Superparamagnetic Iron(II,III) Oxide Silver Cysteine Complex Nanoparticles (SISCCN) in Metal Ions Adsorption and Chiral Recognition

Li, Kwun Wing Thomas
Chu, Pak Hei
Chan, Tat Ngai Davis

Superparamagnetic iron(II,III) oxide silver cysteine complex nanoparticles (SISCCN) is an innovative, economical and highly reusable invention. 1 g of SISCCN can adsorb 281.13 mg mercury(II) ion, 136.04 mg cadmium(II) ion, 58.18 mg iron(III) ion, and 192.27 mg lead(II) ion. By taking its advantage of high surface area to volume ratio, the chelation process of metal ions completed within 6 minutes while the optimum acid leaching for metal ion recovery was found to be soaking the metal ion chelated cysteine with 2.00 M of hydrochloric acid in 20 minutes. The optimum adsorption pH of metal ions by SISCCN was 8. The adsorption of 0.050 M lead(II) ion of SISCCN dropped by 27.6% after being used for 20 times. SISCCN also exhibited chiral recognition on racemic amino acids and racemic drugs such as ibuprofen and salbutamol, showing chiral recognition on 0.00100 M racemic salbutamol solution (enantiomeric excess of 14.00%), 0.00100 M racemic ibuprofen solution (5.31%), 0.00500 M racemic aspartic acid solution (4.80%), 0.00500 M racemic cysteine solution (5.05%), 0.00500 M racemic asparagine solution (-0.756%; - sign for excess (-)-amino acid), 0.00500 M racemic methionine solution (2.21%) and 0.00500 M racemic valine solution (1.56%). The percentages of enantiomeric excess of 0.00500 M aspartic acid (19.33%) and cysteine (16.32%) attained the highest when the concentration of iron(II) nitrate, iron(III) nitrate and silver nitrate solutions were 0.150 M and the sodium hydroxide solution was 1.500 M. In conclusion, SISCCN is a novel and practical invention that can be potentially applied in industrial-scaled sewage treatment and optical purification of racemic drugs in pharmaceutical industry.

Awards Won:
Third Award of $1,000