Studies on Nutrient Removal from wastewater using Electrochemical Method

Krupa Raval (15MCHE08)

Guide: Prof. Priya Saxena, IT-NU

Abstract

The contamination of water resources by nitrogen compounds is a crucial environmental problem gaining attention in recent years. In the present work, anodic oxidation process has been explored as a potential alternative for urea rich wastewater treatment. The optimization of the influencing factors on electrochemical removal of urea was studied. Fabrication of electrodes was accomplished by Standard Thermal Decomposition method. A comparison study by using various electrolytes like NaCl, KBr and Na_2SO_4 was done which showed highest % TN reduction with NaCl as an electrolyte. Batch experimental study was carried out with all fabricated electrodes to check the performance for removal of nitrogen species by electrolysis of urea rich wastewater under optimized conditions and Ti/Ta_2O_5-RuO_2-SnO_2-Sb_2O_5 was found to be the best electrode giving 97.6 % TN reduction. This work also investigates the kinetic behavior of active species formed in electrochemical cell during electrolysis and Ti/Ta_2O_5-RuO_2-SnO_2-Sb_2O_5 having the highest rate constant value proved its effectiveness kinetically. In further study, the most effective Ti/Ta_2O_5-RuO_2-SnO_2-Sb_2O_5 showed its appreciable efficiency in removal of high concentration dye and urea from mixed RB-5 dye (500 ppm) and urea (200 ppm) synthetic wastewater by batch study. Also, actual urea rich industrial wastewater effluent was treated and 93.3 % TN reduction by Ti/Ta_2O_5-RuO_2-SnO_2-Sb_2O_5 was obtained. Continuous study was done with three DSAs Ti/Ta_2O_5-RuO_2-SnO_2-Sb_2O_5 as anode and stainless steel as cathode in three tanks in series to check its potential in large scale at the same operating conditions like in batch study and 97.81 % TN reduction was obtained. The service life of this electrode was found 0.656 years from the accelerated life test. Surface morphology and composition of the best DSA were characterized using Scanning Electron Microscopy (SEM) and Energy Dispersive X-ray Spectroscopy (EDX). Phases in coating were analyzed by X-ray Diffraction (XRD) and electrochemical performance of the DSA was analyzed by Cyclic Voltammetry (CV).

Keywords: Dimensionally Stable Anode (DSA), Standard Thermal Decomposition (STD) Method, Electro-oxidation, Urea wastewater, Accelerated Life-test