

Soil Organic Matter Determination - Loss on ignition method

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Introduction

There are many different methods for determining soil organic matter (SOM) content, all dependent on the research question(s) being asked and the accuracy required. Often logistics and resources (i.e. time and money) are also a consideration. Here is outlined the *loss on ignition* method, which determines SOM gravimetrically by weighing a soil sample before and after combusting the organic material. This method is considered a coarse measure of SOM and bears several limitations. The most cited drawback includes weight loss during combustion due to mineral water and/or volatilization of select minerals, which overestimates the SOM value. Reducing the temperature at which you combust the soil will often reduce but not negate this problem. See Robertson et al (1999) or Sparks (1996) for more details and alternate methods of SOM and organic C determination.

Equipment

Soil sieve (to 2 mm)

Soil tins

Spoon or spatula

Kimwipes and isopropyl alcohol for cleaning spoon between samples

Desiccator and fresh desiccant

Coarse balance (to 0.01 g)

105°C oven

Muffle furnace (to 450°C)

Procedure

1. Record soil tin weight. Mark bottom of tin with ID # or record existing tin #. Do not use Sharpie; engrave tins using a pen or pencil with ID number.
2. Place 20-30 g of sieved (<2 mm) soil into tin.
 - a. Typically you will determine soil gravimetric water content and soil organic matter (SOM) in series using the same sample if you desire GWC, record the initial soil weight, this is your pre-oven weight and should be recorded under the **wet soil + tin weight** column. If only measuring SOM, proceed to next step.
3. Place soil tins in 105°C oven for 24 to 48hr.
4. After at least 24hrs, place tins in desiccator to let cool for 15 minutes, then weigh the samples for the oven dry weight under the **oven dry + tin weight** column. Do not remove all the samples from the desiccator at once to weigh and do not leave desiccator door open, samples will absorb moisture from the air and will gain weight; weigh in batches of 10 tins.
 - a. Make sure the Drierite in desiccator is fresh (should be blue if fresh, purple if spent).
5. Once the dry weight for all samples is recorded, place soil tins in the muffle furnace.
6. Turn on muffle furnace and **set temperature to 450°C**. Make sure the temperature on the furnace begins to rise. At ISU, also turn on the fume hood fan while running the furnace.
Bake soils for 8 hours.

- a. Note: the ISU muffle furnace does not automatically turn off so plan to put your samples in and take them out accordingly.
7. After 8 hours, switch off the furnace and carefully crack the door to cool samples. Depending on how many samples are in the furnace, this will take 1-2hrs before you can handle the tins.
 - a. DANGER!!! When opening the furnace, keep face and hands away from opening.
8. Place soil tins in oven overnight at 105°C to drive off any atmospheric moisture.
9. Place tins in desiccator to let cool for 15 minutes, and then record the final weight under the *ashed + tin weight* column. Do not remove all the samples from the desiccator at once to weigh and do not leave desiccator door open, samples will absorb moisture from the air and will gain weight; weigh in batches of 10 tins. Record soil weights (ashed wt) as above.
10. Calculate the fraction of soil organic matter (remember to subtract the tin weight from the dry and ashed weights):

$$\text{Soil Organic Matter} = \frac{\text{oven dry soil (g)} - \text{ashed soil (g)}}{\text{oven dry soil (g)}}$$

References

- Robertson, G. P., Coleman, D. C., Bledsoe, C. S., & Sollins, P. (1999). *Standard soil methods for long-term ecological research*. Pg. 89-105. Oxford University Press.
- Sparks, D. L., Page, A. L., Helmke, P. A., Loeppert, R. H., Soltanpour, P. N., Tabatabai, M. A., ... & Sumner, M. E. (1996). *Methods of soil analysis. Part 3-Chemical methods*. Pg. 1002-1010. Soil Science Society of America Inc..