Part II
Metals and Organic Compounds in Airborne Particulate Matter: Analytical Methods

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There have been a number of advances made in analytical methods and technologies in recent years that have greatly contributed to our ability to characterize the chemical composition of airborne particulate matter (PM). With these advances, our knowledge regarding the various chemical compounds found in PM, including their concentrations and sources, and their potential to impact human health has significantly improved. This chapter brings together a number of important contributions on the topic of analytical methods. Various technological developments and methodologies to prepare samples, measure the concentrations of metals and organic compounds, determine metal speciation and issues related to quality assurance/quality control are presented and discussed.

In the first chapter of this part, Balasubramanian and He discuss the use of accelerated solvent extraction (ASE) for the trace analysis of persistent organic pollutants such as polychlorinated biphenyls (PCBs) and polyaromatic hydrocarbons (PAHs) in aerosols. They demonstrate the effectiveness of ASE, in combination with GC–MS, which can be applied to both gaseous and particle phase samples, over more traditional procedures, which require long extraction times and are labor intensive. Garcia-Jares et al. describe analytical developments for the determination of emerging pollutants such as organophosphate esters and brominated flame retardants in suspended and settled indoor dust in the second chapter, a medium which has received a great deal of attention in recent years as an important exposure route for various contaminants. This comprehensive section addresses many related issues such as procedures for sampling and enrichment, and methods for analyte isolation, measurement and validation. In the third chapter, Maclean et al. discuss the application of synchrotron radiation-based X-ray absorption and scattering techniques for characterizing the speciation of metals in house dust, which is a complex mix of various compounds. After providing a comprehensive overview of these methods for metal speciation, they then discuss the application of synchrotron radiation-based X-ray absorption and scattering to determine the speciation of Pb and its total and bioaccessible fraction to a house dust sample. Puls et al. discuss the challenges involved in the measurement of palladium (Pd) in the fourth chapter, a metal which has been

observed in increasingly greater concentrations in the environment over time, due to its use as a catalyst in automotive catalytic converters. They provide a comprehensive overview of the various methods available for the preparation and measurement of this noble metal in airborne PM samples. In the fifth chapter, Rauch et al. discuss a procedure for the direct quantification of metal concentrations on PM_{10} filters using laser ablation-inductively coupled plasma-mass spectrometry (LA-ICP-MS). Using airborne PM_{10} samples collected in Boston, they demonstrate the value of this technique and how it allows for the quick and easy determination of metal concentrations, without the labor intensive sample preparatory procedures common to more traditional methods. Jung et al. present the application of an innovative single particle quantification technique, low-Z particle electron probe X-ray microanalysis in the sixth chapter, to examine the particle composition of aerosol samples collected in a subway station in Seoul, Korea. Using this method, they found that the largest proportion of particles contained Fe, most likely originating from within the tunnel such as through rail-wheel-brake interfaces. To conclude in Part II, Alsenz et al. present a method which they developed for the reliable determination of Pd in environmental media. As Puls et al. pointed out in the fourth chapter, an accurate method to measure this metal is needed, as it poses particular analytical challenges. Alsenz et al. describe a method which combines the use of a sample preparation procedure using reductive co-precipitation and He collision gas with isotope dilution-ICP-MS to measure Pd concentrations in airborne PM_{10} collected at three sites in Germany. As demonstrated, this appears to be a promising method which could help overcome many of the past difficulties associated with measuring Pd in environmental media.