Oxidation/reduction efficiency optimization of redox mediators of free Co(III)/(II) and complex $Co(II)(CN)_5^{3-}$/$Co(I)(CN)_5^{4-}$ towards development of electrochemical divided cell operation

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A galvanostatic mode of divided electrochemical cell is the only one economically applied to industrial applications. But, one half cell of the full electrochemical cell has been utilized till date, especially anodic part, as a direct or mediated electrochemical oxidation DEO/MEO using free metal ions. Here, the investigation started to utilize the full electrochemical cell in the form of MEO and MER process. In MER process, utilization of metal complexes like $Co(II)(CN)_5^{3-}$ are used to stabilize the active low valent state like $Co(I)(CN)_5^{4-}$. Being a totally different form of mediators, the operation of the full electrochemical cell is very impractical. Herein, first focus to generate active mediators using different electrodes (Ag, Zn, Cu, Ti, and Pt) and current densities (0.02, 0.05, 0.071 A cm^2) in different kinds of electrolytes (H_2SO_4, KOH). The oxidation/reduction process confirmed using measure oxidation/reduction potential changes via ORP electrode. The oxidation/reduction efficiencies calculated using titration with $FeSO_4$ and $KMnO_4$. The surface analysis of membrane and electrode derives to support the sustainable operation of the full electrochemical cell.