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Refining temperature measures in thermal/optical carbon analysis

J. C. Chow[1], J. G. Watson[1], L.-W. A. Chen[1], G. Paredes-Miranda[1], M.-C. O. Chang[1], D. Trimble[1], K. K. Fung[2], H. Zhang[3], and J. Zhen Yu[3]
[1]Division of Atmospheric Sciences, Desert Research Institute, 2215 Raggio Parkway, Reno, NV 89512, USA
[2]Atmoslytic Inc., 24801 Alexandra Ct., Calabasas, CA 91302, USA
[3]Department of Chemistry, Hong Kong University of Science and Technology, Clear Water Bay, Hong Kong, China

Abstract. Thermal/optical methods have been widely used for quantifying total carbon (TC), organic carbon (OC), and elemental carbon (EC) in ambient and source particulate samples. Thermally defined carbon fractions have been used for source identification. Temperature precision in thermal carbon analysis is critical to the allocation of carbon fractions. The sample temperature is determined by a thermocouple, which is usually located in the oven near the sample. Sample and thermocouple temperature may differ owing to different thermal properties between the sample filter punch and the thermocouple, or inhomogeneities in the heating zone. Quick-drying temperature-indicating liquids (Tempil Inc., South Plainfield, NJ) of different liquefying points are used as temperature calibration standards. These consist of chemicals that change their appearance at specific temperatures and can be optically monitored to determine the sample temperature. Temperature measures were evaluated for three different models of carbon analyzers. Sample temperatures were found to differ from sensor temperatures by 10 to 50°C. Temperature biases of 14 to 22°C during thermal analysis were found to change carbon fraction measurements. The temperature indicators allow calibration curves to be constructed that relate the sample temperature to the temperature measured by a thermocouple.

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