On-site mine water analysis: application note for the PDV6000*plus*

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Mine Waters

Voltammetry

Advantages over spectrophotometric methods

- Portability → bring the instrument to the sample!
- Decentralised and relatively low cost

Voltammetric analytical procedure developed for As contamination in drinking water wells of Bangladesh.

- Rugged, portable
- Rapid (ca. 30 min)
- Accurate
- Precise (RSD<5%)
- Relevant LOD (1 – 2 µg L^{-1})
- Speciation: AsIII/AsV
- Also: Cu, Fe, Zn, Ce, Pb, Mn, Cr, Ni, Co, V,...

PDV6000*plus*

PDV6000*plus*

- Sample volume: 2 – 10 mL
- Reagents: dilute acids (acetic, hydrochloric, nitric) deionised water, arsenic(III) standard
- Linear range: up to 500 ug L^{-1}, undiluted
- BUT: Major interferences:

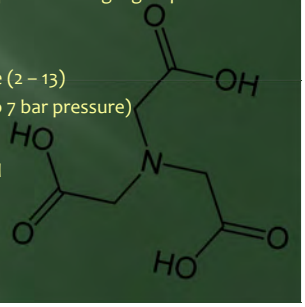
As — Signal reduces by 20% in presence of other metals at concentrations of:
Cu 50 µg L^{-1}
Pb 100 µg L^{-1}
Zn 200 µg L^{-1}
Ag 250 µg L^{-1}
Hg 500 µg L^{-1}
Fe 2000 µg L^{-1}

Toyopearl Resin

- Manufactured by Tosoh Bioscience
- NTA*-type chelating groups on semi-rigid gel spheres
- highly porous
- hydrophilic
- stable over wide pH range (2 – 13)
- mechanically stable (up to 7 bar pressure)

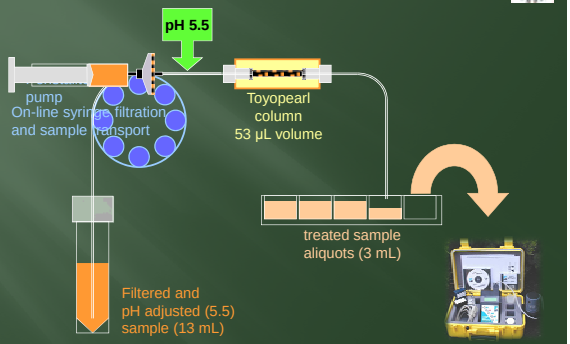
at pH > 5,

- metal cations are retained
- oxyanions not retained



*NTA: nitrilotriacetic acid

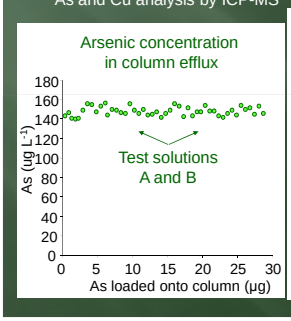
Matrix Removal

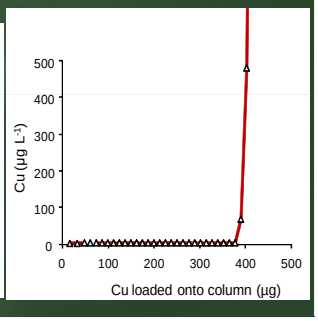


Results: Toyopearl Characterisation

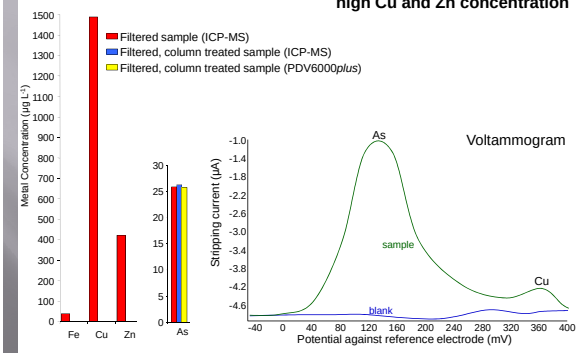
Test solutions A: 150 µg L^{-1} As + 200 µg L^{-1} Cu
B: 150 µg L^{-1} As + 4000 µg L^{-1} Cu

As and Cu analysis by ICP-MS

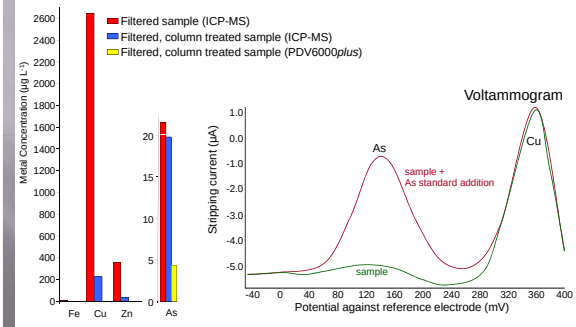




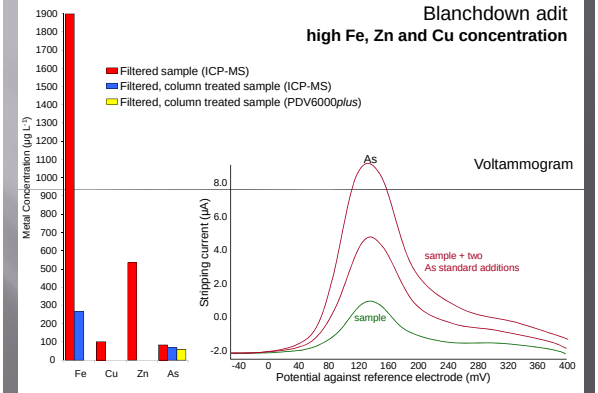
Gunnislake Clitters adit
high Cu and Zn concentration



Wheal Fanny adit
high Cu and Zn concentration



Blanchdown adit
high Fe, Zn and Cu concentration



Summary/Optimisation

Filtration: 0.45 µm versus 0.1 or 0.2 µm poresize
→ the As associated with Fe colloids may be relevant w.r.t. discharge compliance or environmental concerns
→ choice related to application

pH Adjustment - better done with buffer system
→ e.g. ammonium acetate or potassium hydrogen phtalate/NaOH

Fe colloid formation – reduced by dilution before filtration

Thank You