Accurate quantification for the environmental pollutants at trace levels

Accurate quantification using ^{13}C-labeled internal standards

We are developing a certified reference material for the accurate quantification of polycyclic aromatic hydrocarbons (PAHs) at trace levels (< 1 μg/g). PAHs are formed through incomplete combustion and are transported for long distances. It is therefore necessary to monitor the levels of emitted PAHs not only in highly contaminated samples, but also in less-contaminated environmental samples. To develop matrix-type certified reference materials, isotope-dilution mass spectrometry (IDMS) is commonly applied for the accurate quantification of not only PAHs but also other pollutants. The IDMS method is based on the principle that internal standards with stable isotope behave in the same manner as the target (native) compounds throughout analytical processes. However, it is not true for the quantification of PAHs at trace levels using deuterium-labeled PAHs although this is true for those at high levels (> 1 μg/g). In the light of this fact, we used ^{13}C-labeled PAHs as internal standards to develop the matrix-type certified reference material of PAHs at trace levels.

Nobuyasu Itoh
Metrology Institute of Japan
nobuyasu-itoh@aist.go.jp

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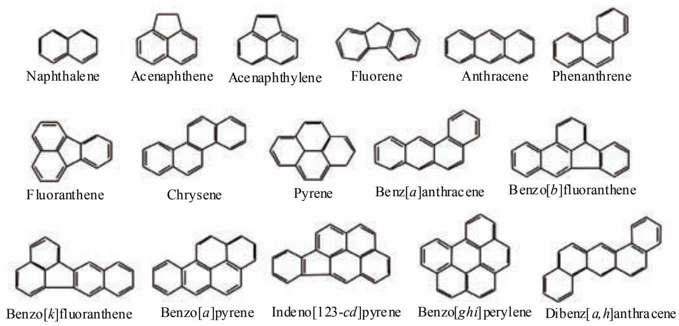

Typical 16 PAHs for environmental monitoring

Development of an optical lattice clock

Toward the next-generation atomic clock

We are developing an optical lattice clock toward realization of the next-generation atomic clock. Optical clocks have an intrinsic superiority over the present Cs microwave clock, which is the definition of the SI second, because they can split time with a much higher rate. These ticks can be precisely counted by using an optical frequency comb, the inventors of which were awarded the Nobel Prize in 2005. The long remaining problem to search for the next-generation optical atomic clock can be solved by the revolutionary idea of the optical lattice clock proposed by Prof. Katori of the University of Tokyo in 2001. At AIST, we started developing the optical lattice clock using ytterbium atoms. This innovation will lead to the redefinition of the second in the near future.

Masami Yasuda
Metrology Institute of Japan
masami.yasuda@aist.go.jp

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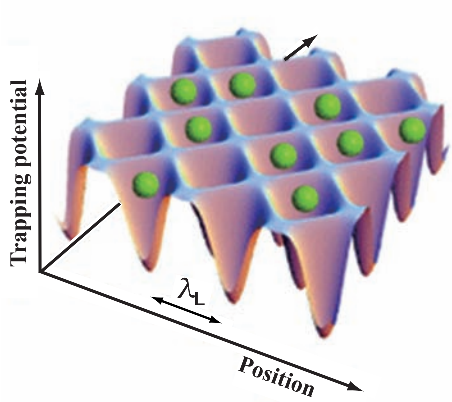

Conceptual image of the optical lattice clock