



## Studies on arsenic adsorption by the use of aluminum anodizing sludge

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### ABSTRACT

The objectives of this work were the testing of the suitability of **AL**uminum **A**nodizing **S**ludge (ALAS) as an arsenic adsorbent and the evaluation of the importance of its constituents on arsenic removal efficiency. The objectives were realized through leaching experiments and adsorption studies, both equilibrium and kinetic, using National Sanitation Foundation (NSF) water samples spiked with arsenic. The results showed that the major component of ALAS samples was that of gibbsite and major trace elements identified were chromium ( $300\text{--}2.8 \times 10^3$  mg/kg) and tin ( $250\text{--}1.9 \times 10^3$  mg/kg). ALAS samples were characterized as mesoporous materials with specific surface area varying between 60 and 216 m<sup>2</sup>/g and judging by the low values of the physico-chemical parameters in their leachates, they are considered as non-hazardous materials. As(V) equilibrium adsorption data obeyed satisfactorily the Freundlich and Langmuir models with kinetics of adsorption governed by both surface adsorption and intraparticle diffusion. All ALAS samples were found to be inefficient adsorbents for As(III). In contrast, they were efficient adsorbents for As(V) with their adsorption capacity depending on gibbsite content with positive effect, phosphate content with negative effect and ambient pH, decreasing significantly as the pH value increased from 5 to 8. ALAS samples with a phosphate content up to 2.2% w/w were satisfactory As(V) adsorbents lowering an initial concentration of 100 µg/l well below the recommended limit for drinking water at a pH range of 5 to 8. In contrast, ALAS samples with higher phosphate content (5.1–8.1% w/w) failed to achieve this limit at pH values higher than 6.6. In conclusion, ALAS samples can be used not only as effective coagulants for wastewater treatment but at the same time as effective As(V) adsorbents provided that their phosphate content is not relatively high. ALAS with high phosphate content, however, comprise only a small part of the total ALAS produced because they originate from the production of shiny aluminum decoratives, which represent a small part of aluminum products.

*Keywords:* Aluminum anodizing sludge; Gibbsite; Physicochemical characteristics; Arsenic(V); Arsenic (III); Adsorption

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