

# Development of Reference Film for Quality Control and Assurance for Beta Attenuation Particulate Matter Measurement

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Beta attenuation method is widely used to determine particulate matter mass concentration for air quality monitoring. Results from the beta attenuation method are used to determine whether air quality standards for particulate matter are attained.

Particulate matter mass concentration by the beta attenuation is determined by the equation

$$I = I_0 e^{-\mu x} \quad (1)$$

where  $I$  is the measured beta ray intensity with particulate matter,  $I_0$  is the measured beta ray intensity without particulate matter,  $\mu$  is the mass absorption coefficient ( $\text{cm}^2/\text{mg}$ ),  $x$  is the areal density of the sampled particulate matter ( $\text{mg}/\text{cm}^2$ ).

A reference beta attenuation instrument and film were developed to establish a harmonized method for the quality control and assurance of the beta attenuation method. Multiple particulate matter samples were prepared to measure  $I$ ,  $I_0$ ,  $x$  and then  $\mu$  ( $0.291 \pm 0.001 \text{ cm}^2/\text{mg}$ ) was determined by using the equation 1 and linear regression. The estimated mass absorption coefficient was applied to the reference beta attenuation instrument to determine the areal density of reference films. The masses of the reference films were determined by the reference beta attenuation instrument and gravimetric method. Results show that the estimated masses by two independent methods agree well, indicating that the developed reference films are valid. The results from this study illustrate that the reference film can be an effective tool for the quality control and assurance of the beta attenuation for particulate matter mass determination.

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