Mn(III) and Fe(III) Porphyrin Complexes as Electrocatalysts for Hydrogen Evolution Reaction: A comparative study

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In the present work, we carried out comparative studies on electrochemical reduction of proton to molecular hydrogen, i.e. $2\text{H}^+ + 2\text{e}^- \rightarrow \text{H}_2$ using *meso*-tetrakis-(tetraphenyl)porphyrin iron(III) chloride [Fe(TPP)Cl] and *meso*-tetrakis(phenyl)porphyrin manganese(III) chloride [Mn(TPP)Cl] as electrocatalysts. Acetic acid (CH_3COOH) was used as the proton source. Results suggest that the reduction of CH_3COOH on the surface of vitreous carbon electrode ($E_p = -1.8$ V vs. Ag/AgCl in $[\text{Bu}_4\text{N}][\text{BF}_4]\text{-DMF}$) shifts to lower negative values in the presence of [Fe(TPP)Cl] and [Mn(TPP)Cl] (-1.6 and -1.3 V, respectively vs. Ag/AgCl). Analysis of peak current values indicated that [Fe(TPP)Cl] was more active (6 x) as compared to [Mn(TPP)Cl]. However, the [Mn(TPP)Cl]-catalyzed reduction process more swiftly (the potential is more positive than +30 mV).

Keywords: Electrocatalysis; hydrogen; iron, manganese complex, porphyrin

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