennies (you will need about £7 worth). Counters would also do.

Notes

If doing porosity and grain size students can put their results on the board and all can then plot a graph of how porosity, retention, and yield vary with grain size.

The sediment can be used again before drying to measure specific yield but not porosity and specific retention.

The sediment must be dried before being stored otherwise it becomes smelly.

Checks

Make sure that the students have not filled the beakers above the level of the sediment and that they are reading the water level in the measuring cylinder at the base of meniscus.

Results

Porosity should not be affected by grain size provided the sediment is well sorted. Specific yield increases with increasing grain size whereas specific retention decreases. The porosity is greater in well sorted sediment and is about 45%.

Roundness does not make too much difference. The difference in porosity between grains of different sphericity is heavily dependent on packing, spheres 45%, pennies 30%.

Time

15 minutes for two jars