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# THE RELATIONSHIP BETWEEN OPTICAL ATTENUATION AND BLACK CARBON CONCENTRATION FOR AMBIENT AND SOURCE PARTICLES*

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## ABSTRACT

Light absorption provides the basis for a fast and nondestructive method for determining concentrations of black carbon (BC). The laser transmission technique measures the attenuation (ATN) of visible light as it passes through filter samples. We have measured [BC] and ATN simultaneously for a large number of solvent-extracted source and ambient particle samples, using temperature-programmed evolved gas analysis with continuous light attenuation measurement. For all data with ATN $\leq$ 200, ATN is directly proportional to [BC], with the proportionality constant = 25.4 ± 1.7 $cm^2\ \mu g^{-1}$. Because the relationship between ATN and [BC] does not depend on the origin of the carbonaceous particles, measurement of ATN alone can provide a good estimate of the black carbon concentration.

## INTRODUCTION

Particulate material from ambient air and combustion sources usually appears black when it is collected on filters, due to the presence of light-absorbing graphitic or black carbon (BC)(ref.1). In the atmosphere, the light absorption due to these particles can degrade visibility (ref.2) and perturb the tropospheric radiation balance (refs.3,4).

Most methods for determination of black carbon (ref.5) rely on separation of organic carbon from black carbon by pyrolysis, oxidation, or solvent extraction before determination of BC as $CO_2$. These methods are destructive and often time consuming. In this paper we describe and calibrate a nondestructive and fast technique for [BC], the laser transmission method (LTM). This technique measures the attenuation of visible light (ATN) as it passes through a particulate sample on a filter.

In this study, we have measured [BC] and ATN simultaneously for a large group of source and ambient filter samples. The results have been used to calibrate the laser transmission method and provide a value for the specific attenuation, $\sigma$. $\sigma$ is the value of ATN per unit mass of black carbon. It is

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