On-site mine water analysis:
application note for the PDV6000plus

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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,...

PDV6000plus

- Sample volume: 2 – 10 mL
- Reagents: dilute acids (acetic, hydrochloric, nitric) deionised water, arsenic(III) standard
- Linear range: up to 500 µg L⁻¹, undiluted
- BUT: Major interferences:
  - Pb 100 µg L⁻¹
  - Ag 250 µg L⁻¹
  - As Signal reduces by 20% in presence of other metals at concentrations of:
    - Zn 200 µg L⁻¹
    - Cu 50 µg L⁻¹
    - Fe 2000 µg L⁻¹
    - Hg 500 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

- Toyopearl column 53 µL volume
- filtered and pH adjusted (5.5) sample (13 mL)
- Analysis by PDV6000plus
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

Arsenic concentration in column efflux

Copper concentration in column efflux

Summary/Optimisation

Filtration: 0.45 µm versus 0.1 or 0.2 µm pore size
- 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 phthalate/NaOH

Fe colloid formation – reduced by dilution before filtration

Thank You