TiO2-Assisted photocatalysis of lead-EDTA

Vohra, M.S. , Davis, A.P.

Water Research
Vol. 34, Issue.3, 2000

Abstract: Several industrial and remedial processes create aqueous wastes containing complexed heavy metal species. TiO2-assisted photocatalysis was evaluated to address contamination problems from Pb-EDTA at both stoichiometric and non-stoichiometric Pb(II)/EDTA ratios. Pb-EDTA destruction occurred rapidly. At higher pH, lead became adsorbed onto the TiO2 as complexed intermediates. Continued PCO saw reappearance of the lead in solution, primarily as Pb2+. Stoichiometric Pb-EDTA studies showed no noticeable pH effects even though Pb-EDTA adsorption depends strongly on pH. This suggests that initial complex adsorption is not required for its destruction and that Pb-EDTA photocatalysis occurs both at the TiO2 surface and in the aqueous phase. Production of CO2 and formaldehyde during photocatalysis suggests initial attack at an acetate group on the complex. Acetate and formate were found as minor intermediates. Nitrogen-containing products were ammonium and nitrate. For EDTA>Pb(II) studies, smaller amounts of CO2 compared with stoichiometric Pb-EDTA were found, suggesting that attack on the acetate group is promoted by lead complexation. Pb(II) > EDTA studies showed decreasing CO2 production with increasing pH, resulting from a shift in adsorbed Pb-EDTA speciation, or increased adsorption of free lead at higher pH, decreasing the available surface sites for OH· production.