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Comparative assessment of magnesium-enhanced-extraction by various sequestering derivatives of 8-hydroxyquinoline via layer-by-layer chemical deposition technique

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Abstract

Design and fabrication of the most highly effective reagent for removal of the target analyte from their matrices represent a great challenge. Therefore, the present work is aimed to explore the potential contribution of different functional groups on the Mg(II) extraction process using Layer-by-layer (LbL) chemical deposition process. Two sequestering reagents, viz 5-phenyl-azo-8-hydroxyquinoline (5PA-8HQ) and 5-azo-benzoate-8-hydroxyquinoline (5AB-8HQ) were synthesized, characterized and compared with the starting 8-hydroxyquinoline (8HQ) material for removal of Mg(II) ion from aqueous solution. The extraction process was evaluated on the basis of surface coverage values ($\mu\text{g}/\text{cm}^2$) under different influencing factors. The results of these studies confirmed the superiority of (5AB-8HQ) in double extraction of Mg(II) due to the presence of four reactive functional groups including the quinoline OH and N as well as the azo and carboxyl groups compared to (5PA-8HQ) and (8HQ). The surface coverage values of Mg(II) by (5AB-8HQ), (5PA-8HQ) and (8HQ) were identified as 119.9, 60.8 and 60.8 $\mu\text{g}/\text{cm}^2$, respectively in presence of pH 9.0. Under all experimental conditions, (5PA-8HQ) was identified to similarly behave as (8HQ) without the contribution of azo group in metal binding process. The characterization of deposited Mg(II) complexes confirmed the formation of Mg(II)-(8HQ)₂, Mg(II)-(5PA-8HQ)₂ and Mg(II)-(5AB-8HQ) in 1:2, 1:2 and 1:1 stoichiometric ratios, respectively to account for the high surface coverage values of Mg(II) by (5AB-8HQ). The effect of reaction dipping time as well as kinetics

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