# DRY WEIGHT AND ASH FREE DRY WEIGHT

**General:** This gravimetric approach involves collecting particulate matter on a pre-rinsed and ashed filter, then drying it to a constant weight. For ash free dry weight (AFDW), the dried material is oxidized (ashed) in a muffle furnace at high temperature and re-weighed. The loss upon oxidation is referred to as AFDW. Note that we consider AFDW to be equivalent to ash free dry mass (AFDM).

Note: The AFDW determination does not distinguish algal material from other organic material (e.g., bacteria, fungi, etc) in the sample, nor does it account for the physiological state of the organic material (i.e. detritus, and/or other senescent material). Therefore if one is interested in algal biomass alone this method may prove unsatisfactory if there is a large fraction of non-algal material in the sample.

This method was adapted from the Lab Manual of the Central Analytical Laboratory at Natural Resources Research Institute, University of Minnesota-Duluth (Ameel, J., E. Ruzycki and R.P. Axler. 1998. Analytical chemistry and quality assurance procedures for natural water samples. 6th edition. Central Analytical Laboratory, NRRI Tech. Rep. NRRI/TR-98/03 revised annually). These methods are based on American Public Health Association (APHA) and US EPA compilations of water quality methods and the Lab and its Methods Manual is certified biannually by the Minnesota Department of Health. For ease of use by teachers using the *Water on the Web* curriculum, some simplifications have been added since class data will likely be used only for instructional purposes. Where appropriate, the *WOW* lecture module slides will include troubleshooting tips and techniques suggestions.

**Safety:** It is assumed that instructors are proficient in the handling of hazardous chemicals. Dangerous concentrated acids and toxic and carcinogenic chemicals may be used in some methods. For this method the main concern involves the use of a drying oven and high temperature muffle furnace.

**Sample Collection:**
See *Determining Periphyton Biomass* in *WOW Lecture* Module 4/5, Unit 1

**Equipment:**

1. filtration tower
2. aspiration pump or other vacuum source
3. aluminum weigh pans
4. 4.7 cm Whatman GF/C or Gelman A/E filters
5. drying oven, 103-105°C
6. muffle furnace, 550°C (Note 475 °C will usually suffice)
7. analytical balance

**Procedure:**

Filter preparation: Insert filter with wrinkled side up on filtration apparatus. Apply vacuum and wash with three successive 20 mL portions of MQW. Continue suction to remove all traces of water, discard the washings. Remove filter and transfer to a labeled aluminum weigh pan. Let

dry to a constant weight (103-105°C). If AFDW is to be determined ignite filters at 550°C for 15 min in a muffle furnace. Cool in a desiccator to room temperature and weigh. Store in desiccator until needed. Weigh immediately before use.

Sample analysis: Assemble filtering apparatus, seat filter and begin suction. Wet filter with a small volume of MQW to seat it. Filter a measured volume of a well-mixed sample through the filter. Wash with three successive 10 mL volumes of MQW. Carefully remove filter from filtration apparatus and transfer to aluminum weigh pan. Dry at least 1 h at 103-105°C in an oven, cool in desiccator to room temperature, and weigh. Repeat until a constant weight is obtained or until the weight loss is less than 4% of the previous weight or 0.54 mg whichever is less. For AFDW; after a dry weight is obtained ignite the filter and sample at 550°C for 1 h in a muffle furnace (note that 475°C will typically suffice). Cool and weigh until a constant weight is achieved.

**Calculation:**

$$\text{Dry weight, mg/L} = \frac{(A - B) \times 1000}{\text{sample volume, mL}}$$

where: A = weight of filter + dried residue, mg
B = weight of filter, mg

$$\text{AFDW, mg/L} = \frac{(C - D) \times 1000}{\text{sample volume, mL}}$$

where: C = weight of filter + residue before ignition, mg
D = weight of filter + residue after ignition, mg

**QA/QC:**

- Record temperatures of drying oven and muffle furnace
- Record balance used and calibrate routinely
- Use replicates for estimating precision as required
- Refer to WOW Module 13 (Unit 4) for detailed Quality Assurance and Quality Control information

**References**

Standard Methods for the Examination of Water and Wastewater, Method 10300 C,D. 20th Ed. 1998. American Public Health Association, Washington, D.C.

Steinman, A.D. and G. A. Lamberti. 1996. Biomass and pigments of benthic algae. P. 297. In "Methods in Stream Ecology". Hauer, F.R. and G.A. Lamberti (eds). Academic Press , San Diego, CA.