USE OF NEW FUNCTIONALISED MATERIALS WITH ORGANOPOLYSILOXANE STRUCTURE FOR PURIFICATION OF ARSENIC(III) IN HYDROCHLORIC ACID MEDIA

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ABSTRACT
This study shows that impurities such as bismuth(III) and antimony(III) can be efficiently removed from arsenic(III) solutions in highly acidic media (e.g. 3 to 6 mol/L HCl) by using a new functionalised material possessing an organopolysiloxane structure and diphenylphosphine functions.

INTRODUCTION
Classical procedures for chemical purification of arsenic are based on the separation of arsenic(III) halo-complexes by distillation or solvent extraction. Highly concentrated chloride media (e.g. 8 to 12 mol/L HCl) have proved effective for the extraction of the chloro-complexes of arsenic(III) into carbon tetrachloride (1,2), chloroform (1), benzene (1 - 4), bis(2-chloroethyl) ether (1,5) or Solvesso 150® (solvent constituted of 99% aromatics) (6). However, distillation and solvent extraction of arsenic(III) halo-complexes are not completely selective against various impurities such as antimony(III) or bismuth(III). In the present paper, we have investigated the removal of antimony(III) and bismuth(III) from moderately concentrated (e.g. 3 to 6 mol/L) hydrochloric acid solutions containing arsenic(III) by using new materials possessing an organopolysiloxane structure and monophenyl [-PPh] (material 1) or diphenylphosphine [-PPh₂] (material 2) groups as functional
groups. Such materials belong to a series of functionalised materials which have been synthesized at Degussa (Germany) by the polycondensation of suitable bifunctional silane monomers (7). They appear as spherical or egg-shaped particles with a grain size ranging between 0.1 and 1.5 mm (mean value: 0.6 mm). The main physical advantages of functionalised organopolysiloxanes lie in the absence of swelling or shrinking during ion sorption and in their high thermal stability.

**EXPERIMENTAL**

The two functionalised organopolysiloxanes have been kindly supplied by Degussa Company and used as received. Their functional group concentration was as follows: material 1 (monophenylphosphine groups): $1.5 \times 10^{-3}$ mol/g (dry mat.); material 2 (diphenylphosphine groups): $1.2 \times 10^{-3}$ mol/g (dry mat.). Arsenic trioxide of analytical (Prolabo) or technical (Metaleurop) grade quality was used for the preparation of arsenic(III) solutions. The other reagents from various suppliers were all of analytical grade.

Metal determinations in aqueous phases were carried out by inductively coupled plasma emission spectrometry with an ICP 1500 Plasma Therm instrument coupled with a Video 11 A/A Instrumentation Laboratory Spectrophotometer. The batch sorption experiments were carried out by vigorously shaking measured amounts (typically 0.5 g of wet material) of each of the two functionalised organopolysiloxanes with definite volumes of aqueous metal solutions of known concentration for 24 h at $20 \pm 2 ^\circ C$. The experiments in dynamic conditions were performed at $20 \pm 2 ^\circ C$ with a column filled with a given quantity of functionalised organopolysiloxane.

**RESULTS AND DISCUSSION**

The equilibrium data for sorption isotherms of As(III), Bi(III) and Sb(III) from 5 mol/L HCl on materials 1 and 2 are given in Figures 1 and 2, respectively.