Multi-wavelength absorption black carbon instrument

MABI

The Multi-wavelength absorption black carbon instrument (MABI) can determine both precisely and accurately the concentration and source of black carbon air pollution.

Black carbon is one of the most significant constituents of atmospheric fine particle pollution. It has impacts on health and climate change.

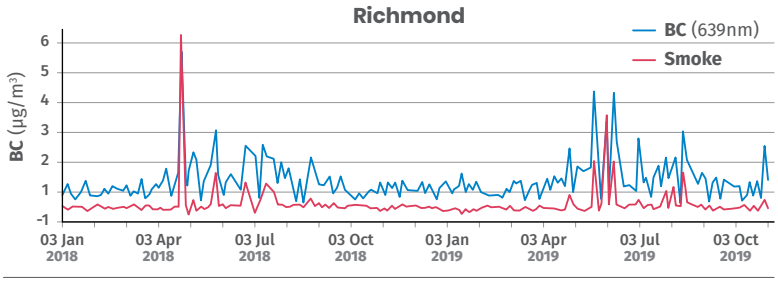
Using typical aerosol filter samples, the Multi-wavelength Absorption Black carbon Instrument (MABI) measures light absorption at seven different wavelengths.

As black carbon can be emitted from a range of different sources, primarily either diesel vehicles or biomass burning, particles have a range of densities and sizes.

When the black carbon concentration equation is modified to include contributions relating to the size and density of the particles, a more accurate measurement is acquired.

Spanning ultraviolet to infrared wavelengths, the measurements can be used to differentiate the contribution from different sources.

Burning biomass is a primary source of black carbon.



The blue curve in the graph is the total black carbon estimate from MABI using the 639nm data and includes both diesel and smoke components. The red curve is a smoke indicator obtained by subtracting the BC(1050nm) data from the BC(405nm) data. Peaks in the red curve correspond to large smoke contributions while values near zero represent mainly BC from diesel vehicles.

Developed by ANSTO, Manufactured and Supported by Thomson Environmental Systems

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Key features of the MABI unit

Small desktop size (portable)

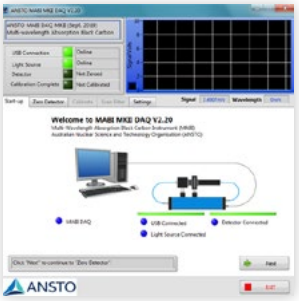
Connects directly to your computer's USB port

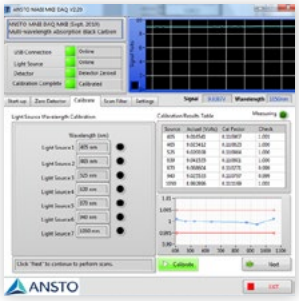
Designed specifically for typical aerosol filter samples (47mm polycarbonate, 47mm Teflon, 25mm stretched Teflon, etc.)

Non-destructive, filters can be further analysed with other techniques, such as ion beam analysis (IBA) or X-ray fluorescence (XRF)

Fast, takes less than 35 seconds to complete a 7 wavelength measurement

Provided with digital acquisition software (see below)





Specifications

LED WAVELENGTHS
405nm, 465nm, 525nm, 639nm, 870nm, 940nm and 1050nm

POWER SUPPLY
Data communication and power supply is provided to the MABI via a Universal Serial Bus (USB) cable

FILTER HOLDERS
25mm and 47mm filter holders are provided
Additional filter holder sizes may be provided on request

COMPUTER REQUIREMENTS
The instrument requires a minimum of Microsoft Windows 7 or higher

DATA FORMAT
Data output is provided in CSV file format, which can be easily imported into programs such as Microsoft Excel

Contact

Thomson Environmental Systems
www.thomsongroup.com.au
sales@thomsongroup.com.au
+61 2 9526 8199
NSW | ACT | VIC | QLD | WA

Calculations

$$b_{abs}(Mm^{-1}) = 10^2 \left[\frac{A(cm^2)}{V(m^3)}\right] ln\left[\frac{I_0}{I}\right]$$

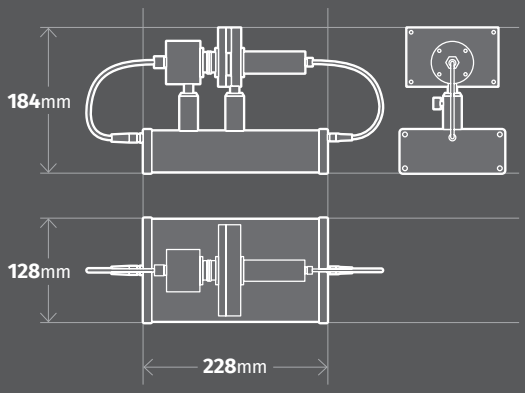
$$BC(ngm^{-3}) = \frac{10^5[A(cm^2)]}{[\epsilon(m^2g^{-1})][V(m^3)]} ln\left[\frac{I_0}{I}\right]$$

ϵ	Mass absorption coefficient in m^2/g
A	Filter collection area in cm^2
V	Volume of air sampled though filter in m^3
I_0	Measure light transmission through blank (unexposed) filter
I	Measure light transmission through filter after particle sampling

Although single-wavelength light absorption methods are widely used and accepted to determine the concentration of black carbon, the result may be inaccurate. Black carbon can be emitted from a range of different sources and have a range of different densities and sizes. The mass absorption coefficient is wavelength and density-dependent.

MABI measures light transmission at seven different wavelengths to address the limitation of single wavelength methods. The user performs the black carbon calculation, ensuring full control and understanding in the interpretation of values.

Dimensions



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