Procedures for Performing Grain-Size Analysis Using the Model L3P Sonic Sifter Separator

1.1. Identification of the test method

This procedure outlines the use of the Sonic Shifter Separator Model L3P for measuring grain size sand and silt particles for sediment or soil samples for phi sizes 2 mm, 1 mm, 500µm, 250µm, 125µm, 63µm, and 32µm.
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1.2. Applicable matrix or matrices

Sediment and/or soil

1.3. Detection Limit

Sonic Shifter is applicable for particle sizes between 32 µm and 2 mm.

1.4. Scope of test method

This standard operating procedure provides the Missouri State University (MSU) Geomorphology Laboratory personnel with guidance on the procedure for determining sediment grain size using the Sonic Sifter Separator (Model L3P).

1.5. Summary of test method

The sonic sifter is a sieving instrument designed for fast accurate separation of sand-size particles (particles > 32µm) according to particle size. The sonic sifter combines two distinct motions to provide a precise particle separation: a vertical oscillating column of air and a repetitive mechanical pulse. Selection of the sonic pulse amplitude and sift/pulse combination required to separate particles are dependent upon particle size, density, and volume of sample on the screen. Various power levels may be selected to match the work required to initially oscillate materials being separated. The vertical pulsing helps to rearrange clustered particles, allowing sediment to pass through the sieve openings, providing an accurate grain size separation. This technique of sieving results in very little particle attrition during sample separation.

1.6. Definitions

Below is a list of definitions specific to this procedure:

1.6.1. Amplitude
1.6.2. Diaphragm
1.6.3. Fines Collector

1.6.4. Hexametaphosphate
1.6.5. Sift
1.6.6. Sift/Pulse
1.6.7. Sieves
1.6.8. Spacers
1.6.9. Top Cone

1.7. Interferences/Comments

- Insufficient drying of soil samples will cause retention of water in sediment samples with a result of an incorrect mass being recorded for the soil sample mass.

1.8. Health and Safety

1.9. Personnel Qualifications

Laboratory and field personnel shall have a working knowledge of this analytical procedure and will have received training from an MSU employee knowledgeable of the proper sample analysis procedures.

1.10. Equipment and Supplies

1.10.1. Oven: Temperature set to 105°
1.10.2. Mortar and pestle
1.10.3. Weighing Device (balance or scale accurate to 0.01g)
1.10.4. Appropriate ASTM Sieves (Available sieves are sizes: 2000µm (No.?), 1000µm (No.18), 500µm (No.35), 250µm (No.60), 125µm (No.125), 63µm (No.230), and 32µm (No.?)
1.10.5. Camel hair (or other soft bristle) paint brushes
1.10.6. Talcum Powder
1.10.7. Data recording sheet

1.11. Reagents and Standards

1.12. Sample Collection, Preservation, Shipment, and Storage

1.13. Quality Control

1.14. Calibration and Standardization

For large sample sets, it is recommended that a test run be conducted to determine the appropriate SIFT, PULSE, or SIFT/PULSE and amplitude settings.

1.15. Procedure

1.15.1. Sediment/Soil Prep

1.15.1.1. Dry sample in oven at 105°.
1.15.1.2. Disaggregate sample with mortar and pestle
1.15.1.3. Sieve material through a 2-mm sieve.
1.15.1.4. Weigh and record sample weight

***Sediment/Soil Prep Notes*:

- When sieving materials larger than 38 µm, do not exceed 20g; when sieving materials less than 38µm, do not exceed 10g.
- After drying and disaggregating, the sample must be at least a 1-g soil sample to perform analysis.

1.15.2. Sonic Sifter Analysis

1.15.2.1. Weigh and record the tare weights of the diaphragm, top cone, spacers, sieves, and fines collector.
1.15.2.2. Install the fines collector in the fines collector holder. Fasten the round metal plate at the bottom of the fines collector to the fines collector holder by sliding the keyhole slot in the fines collector over the fastener mounted in the fines collector holder base.
1.15.2.3. Assemble the sieve stack with the coarsest sieve on top and finest sieve on bottom. If fewer than six sieves are being used, add spacers as necessary to fill out the proper stack height (*combination of 6-sieves/spacers*). If it is necessary to use spacers, they should be placed at the top of the stack, just below the cone (Photo 1).

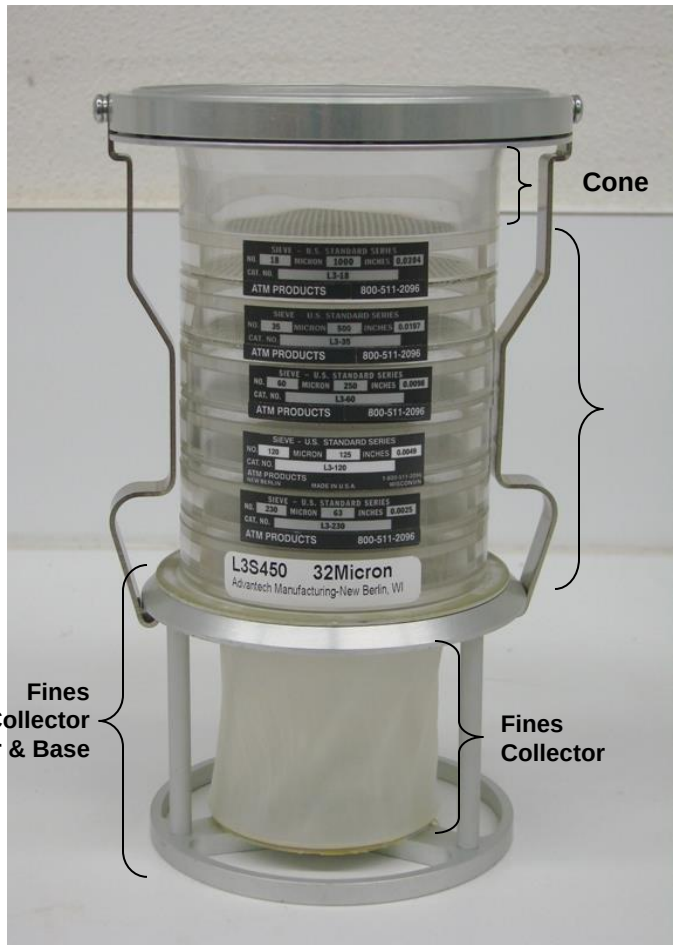

Photo 1. Sieve stack components.

1.15.3. Pour prepared sample (see steps 15.1 to 15.10 above) into sieve stack assembly.

1.15.4. Install diaphragm by placing it on top of the top cone with the metal ring protruding downward. (NOTE: The proper orientation of the diaphragm can be determined by the word “TOP” stamped on the latex.)

1.15.5. Place the column lock onto the sieve stack and press straight down until the locking arms snap onto the fines collector holder.

1.15.6. CHECK THE CONTROL PANEL TO ENSURE THE AMPLITUDE DIAL IS SET TO “0” AND THE TIMER IS IN THE “CLOCK” MODE OR THE DISPLAY IS BLANK BEFORE PLACING THE STACK ASSEMBLY INTO THE TEST CHAMBER.

Photo 2. Sonic Sifter control panel.

1.15.7. Slide the stack assembly into the test chamber with column arms locked. Once the stack is in proper position, release the column lock.

1.15.8. Close the sliding door to the test chamber.

1.15.9. Rotate the SIFT/PULSE dial to the appropriate setting (choosing either SIFT, PULSE, or SIFT/PULSE).

1.15.10. Set the interval timer to desired testing interval. The time interval should be sufficient enough that no more material can be seen falling through the sieves. This may be determined by completing a routine test run on the material to be sieved.

1.15.11. After setting the interval timer, begin to increase the amplitude SLOWLY until the largest of the particles begins rolling on the top sieve. Continue increasing the amplitude just enough so that material is no longer falling through sieves. DO NOT use excessive amplitude as this may increase electrostatic charges (in sediment grains), create sample loss, and equipment wear. The amount of lift required for each sample is determined by the density of the particles, the presence of electrostatic or other physical bonds, and the percentage of fine material in the sample.

1.15.12. When the timer counts down to zero, prepare to dismantle the stack assembly:

1.15.13. Open sliding door and lock down column arms around stack assembly and slide the assembly out.

1.15.14. Slide assembly out and carefully disassemble sieve stack.

1.15.15. Weigh each sieve stack part (sieves, cone, fines collector, etc.), recording the Total Weight. Weight should be reported to the nearest 0.01 g.

1.15.16. Determine the amount of sediment sample retained on each sieve by subtracting the tare weight of each sieve (as recorded in Step 15.11). The final weight of other stack assembly components (cone, spacers, diaphragm, etc.) that are not intended to retain sediment should also be weighed to account for particles that may have acquired an electrostatic charge and "adhere" to other parts of the stack assembly. This is sometimes a problem when working with very small sample sizes with appreciable fines (versus sand fraction).

1.15.17. Carefully clean all stack assembly components using a camel hair (or other soft bristle) brush. DO NOT FORCE ANY GRAINS THROUGH THE SIEVES. Invert sieves (turn upside down) and carefully brush grains from the mesh.

1.16. REFERENCES

Advantech Mfg., *Model LP3 Sonic Sifter Separator Operation Manual*.