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Electrolyte Sensitivity of TEMPO Mediated Methanol and Glycine Electrooxidation

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Abstract: In order to emphasize the importance of electrolyte-tuning in the nitroxyl radicals mediated electrocatalytic reactions, methanol and glycine electrooxidation reactions catalyzed by TEMPO under different properties (pH, identity, concentration) of buffer solutions were investigated by cyclic voltammetry. It was discovered that in both carbonate buffer solutions and borate buffer solutions, catalytic abilities increase with the rising of pH for both glycine electrooxidation and methanol electrooxidation. The electrocatalytic performance is also affected by the identity of buffer, for both cases of glycine and methanol, the electrooxidation activities in borate buffer solutions are apparently higher than those in carbonate buffer solutions. For both glycine and methanol electrooxidation, relationships between concentrations of carbonate ions and relative catalytic current densities were observed to be volcano-shaped, while electrocatalytic abilities increase with the increasing of concentrations of borate ions within the studied concentration range. These findings suggest that the electrolyte should be treated as important as the catalyst in the designing of nitroxyl radicals mediated electrocatalytic systems.

Keywords: TEMPO; Glycine; Methanol; Electrolyte; Electrooxidation

1. Introduction

It has been demonstrated that TEMPO(2,2,6,6-tetramethyl-1-piperidine 1-oxyl) and related nitroxyl derivatives are useful catalysts for primary and secondary alcohol electrochemical oxidation [1,2], The resulting aldehyde and ketone reaction products are widely used in biomass utilization and drug precursors synthesis. Cyclic voltammetry was proposed as a simple but powerful method to optimize the reaction