Measuring Black Carbon in the Atmosphere

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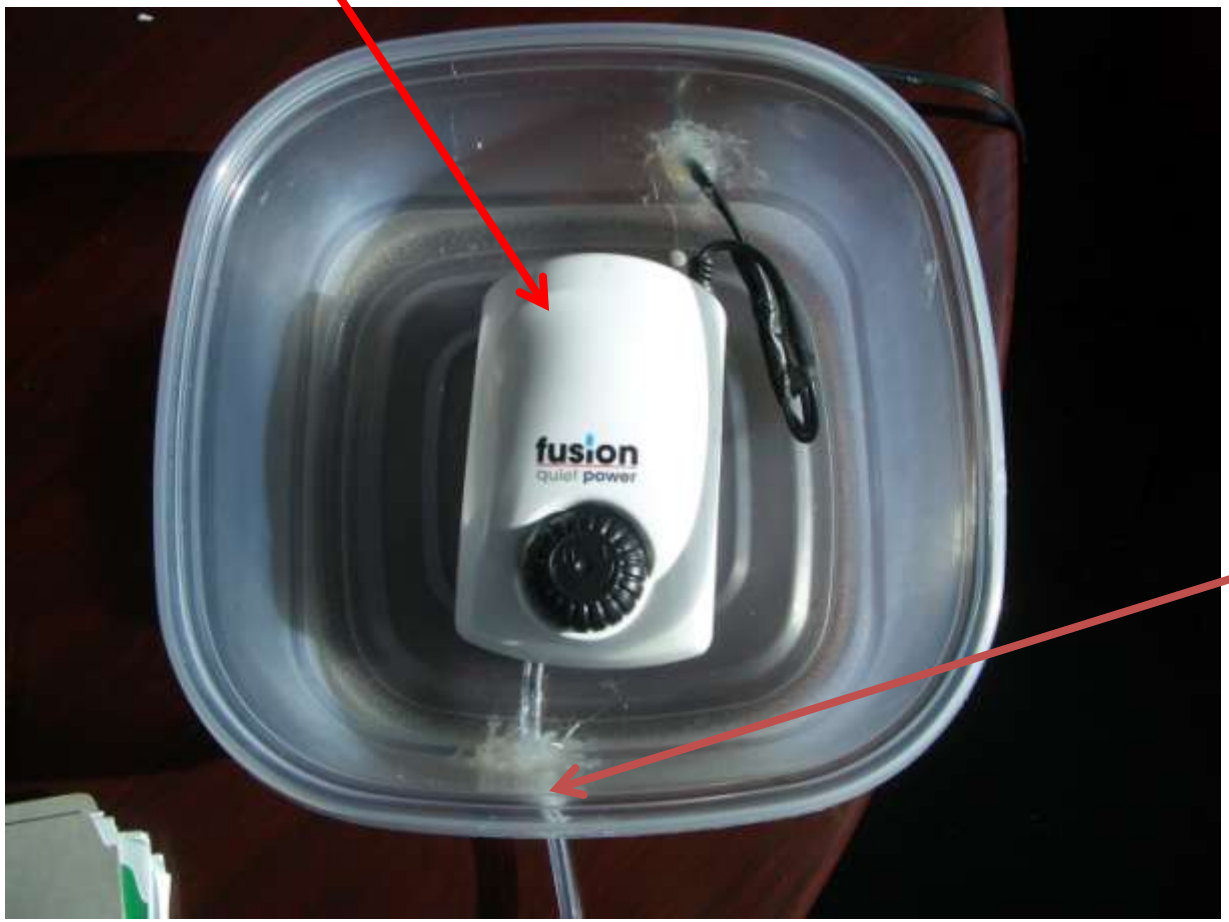
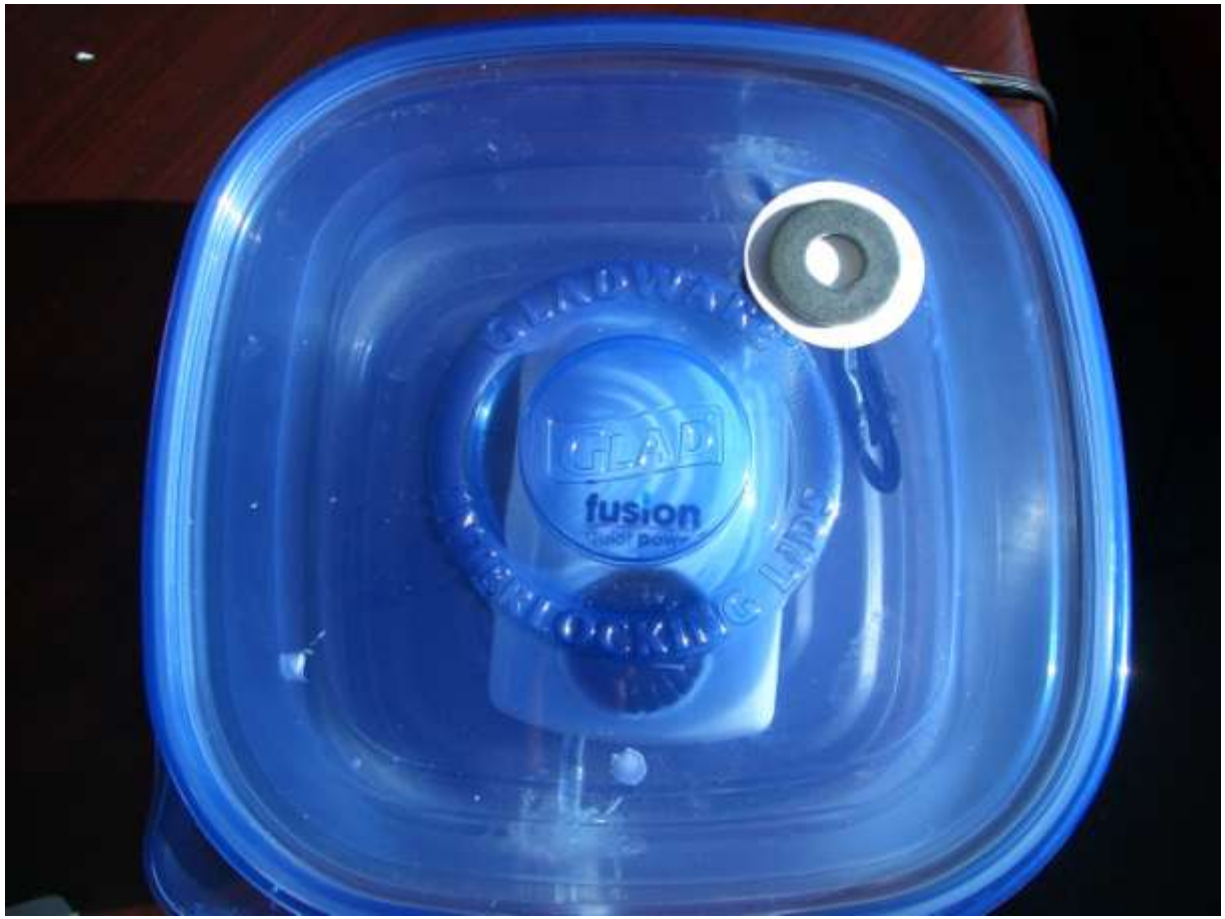
Put aquarium pump inside a plastic food container, exhaust outside



Exhaust outside box and seal around Exhaust Line

Turn on pump and air going into container will be filtered leaving black carbon and/or pollen (yellow) on filter



Remove filter after a visible spot develops (hours to days depending on the air quality).

Education value

- Simple science concept, suitable for a wide age range of students.
- Very direct easy-to-understand equipment (no “mystery” about how it works).
- Low cost.
- Can provide qualitative or quantitative results.
- Related to air quality, environmental health, phenology (pollen), effect of black carbon on surface albedo.

Science value

- Without a **specific science plan**, the activity is an interesting hands-on activity, but with no science value.
- Spatial and temporal variability (several orders of magnitude!) is a huge factor in assessing the impact of black carbon on climate (changes in surface reflectivity, etc.). This variability is insufficiently understood, so there is science potential. **Local comparisons (even relative) against regulated air sampling sources provide scientifically useful information about how to interpret "official" data (e.g., are the official sites really representative, urban vs. rural gradients).**
- In some places, this project might provide the only source of particulate sampling data. (This was true when a similar device was used by students in Estonia and Slovenia in the early 1990's. See *Journal for Chemical Education ,* **71**, pp. 318-23, 1994; *Bulletin of the World Meteorological Organization*, **43**, *1*, January 1994, p. 60); Carbonaceous particles in the atmosphere: A historical perspective to the Fifth International Conference on Carbonaceous Particles in the Atmosphere, *JGR*, **101**, *D14*, pp 19,373-19,378, 1996.)
- "The October 2009 Interior Appropriations bill (P.L. 111-88) requires the EPA, in consultation with other Federal agencies, to prepare a comprehensive report to Congress on the **climate effects** of black carbon. Black carbon, or soot, results from incomplete combustion of organic matter such as fossil fuels and biomass."
- Black carbon has potentially serious local health effects.

STEM Applications

- **S**cience: weather, climate, air quality, surface albedo, environmental health
- **T**echnology/**E**ngineering: experiment design, instrument construction, basic analysis software (e.g., Excel)
- **M**athematics: basic statistics (e.g., histogram of class analysis of darkness of sample), comparisons with online air quality values, calculating air flow rate, graphing results

Potential Implementation Issues

- Equipment standardization.
- Accurate airflow calibration (l/s, for example) and conversion to particle density to (µg/l) may be difficult.
- Particle identification (black carbon, dust, spores, pollen) needs high-quality microscope?
- Long-term (temporal sampling) vs. short-term (geographical sampling).
- Defining the climate science audience (climate modelers, air quality officials?).