

**Appendix** Procedure of measuring soil specific surface area using EGME adsorption method

1. Air-dry soil samples;
2. Break up soil clusters in a grinding machine;
3. Pulverize the soil to pass #40 sieve using a rubber tipped pestle (0.42 mm);
4. Label aluminum dishes and put them into the oven to remove the adsorbed water.

These dishes are 76 mm in diameter and 25 mm in height.

5. Weight the aluminum dishes using a balance with an accuracy of 0.00001 g.
6. Spread approximately 2 to 3 grams of each soil into the bottom of the aluminum dish; Place the soil samples in the oven at a temperature of 120 degrees overnight to remove water;
7. Place 110 grams of 40-mesh Anhydrous Calcium Chloride in an oven for 1h;
8. Weight the tare with oven-dried soils to an accuracy of 0.00001 g. Quick action is necessary to prevent the adsorption of moisture in the air to the surfaces of the soil samples.
9. Add 100 grams of the dried Calcium Chloride into a bowl and 20 milliliters (1/1000<sup>th</sup> of a liter) of EGME to another bowl;
10. Place the two bowls in the bottom of a desiccator. The desiccator has a diameter of 210-250 mm and can accommodate up to 10 soil samples at a time.
11. Add several milliliters of laboratory grade EGME to the oven-dried soils with a pipette and mix them with a gentle hand swirling motion to create uniform slurry;
12. Place the dishes into a standard laboratory glass sealed vacuum desiccator for 30 min.

13. Evacuate the desiccator using a vacuum pump providing a vacuum of 10 micron (10 mtorr or  $1.3158 \times 10^{-5} \text{ atm}$ , or  $1.3595 \times 10^{-5} \text{ kg / cm}^2$ );

14. Weigh the dishes after a period of 4 hrs and after 18 hrs following the initial evacuation. Weigh again after 24 hrs if the mass variation between the first two measurements is larger than 0.001 grams. Before weighing the samples, the pressure in the desiccator was brought back to the air-pressure by allowing the air to slowly enter the desiccator through a tube filled with dried calcium chloride.

15. Determine the weight of adsorbed EGME by subtracting the weight of the dried soil samples (from step 8) from that of the EGME attached soil samples (from step 14).