Use of Ion Exchange Resins Modified with Zero-Valent Iron for The Sorption/Speciation of Inorganic As(III) and As(V) in Waters

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Arsenic is a cumulative toxic element and according to Environmental Protection Agency, and its maximum admissible concentration is established as 10.0 µg L⁻¹ in drinking water. The consumption of arsenic via contaminated drinking water causes chronic and acute poisoning which results in different cancer types. Therefore, determination, speciation and removal of arsenic compounds are important. This study aims to develop a new sorbent for removal of inorganic arsenic species from contaminated waters. For this purpose a strong anion exchange resin (Amberlite IRA458) was modified with zero-valent iron (ZVI).

Various commercial anion and cation exchange resins and novel resins modified in the study were used for sorption and speciation of inorganic arsenic. For all the sorbents, the optimized sorption parameters were determined to be 25 °C for sorption temperature, 50.0 mg for sorbent amount, 60 min for shaking time for 20.0 mL of 100.0 µg L⁻¹ of arsenic species. The release of As(III) and As(V) from the sorbents was realized using two eluents, 2% (m/v) NaOH + 3% (m/v) NaCl and 5% (m/v) NaOH + 3% (m/v) NaCl, respectively. The accuracy of the proposed methodology was verified with sorption studies for various water types spiked with 100.0 µg L⁻¹ As(III) and As(V). Sorption values of ZVI-IRA 458 were determined to range between 59.1% and 100% for As(III) and between 61.5% and 100% for As(V). Moreover, the sorption efficiencies of the novel sorbents were compared with those of the commercial sorbents.

Sorption results also demonstrated that the most effective iron immobilization method was NaBH₄ reduction and the most efficient resin was Amberlite IRA 458. Also, the sorption characteristic of ZVI modified resins showed that the removal efficiency depended on the type of resins and arsenic species in the water.

KEYWORDS: arsenic, ion-exchange resin, zero valent iron

REFERENCES: