INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

Name of the Student	:	V Shyam Kumar Yadav
Roll Number	:	126107025
Programme of Study	:	Ph.D.

Thesis Title: **Electrochemical and Photo Electrochemical Studies for CO_2 Reduction and Dye Removal using Co_3O_4 as Anode**

Name of Thesis Supervisor(s)	:	Mihir Kumar Purkait
Thesis Submitted to the Department/ Center	:	Chemical Engineering
Date of completion of Thesis Viva-Voce Exam	:	3-6-2016
Key words for description of Thesis Work	:	CO_2 reduction; Solar energy, Faradaic efficiency; $Co3O_4$; Sn; Zn; HCOOH.

SHORT ABSTRACT

Global warming effect was caused by the combustion of fossil fuels which releases greenhouse gases during energy generation and causes great damage to the society. There is a need to reduce these CO_2 before it cause damage to the environment. The studies discussed here were mainly focused on the electrocatalyst synthesis by electrodeposition method and their analysis using a 2-electrode glass reactor. The synthesized electrocatalysts Cobalt oxide (Co_3O_4) was used as the anode for water oxidation reaction in place of expensive platinum (Pt) electrocatalyst. The other synthesized electrocatalysts (Copper oxide (Cu_2O), Lead oxide (Pb_2O), Zinc (Zn) and Tin (Sn) were used a cathode for reduction of CO_2 to products electrochemically (RCPE). The synthesized electrocatalyst were characterized using X-ray diffraction (XRD), Fourier transform infrared (FTIR) spectroscopy, Particle size analyzer (Delsa Nano). The performance of characterized electrocatalyst was studied using a reactor for liquid product formation in different electrolyte ($KHCO_3$, $NaHCO_3$, K_2CO_3 and Na_2CO_3) solutions. The electrodes for anode and cathodes were prepared by coating the electrocatalyst ink on the surface of graphite plate. From electrochemical studies, the ability of selected electrocatalyst towards RCPE was studied. However, electrical energy was used as a source for reaction. Use of solar energy might be a better alternative as this energy is available in free of cost. From the results of electrochemical studies, bicarbonate electrolyte solutions showed higher efficiencies than carbonated solutions. From both electrochemical and photo electrochemical studies, it was observed that Sn and Zn electrocatalysts showed better Faradaic efficiencies and selectivity towards HCOOH formation in bicarbonate based solutions. So, using these electrocatalysts, studies on the simultaneous CO_2 reduction and dye removal was done electrochemically and photo electrochemically and found that in both cases the formation of HCOOH and dye removal was studied all applied conditions.