**In-vitro biochemical analysis: A novel lead analysis based on amine functionalized bimodal mesoporous silica nanoparticles in human biological samples by ultrasound assisted-ionic liquid trap-micro solid phase extraction**

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**Abstract**

A novel and applied method based on ultrasound assisted- Ionic liquid trap-micro-solid phase extraction (USA-ILT-μ-SPE) was demonstrated for preconcentration /separation of lead (Pb) in human blood and urine samples. By proposed method, the amine-functionalized bimodal mesoporous silica nanoparticles (NH2-UVM7) as solid phase sorbent was used for in-vitro lead analysis in human biological samples at pH≈ 7.0. After shaking/ centrifuging of sample, the Pb (II) was extracted with NH2-UVM7 without any chelating agents, trapped in ionic liquid phase and settled down in conical centrifuge tube as a residual solution [IL/ Pb…(NH2-UVM7)…Pb]. The lead ions was back extracted from residual solution and determined by atom trap flame atomic absorption spectrometry (AT-FAAS). Under the optimal conditions, the linear range (LR), limit of detection (LOD) and preconcentration factor (PF) were obtained (10–950 µg L−1; 2.0- 210 µg L−1), (1.5 µg L−1; 0.4 µg L−1) and (19.8; 99.7) for human blood and urine samples, respectively (RSD< 1%, intra-day). The reusability and batch adsorption capacity of the NH2-UVM7 were also obtained 24 and 213.8 mg g-1, respectively. Validation of methodology was confirmed by standard reference materials (SRM), electro thermal atomic absorption spectrometry (ET-AAS) and ICP-MS.

**Keywords:** L**e**ad analysis**,** Human blood and urine**,** Amine-functionalized bimodal mesoporous silica nanoparticles.

1. **Introduction**

Lead (Pb) is one of the most toxic metals which has anemia effect in occupationally exposed workers and can be decreased the total amount of red blood cells (RBCs) or hemoglobin in human blood. Lead is considered a toxic and non-essential element that has been shown to be particularly harmful to human workers and accumulates in tissues and can cross the blood-brain-barrier (BBB). Lead causes toxic effects in industrial workers; like brain damage, anemia and chromosomal aberrations. Therefore, due to high toxicity and bioaccumulation factor, Pb determination is very important in biological samples of workers [1-10].

1. **Material and Methods**

The Pb concentration was determined by a spectra GBC 906 double beam atomic absorption spectrophotometer equipped with atom trap, (AT-FAAS, GBC, Model; Plus 906, Australia). The air-acetylene and deuterium lampas (DL) a background correction was used by AT-FAAS. The computational element of pipe string is a circular arc in the space on the inclined plane. Before water injection, the thermals of the pipe string, fluid in the wellbore and the ground are equal and in equilibriums situation.

***2.1. General procedure***

 By proposed method, 10 mL of blood or serum samples was used for separation/microextraction of lead (Pb) at optimized pH. In this procedure, 10 mg of NH2-UVM7 dispersed to 1-octyl-3-methylimidazolium bis(trifluoromethanesulfonyl)imide as hydrophobic ionic liquid (100 mg of C14H23F6N3O4S2 120 μL) which was diluted with acetone as a dispersant solvent.

**Table 1:** Parameters of highly deviated well

|  |  |  |  |
| --- | --- | --- | --- |
| Parameter name | Value  | Parameter name | Value |
| Drill pipe inner diameter (m) | 0.031 | Specific heat of string KJ/(kg°C) | 0.11 |
| Drill pipe outer diameter (m) | 0.0365 | Thermal conductivity of string W/(m2°C) | 0.64 |
| Inner casing diameter (m) | 0.06068 | cement sheath diameter (m) | 0.3 |
| outer casing diameter (m) | 0.06985 | Specific heat of cement sheath KJ /(kg°C) | 0.21 |
| Specific heat of formation KJ/(kg°C) | 0.25 | Specific heat of water KJ/(kg°C) | 1.0 |
| Well depth (m) | 2955 | Water injection rate (m/s) | 0.2 |

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**Figure 7:** Tester structure diagram

**Acknowledgements**

Authors thank National Iranian South Oilfield Company’s staffs for their help and support during this work and providing sufficient dataset for article.

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