

Synthesis, characterization, structural, redox and electrocatalytic proton reduction properties of cobalt polypyridyl complexes

Karumban K.S.a,
Muley A.a,
Giri B.a,
Kumbhakar S.a,
Kella T.b,
Shee D.b,
Maji S.

Abstract

A monoanionic amido pentadentate ligand bpaqH (2-(bis(pyridin-2-ylmethyl)amino)-N-(quinolin-8-yl)acetamide) and its corresponding cobalt(III) chloro complex [Co(bpaq)Cl]Cl: 1 and aqua derivative [Co(bpaq)(OH₂)](ClO₄)₂: 2 were successfully synthesized and fully characterized by different analytical and spectroscopic techniques such as FT-IR, ¹H NMR, UV-vis spectroscopy, ESI mass spectra. The structures of 1 and 2 have been determined by the single-crystal X-ray diffraction. Spectral and redox properties were investigated along with free ligand under electrochemical conditions. Both complexes performed proton reduction activity under soluble, diffusion-limited conditions in acetonitrile with acetic acid as an external proton source with overpotentials of 0.412 V for 1 and 0.394 V for 2. The stability of the catalysts was inspected by the time-dependent UV-vis spectroscopy; 1 and 2 were found to be highly stable in the absence and presence of acetic acid. There was no significant spectral change before and after the controlled potential electrolysis suggesting no change in molecular integrity during electrocatalysis.