

## Abstract:

Myoglobin (horse heart, Mb) adsorbed on carbon electrodes or in solution at platinum electrodes was used for electrocatalytic reduction of trans-1,2-dibromocyclohexane (DBCH) and trichloroacetic acid (TCA) in a bicontinuous microemulsion, prepared from sodium didodecyl sulfate (SDS) or hexadecyltrimethylammonium bromide (CTAB), tetradecane, pentanol, and water. Carbon electrodes (glassy carbon, GC, and pyrolytic graphite, PG) exhibited adsorption peaks, whereas platinum (Pt) portrayed diffusion-controlled peaks. Electrode reduction of Mb had  $E_0'$  at  $-0.179 \pm 0.013$  V at GC/SDS,  $-0.189 \pm 0.015$  at GC/CTAB, and  $-0.562 \pm 0.018$  at Pt/SDS and  $0.611 \pm 0.008$  at Pt/CTAB media. Current efficiencies for electrocatalytic reduction of TCA were higher than that for reduction of dibromocyclohexane. For both substrates, dibromocyclohexane and trichloroacetic acid, a lowering of overpotential of at least 1.3 V was achieved. Overall, the Pt electrode exhibited higher catalytic efficiencies compared to carbon electrodes, suggesting higher surface concentration and unhindered orientation of the substrate on the Pt electrode. For DBCH, catalytic efficiencies decreased with scan rate, at carbon electrodes as expected for homogeneous solutions, whereas an average value of  $2.22 \pm 0.42$  in SDS and  $3.29 \pm 0.76$  in CTAB microemulsion was obtained at Pt electrodes at a scan rate range of 15 to 3000  $\text{mVs}^{-1}$ . Pseudo-first-order rate constants ( $k'$ ) for the rate-determining step (rds) involving reaction of organohalides with catalyst had an average value of  $41 \pm 1 \text{ M}^{-1} \text{ s}^{-1}$  for reduction of DBCH/SDS and  $4.8 \pm 1.0 \times 10^2 \text{ M}^{-1} \text{ s}^{-1}$  for reduction of TCA/SDS. Moreover, rate constants were higher in CTAB microemulsion, giving values of  $1.5 \pm 0.016 \times 10^2$  and  $2.75 \pm 0.67 \times 10^3 \text{ M}^{-1} \text{ s}^{-1}$  for DBCH and TCA, respectively. Positive interfacial charge of the microemulsion conduits influenced catalytic reaction of catalyst and the substrate. Under the conditions of the experiment, no hydrogen evolution was observed at Pt electrodes.