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Water oxidation reaction in the presence of a dinuclear Mn(II)-semicarbohydrazone coordination compound

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Water splitting, producing of oxygen, and hydrogen molecules, is an essential reaction for clean energy resources and is one of the challenging reactions for artificial photosynthesis. The Mn_4Ca cluster in photosystem II (PS-II) is responsible for water oxidation in natural photosynthesis. Due to this, water oxidation reaction by Mn coordination compounds is vital for mimicking the active core of the oxygen-evolving complex in PS-II. Here, a new dinuclear Mn(II)-semicarbohydrazone coordination compound, $[Mn(HL)(\mu\text{-}N_3)Cl]_2$ (**1**), was synthesized and characterized by various methods. The structure of compound **1** was determined by single crystal X-ray analysis, which revealed the Mn(II) ions have distorted octahedral geometry as (MnN_4OCl). This geometry is created by coordinating of oxygen and two nitrogen donor atoms from semicarbohydrazone ligand, two nitrogen atoms from azide bridges, and chloride anion. Compound **1** was used as a catalyst for electrochemical water oxidation, and the surface of the electrode after the reaction was investigated by scanning electron microscopy, energy dispersive spectrometry, and powder X-ray diffraction analyses. Linear sweep voltammetry (LSV) experiments revealed that the electrode containing **1** shows high activity for chemical water oxidation with an electrochemical overpotential as low as 377 mV. Although our findings showed that the carbon paste electrode in the presence of **1** is an efficient electrode for water oxidation, it could not withstand water oxidation catalysis under bulk electrolysis and finally converted to Mn oxide nanoparticles which were active for water oxidation along with compound **1**.

Słowa kluczowe

Water splitting, Artificial photosynthesis, Oxygen evolution reaction, Electrocatalyst, Mn(II) coordination compound

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