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Competitive sorption of anionic dyes on CoFe-layered double hydroxide in single and binary solutions

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The synthetic dyes released by the effluents of various industries result in severe environmental pollution that may cause carcinogenic and mutagenic effects on living organisms. Layered double hydroxides (LDH) were extensively studied as high capacity sorbents for the removal of dyes from water. However, a comprehensive understanding of why one dye is sorbed more than the other still remains unknown. In addition, we know very little how sorption mechanisms scale when more than one dye is present in the solution. In this study, a comparative investigation was performed to evaluate the sorption capacity of CoFe LDH for three different dyes: methyl orange (MO), remazol brilliant blue reactive (RBBR) and allura red (AR). Moreover, to shed light on the competitive sorption mechanisms, the sorption behaviour of CoFe LDH in a binary dye solution of MO and RBBR was elucidated. The results indicated that the sorption affinity of CoFe LDH is the highest for MO (750 mg/g) followed by RBBR (155 mg/g) and AR (~83 mg/g), respectively. Sorption of MO on CoFe LDH is best described by the Freundlich isotherm model whereas the Langmuir model has the best fit for RBBR and AR sorption. Fourier-transform infrared spectroscopy and LDH charge analysis results showed that ion exchange mechanism and electrostatic interactions play important roles in dye sorption. In a binary solution, the mass of MO sorbed was reduced significantly while the mass of RBBR sorbed did not change, which was attributed to the alteration of the electrostatic properties of the LDH after the sorption.

Biography

Ime Akanyeti obtained her Environmental Engineering Degree from Marmara University, Istanbul, Turkey in 2005. After she received her Master's Degree in Environmental Sciences in Wageningen University, 2007; she has worked as a Researcher in Wetsus, Centre of European Centre of Excellence for Sustainable Water Technology in the Netherlands for about a year. She has completed her PhD degree in Edinburgh University, Scotland in 2013. She obtained a position as a Lecturer in February 2014 and Assistant Professor in July 2014 in Department of Environmental Engineering at Cyprus International University. She has published several papers in reputed journals.

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