A Novel Adsorbent Nickel / Nickel Boride Nanoparticles Coated Resin for Arsenic(III) and Arsenic(V) Removal

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Arsenic is a toxic element for both plants and animals and inorganic arsenicals are proven carcinogens in humans [1]. It is commonly accepted that inorganic As(III) compounds are approximately 60-80 times more toxic to humans than As(V) and inorganic arsenic compounds are about 100 times more toxic than organic ones [2,3]. The World Health Organization (WHO) revised the guideline for arsenic in drinking water as 10 µg/L in 1993 [4] and The United States Environmental Protection Agency (USEPA) has eventually implemented the reduction of permissible values of arsenic in drinking water from 50 to 10 µg/L in light of the epidemiological evidence to support the carcinogenic nature of the ingested arsenic and its connection with liver, lung and kidney diseases and other dermal effects [5].

A novel adsorbent named nickel / nickel boride nanoparticles coated resin has been introduced for the removal of both As(III) and As(V) from water. Nickel / nickel boride nanoparticles were formed on Purolite C-100 resin successfully. Perlite, pumice, zeolite and silica gel were also tried as the support material. However, nickel / nickel boride nanoparticles on those materials were not stable. Optimal preparation conditions for nickel / nickel boride nanoparticles coated resin were established. In the batch method, initial pH did not significantly affect the arsenic removal efficiencies for As(III) and As(V) in the pH range 3.3-11.5. Very high arsenic removal efficiencies of 99.2% and 100.3% were observed for As(III) and As(V), respectively. The plots of Langmuir, Freundlich and DR were drawn. The isotherms showed that the adsorption is favorable. Maximum arsenic adsorption capacities were calculated as 23.4 mg/g and 17.8 mg/g for As(III) and As(V), respectively. As(III) and As(V) could be desorbed from the adsorbent using a mixture of NaCl and NaOH and, therefore, the adsorbent could be used several times.

KEYWORDS: arsenic removal, nickel / nickel boride nanoparticles coated resin, water

REFERENCES: