Supporting Information

A Novel Tungsten Coil Electrothermal Vaporizer with Composite Structure Coupled with Dielectric Barrier Discharge Optical Emission Spectrometer for Direct Determination of Trace Mercury

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1. instrumentation

Fig S1. Photograph of direct sampling Hg analyzer. This instrument with 0.57×0.42×0.19 m dimensions, <12 kg weight, and ~100 W power consumption.

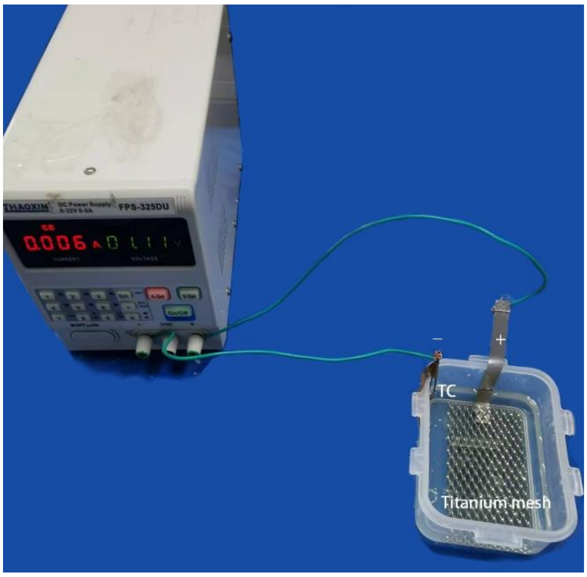

Fig S2. Photograph of electrochemical plating instrument

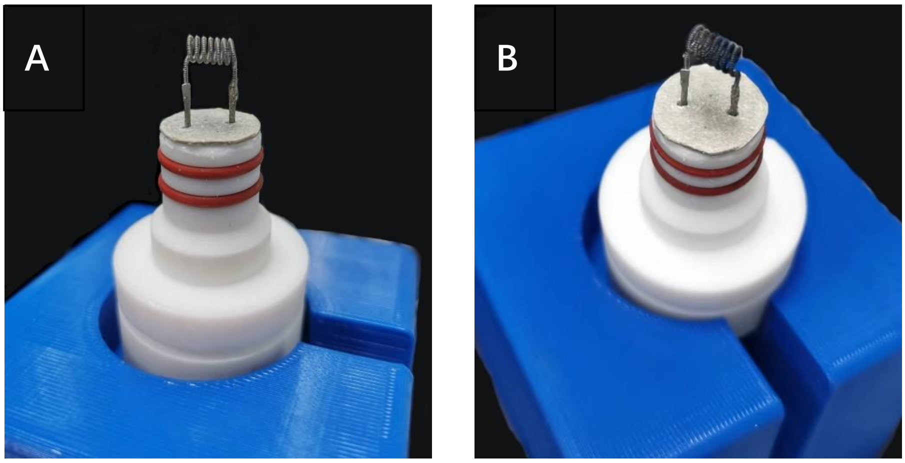

Fig S3. Photograph of platinized TC used in different atmosphere. (A) platinized TC used in Ar/H2 mixture; (B) TC used in Ar atmosphere that produced tungsten oxides (WOx) (right).

2. Emission data handling

Algorithm of emission data handling affects both quantitation precision and reproducibility. In ETV-DBD-OES, it took certain time to completely release Hg. Signals can be calculated based on intensity, wavelength and time, which are combined in 3 dimensions as peak volume. [1]Peak volume algorithm was reported to significantly improve precision and linearity in electrothermal vaporization (ETV)-OES. Equations of peak volume (Eq. 1,2) are shown below:

$$I_{area}(t) = \sum_{\lambda=\lambda_{start}}^{\lambda=\lambda_{end}} I_t(\lambda) \quad (1)$$

$$I_{volume} = \sum_{t=t_{start}}^{t=t_{end}} I_{area}(t) \quad (2)$$

In Eq. 1, $I_{area}(t)$ is the calculated peak area at time t, $I_t(\lambda)$ is the intensity at time t, λ_{start} and λ_{end} are the starting and ending wavelengths of the Hg peak. In Eq. 2, I_{volume} is the calculated peak volume, t_{start} and t_{end} are the starting and ending time.

3. Standard curves

The standard curves were constructed by plotting the calculated peak volume versus the analyte concentrations of Hg solutions. The result was shown in **Fig. S4**. The linearity of R^2 was achieved to 0.9994. The LOD was 0.1 μg/L.

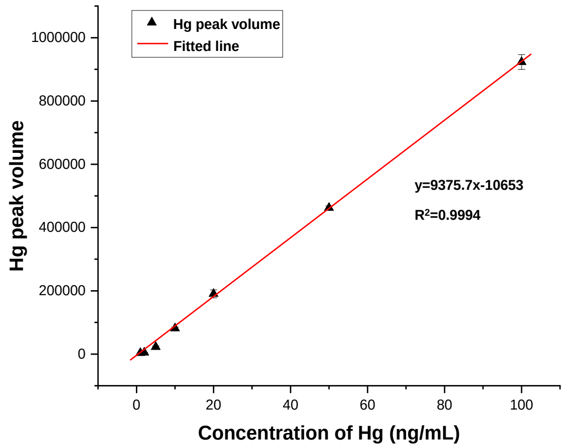

Fig. S4. The calibration curve of Hg by this ETV-DBD-FOS. (n=3)

4. Stability

To evaluate the stability of the instrument, the solution with 10μg L^{-1} Hg standard solution were continuously analyzed for 11 times. The result was shown in **Fig. S5**. The RSD if the determination is 3.2%, which demonstrated a good stability of this instrument.

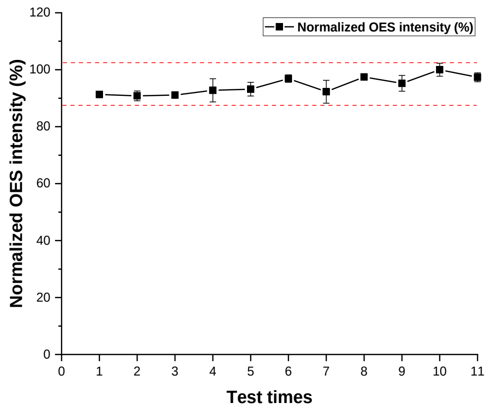

Fig. S5. Precision assessment of Hg solution. (n=3)

1. J. Shan, W. Jin, B. Yu, Y. Ying, D. Zhu, H. Yu, Y. Yan and Q. Jin, *Journal of Chemometrics*, 2018, **32**.