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Abstract: Here, a novel and low cost redox flow fuel cell that directly converts raw biomass to electricity at low temperature without utilizing any noble metal catalyst is reported. In this cell, Fe^{3+} ion, which has strong oxidizing power and is chemical stable, was directly utilized as an oxidant for biomass in anolyte. The reduced Fe^{2+} acted as charge carriers, transferring the electrons to the anode of the cell and being converted back to Fe^{3+} simultaneously. The degradation chemistry of the biomass from the oxidation reaction and the apparent oxidation kinetics were investigated using glucose as the biomass model compound. The results showed that glucose was decomposed to small organic molecules and even CO_2, and the reaction rate was significantly affected by temperature and content of reactant. The apparent activation energy of the redox reaction is 127.85 $kJ \cdot mol^{-1}$ based on the linear relation equation at the initial stage of the reaction. And the preference conditions of the redox reaction are 100～110 ℃, 0.2～0.5 $mol \cdot L^{-1}$ glucose and the mol ratio of