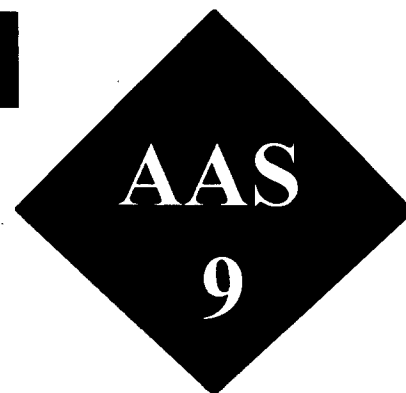


APPLICATION



A New Light Source to Improve the Detection Limits in Atomic Absorption Spectroscopy - Determination of Arsenic -

Dr. A. Klose, U. Oppermann, Shimadzu Deutschland GmbH, Duisburg

The quantitative determination of Arsenic is a routine job in most AAS laboratories and can be performed using flame-, furnace-, and hydride technique. Especially the analysis of human body fluids and the control of water especially mineral water due to recent publications is an important application field. The DIN-38405-D18 regulation (Deutsche Einheitsverfahren) gives a description of the analytical procedure using the hydride technique [1]. This method requires a reduction of the As (V) to the As (III) using KJ

and ascorbic acid. In the hydride technique the As (III) is the preferable modification because of its higher sensitivity.

Another possibility for the Arsenic determination is the electrothermal atomization using the high sensitivity graphite furnace GFA-6500. Here only an injection volume of 20 μ l is required to get a similar sensitivity in comparison with the hydride technique.

The basic problem in the Arsenic determination is the fact, that the resonance line of the hollow cathode lamp at 193,7 nm has a weak light energy, resulting in a poor quality of analytical results, especially during trace- and ultratrace concentrations, due to the light source. The high performance optical systems of state of the art atomic absorption spectrometers like AA-6701/6601 are optimized in that way, that only the light source itself is the limiting factor.

The stronger the energy of the hollow cathode lamp is - the better we can expect the noise of the baseline, resulting in a high signal/noise ratio and in an improved detection limit.

The easiest method to increase the energy output of the light source is a higher lamp current. This causes at a certain height of the current the elementspecific effect of self reversed line profile and is used as a background compensation method for spectral interferences by absorption line overlapping [2]. The sensitivity will be slightly reduced depending on the element.

The new Hyper lamp (Fig. 1) uses in addition to cathode and anode a third electrode, which is heated by an external power supply. This additional energy is able to compensate the self reversed line profile. The result is a ten times higher energy in comparison to the standard hollow cathode lamp.

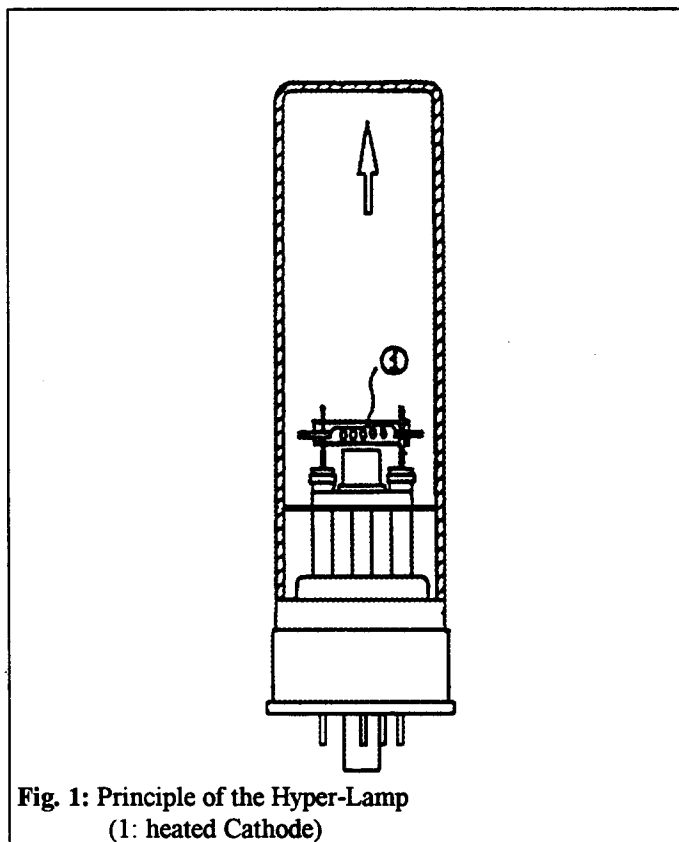


Fig. 1: Principle of the Hyper-Lamp
(1: heated Cathode)

APPLICATION

Figure 2 shows an absorption signal generated in the high sensitivity furnace GFA-6500 using an Arsenic standard solution with a concentration of 6 µg/l.

The determination of Arsenic has been evaluated using an international reference water (SLRS-3, NRC-CNRC, Ottawa, Canada). The certified value is 0.72 ± 0.05 µg/l. Our measured result is 0.727 µg/l (Average value from 3 determinations in Table 1).

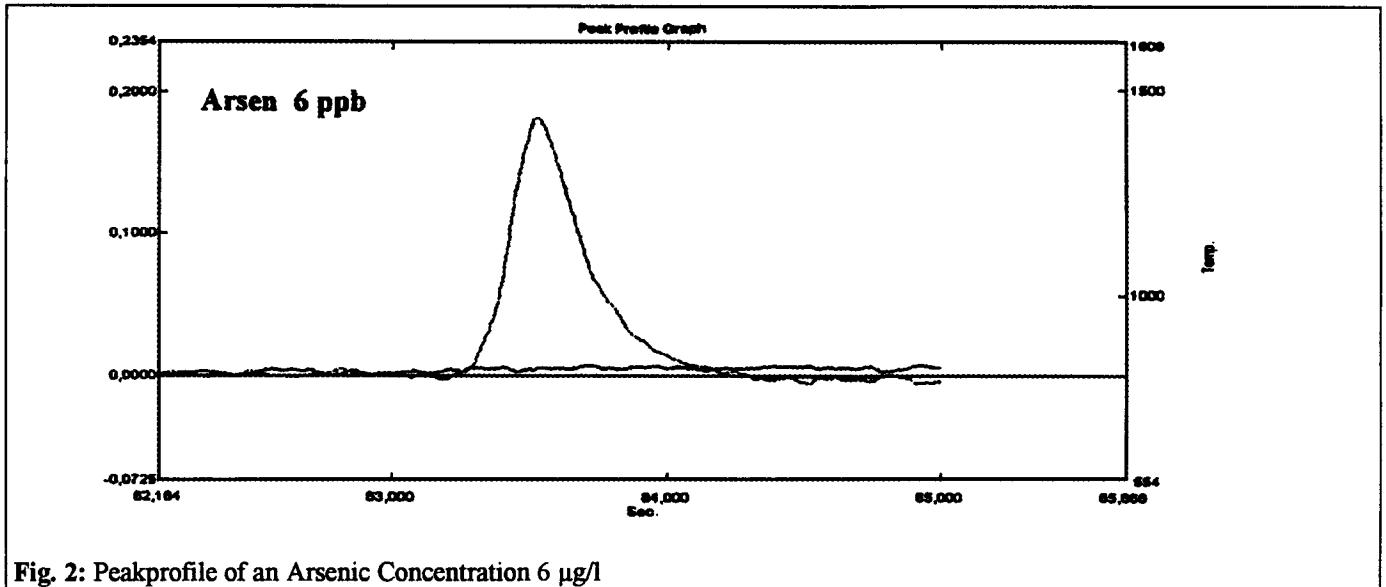


Fig. 2: Peakprofile of an Arsenic Concentration 6 µg/l

	Sample	Abs. Signal	Concentration [µg/l]
UNK	SLRS 3	0,0153	0,7169
UNK-REP	SLRS 3	0,0162	0,7561
UNK-REP	SLRS 3	0,0152	0,7097
UNK-AVG	SLRS 3	0,0156	0,7276

Table 1: Results from the MRT copied to Excel

Literature

- [1] Deutsche Einheitsverfahren zur Wasser-, Abwasser-, und Schlammuntersuchung, VCH, Beuth, 1996
- [2] U. Oppermann, Zn- Measurements using High Speed Self Reversal Background Correction, Shimadzu Application Note AAS 1 (SCA 120-001)

Instrumentation

Atomic Absorption Spectrometer: AA-6601F
 Autosampler: ASC-6000
 Graphite Furnace: GFA-6500
 Hydride System: HVG-1



Shimadzu Deutschland GmbH
 Albert-Hahn-Str. 6 - 10, D-47269 Duisburg
 Telefon: (0203) 7687-0
 Fax: (0203) 766625, Telex: 855220 shim

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