

Development of Selected New Natural Matrix and Solution Standard Reference Materials for the Determination of PAHs

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Several new natural matrix and solution Standard Reference Materials (SRMs) are available for the determination of PAHs. SRM 1597a, Complex Mixture of Polycyclic Aromatic Hydrocarbons from Coal Tar, is a reissue of SRM 1597 with concentration values for a wider range of analytes, including many alkyl-substituted PAHs, relative to its original examination. SRM 1597a is a natural, combustion-related mixture of PAHs isolated from a coal tar sample and dissolved in toluene. The material is intended for use in the evaluation and validation of analytical methods for the determination of PAHs. A unique aspect of this SRM is that it is suitable for direct analysis (i.e., without sample cleanup or concentration) in the determination of PAHs using analytical techniques such as gas chromatography (GC), liquid chromatography (LC), gas chromatography/mass spectrometry (GC/MS), and even liquid chromatography/mass spectrometry (LC/MS). The analytes characterized in SRM 1597a span a wide range of vapor pressures and solubilities so it is useful for evaluating the performance of chromatographic columns (i.e., separation efficiency and selectivity). It is also useful for evaluating procedures for measurement of mutagenic activity of combustion-related mixtures of PAHs and related compounds as values are provided for the mutagenic activity of SRM 1597a.

A new class of compounds examined in SRM 1597a is the higher molecular mass PAHs (300 and 302 amu). The determination of PAH isomers with molecular mass 302 in complex mixtures such as coal tar has received little attention in the past for several reasons, including the large number of isomers and that many have not been sufficiently resolved on conventional GC or LC columns. However, using multiple, selectively different, gas chromatographic columns allows for enhanced, individual determination of these compounds. For example, in SRM 1597a, up to 17 isomers have been quantified. Specifically, 3 isomers have certified concentration values and an additional 14 compounds have reference concentration values. These values were determined using multiple methods of analysis, up to 5 methods for some compounds. The availability of these values in an SRM provides valuable information, particularly since the carcinogenicity of the isomers varies greatly from that of the other PAHs. In addition, four isomers have been listed as potential carcinogens to humans and the interest in measuring these compounds in complex environmental mixtures is increasing.

A second combustion-related new Reference Material (RM) has been developed and examined for PAHs. RM 8785, Air Particulate Matter on Filter Media, consists of a fine fraction SRM 1649a, Urban Dust, resuspended in air and filtered onto quartz-fiber filters (exact mass known for each filter). RM 8785 currently has values assigned for total carbon, elemental carbon, and organic carbon mass fractions and is intended primarily for use in the evaluation of analytical methods used to characterize the carbon composition of atmospheric fine particulate matter. The material was recently used as part of the Intercomparison Program for Organic Speciation in PM_{2.5} and was distributed for examination of a wide range of analytes including PAHs, nitro-PAHs, hopanes and steranes, sterols, carbonyls, acids, phenols, methoxyphenols, and sugars.

In support of the Intercomparison Program for Organic Speciation in PM_{2.5}, several new solutions of organic contaminants related to air particulate matter have been developed. These include two solutions of nitro-PAHs (11 and 16 compounds), a solution of hopanes and steranes (10 compounds), a solution of deuterated levoglucosan, and a solution of carbon-13 labeled levoglucosan.