A control strategy to optimize the keggin formation in concentrated intercalating solution of Al and Al/Fe by catalyzed hydrolysis

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Natural Organic Matter (NOM) concentration has significantly increased in the past few decades in almost all supply sources employed to produce drinking water all around the world [1]. Catalytic Wet Peroxide Oxidation (CWPO) is an Advanced Oxidation Process (AOP) that has been highlighted thanks to its very low cost and simple operation, depleting very efficiently the concentration of almost any organic contaminant dissolved in water, including NOM [1]. A novel approach is being explored in the "Grupo de Investigación en Materiales Funcionales y Catálisis" (GIMFC) in order to produce interlayering Al/Fe-oligomeric solutions capable of expand natural clays towards PILCs even from pretty more concentrated metal precursors, based on the self-hydrolyzing dissolution of elemental aluminium in $[Al(H_2O_6)]^{3+}$ and $[Fe(H_2O_6)]^{3+}$ dissolutions [2]. In this work, based on the method developed by GIMFC, we formulated a set of optimal control problems that maximize the formation of Keggin and minimize the formation of precipitates during the experiment. We use the Pontryagin's Principle to analyze the existence of the optimal controls and the adjoint differential equations. Finally, the control problems are solved using the Forward-Backward Sweep Method. The results corroborate that the controlled addiction of aluminum Al^0 increases the formation of Keggin.

References

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