Last updated: November 19, 2012

UT GeoMechanics Lab

Specific Surface Area Procedure

This procedure is based on the Methylene Blue absorption technique using the European standard (spot test) after Kandhal and Parker (1998) and Santamarina et al. (2002).

Note: Italic numbers refer to items in Figure 1.

Materials

1. Gather the following items:
   a. several sheets of filter paper (Fisher brand P5, diameter 12.5 cm) ***(1)***
   b. Methylene Blue Chloride powder ***(2)*** (Fisher Scientific, 25 g bottles)
   c. a 10 mL pipette with 1/10 readings ***(3)***
   d. a small "drop-pipette" ***(4)***
   e. a 500 mL glass beaker ***(5)***
   f. de-ionized water.
2. Oven-dry the sediment sample.

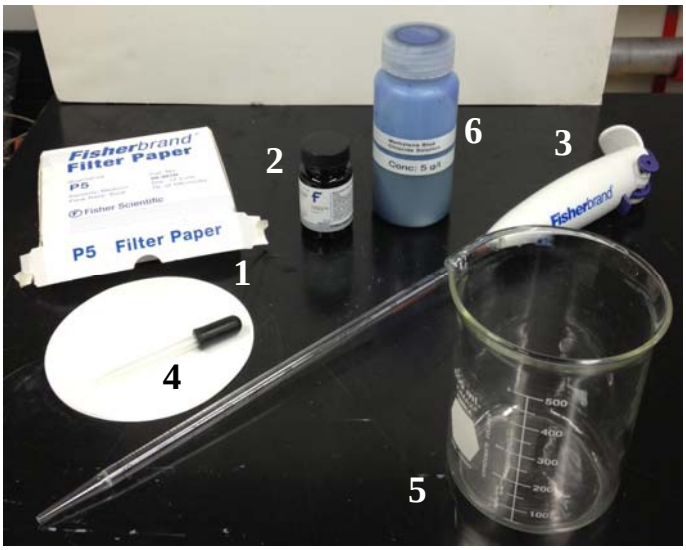

Figure 1: Materials needed for Specific Surface Area measurements. (1) filter paper (2) Methylene Blue Chloride powder (3)10 mL pipette (4) drop-pipette (5)500 mL glass beaker (6) plastic bottle with prepared Methylene Blue solution.

Preparation of Methylene Blue solution

3. Mix 1g of dry Methylene Blue Chloride powder ***(2)*** with 200 mL of de-ionized water in a 500 mL glass beaker ***(5)***.
4. Stir the solution till the powder is dissolved.

Preparation of soil solution

5. Mix 10 g of the oven-dried sediment with 30 mL of de-ionized water.
6. Stir the solution till the sediment is suspended.

Spot test

Note: *This test can take a long time, especially for swelling clays. If you know in advance that your sample contains a large amount of very fine clay particles with a large surface area or swelling clay minerals, a quick first run could be performed, where larger than 0.5 mL increments are added till the end point is reached in order to get the ball park amount of Methylene Blue. Then in the second run, increments of 0.5 mL should be used well in advance of reaching that ball park amount. However, adding an amount larger than 0.5 mL at a time requires mixing/equilibration times much longer than just 1 minute.*

7. Add the Methylene Blue solution to the soil solution in 0.5 mL increments using the 10 mL pipette.
8. For each addition of Methylene Blue, mix the soil suspension for 1 minute by swirling the solution around in the beaker.
   Note: *An electric stirrer as in Figures 2a and 2c could be very helpful, however, the UT GeoMechanics Lab does not own one at this time. The malt mixer used for grain size analyses could possibly be considered.*
9. Then for each addition of Methylene Blue, remove a small drop of the suspension with the "drop-pipette" ***(4)*** (does not have to be an exact amount), and place it on Fisher brand filter paper P5.
10. Count the number of additions of Methylene Blue.
11. If the unabsorbed Methylene Blue forms a permanent light blue halo around the wet soil aggregate spot on the filter paper (Fig. 2b), the "end point" has been reached (i.e., the Methylene Blue has replaced cations in the double layer and coated all the mineral surfaces).
12. Determine the specific surface area from the amount of Methylene Blue (i.e., number of additions) required to reach the end point using the "SSA_LookUpTable".
13. If Methylene Blue solution is left over it can be filled in an appropriately labeled plastic bottle ***(6)*** and stored.

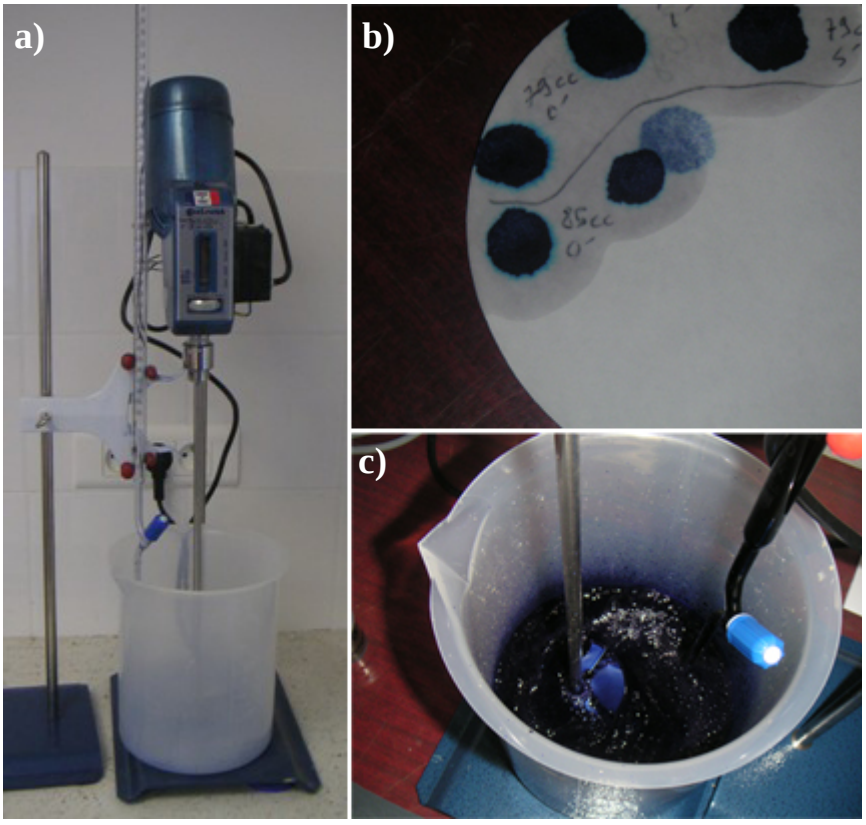

Figure 2: (a) Setup from another laboratory with electric mixer. (b) Example of "end point" (left in the picture), when light blue halo forms around wet soil spot on the filter paper. (c) Close-up of electric mixer used for stirring the soil-Methylene Blue solution.

References cited:

Kandhal, P.S. and Parker, F., Jr. (1998). Aggregate tests related to asphalt concrete performance in pavements, National Cooperative Highway Research Program (NCHRP) Report 405, Transpotation Research Board, National Research Council, National Academy Press, Washington, D.C., 109 p.

Santamarina, J.C., Klein, K.A., Wang, Y.H., and Prencke, E. (2002). Specific surface: determination and relevance, *Canadian Geotechnical Journal*, 39, 233-241, doi:10.1139/T01-077.

Data Files are located on the server:
\\Utig3.ig.utexas.edu\flemings\shannon\All_Access\GeoMechanics_Lab\Tests\SSA