Classification of Aerosols in Mixed Samples by Imaging using a Fabricated Portable Aerosol Monitor and Image Processing Techniques

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Abstract

Air pollution poses lethal health and environmental problems for the general public. Air quality monitoring could help medical and environmental research to solve air pollution. Current instruments that monitor aerosols can only measure concentrations of a certain particle size and cannot distinguish between different aerosol types contained in the aerosol samples. Classifying these aerosols can help identify the possible health effects and more accurately point out the major sources of pollution in the area. This study utilizes an optical aerosol monitoring instrument that takes images of aerosols exhibiting their light scattering. This study aims to develop an image processing algorithm to classify different aerosol types in a sample using light scattering features. Reference aerosols of soot and mineral oxides (zinc oxide and manganese oxide) are mixed in different ratios. These aerosols are submitted to imaging using a robust optical aerosol monitor that utilizes a light source and a camera to take images of the aerosols *in situ*. Python libraries were used to produce an algorithm to process the images and extract information to differentiate the different aerosol types within the sample. Different features of the light scattering of the reference materials and their mixtures were obtained using image processing. The features that were extracted are: intensity of the light scattering of the particles, the density of the light scattering, and the size of the scattered light. These features exhibit that as more soot is contained in the mixture, it resembles the scattering behavior of the pure soot samples, likewise, an increase in mineral oxide concentration results in the behavior of the scattering of light to resemble more of the pure mineral oxide samples. These findings suggest light scattering alone can be used to detect and classify soot and mineral oxide aerosols.

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