Supplementary Information

UV-Vis determination of acetate in ethanol electrolysis for renewable hydrogen production

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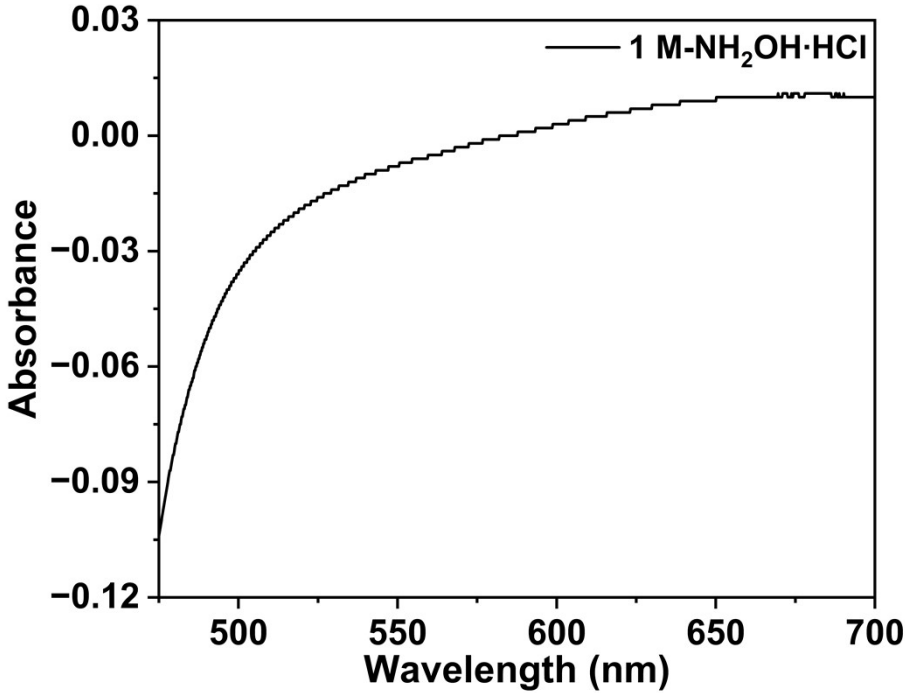

Fig. S1 UV-Vis spectra of $NH_2OH{\cdot}HCl$ solution.

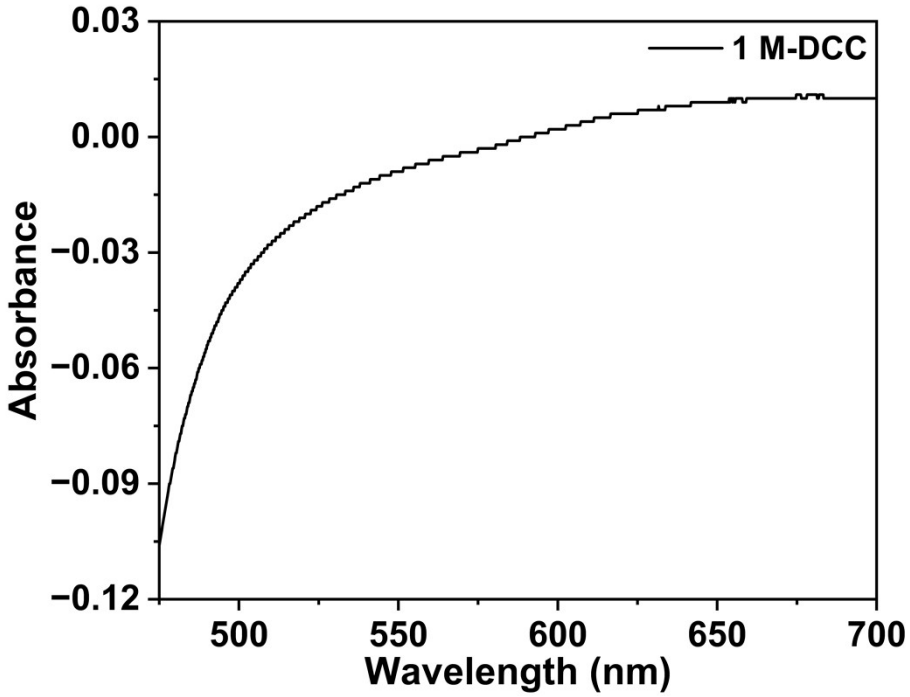

Fig. S2 UV-Vis spectra of DCC solution.

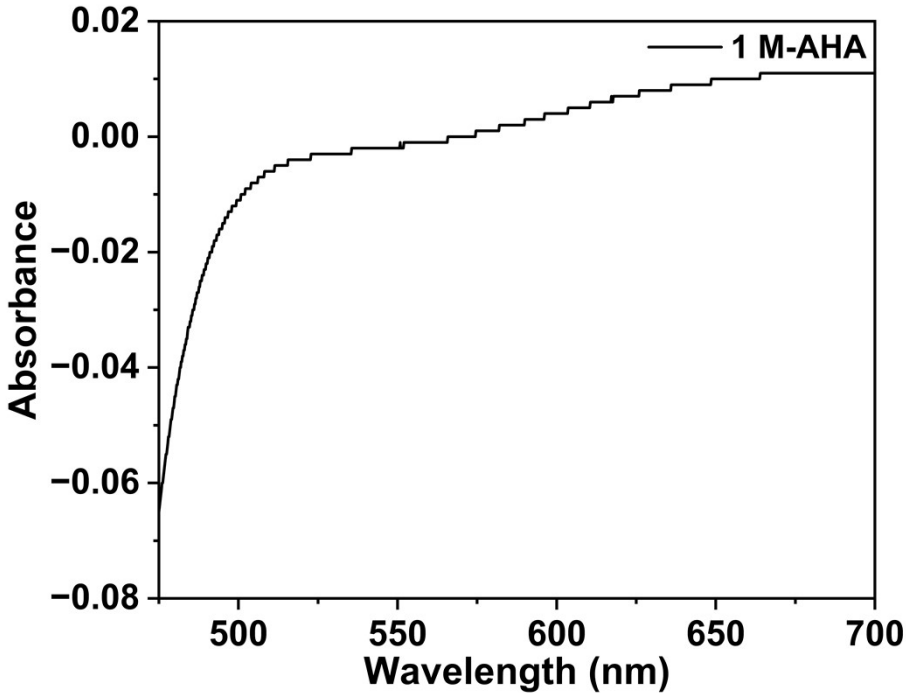

Fig. S3 UV-Vis spectra of AHA solution.

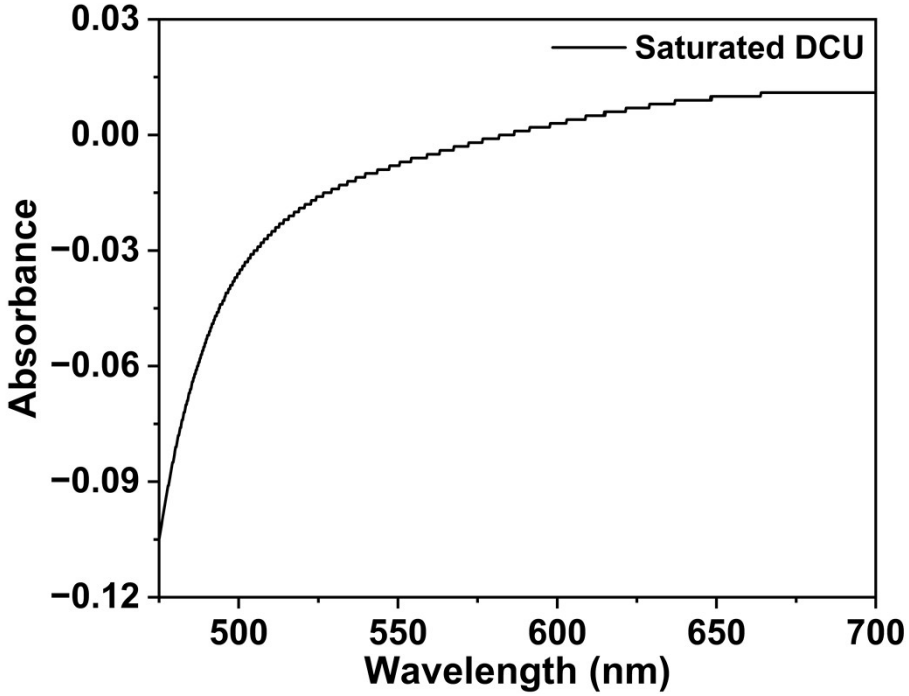

Fig. S4 UV-Vis spectra of DCU solution.

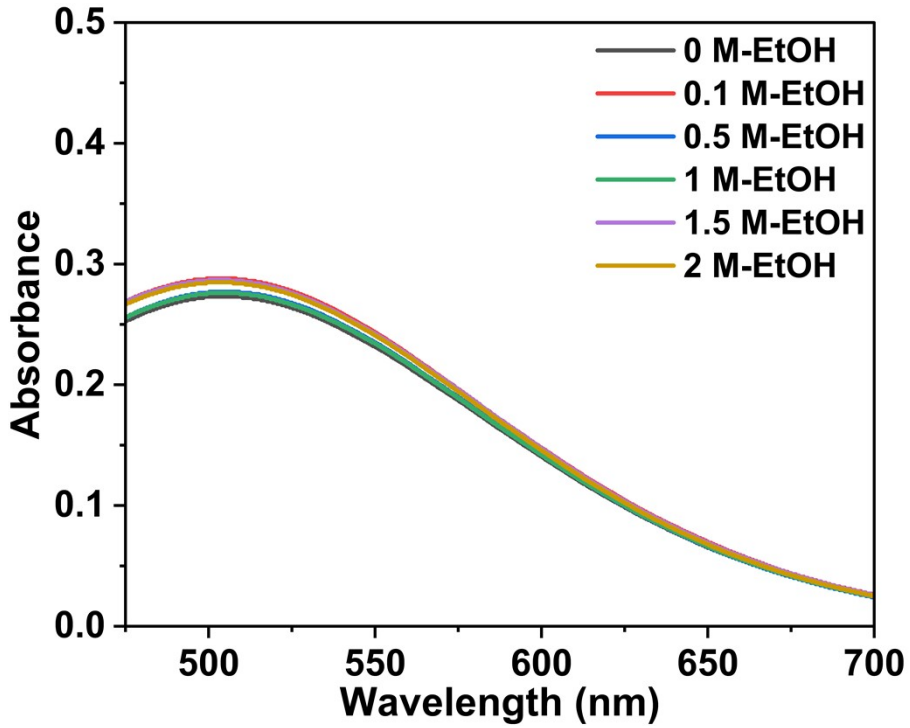

Fig. S5 UV-Vis spectra of acetate derivative solution with varying ethanol concentration.

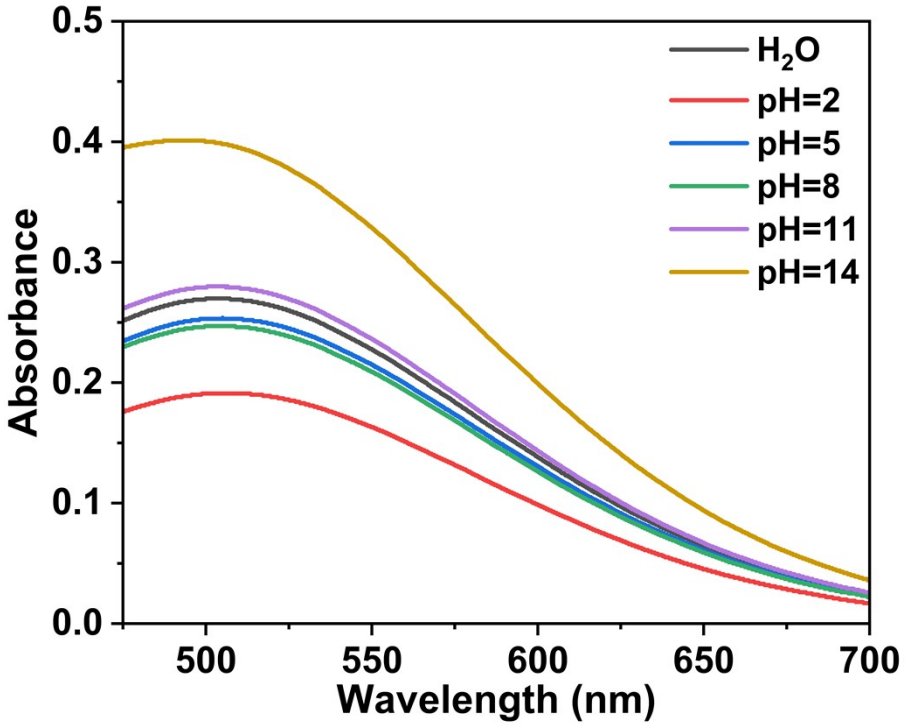

Fig. S6 UV-Vis spectra of acetate derivative solution with varying pH.

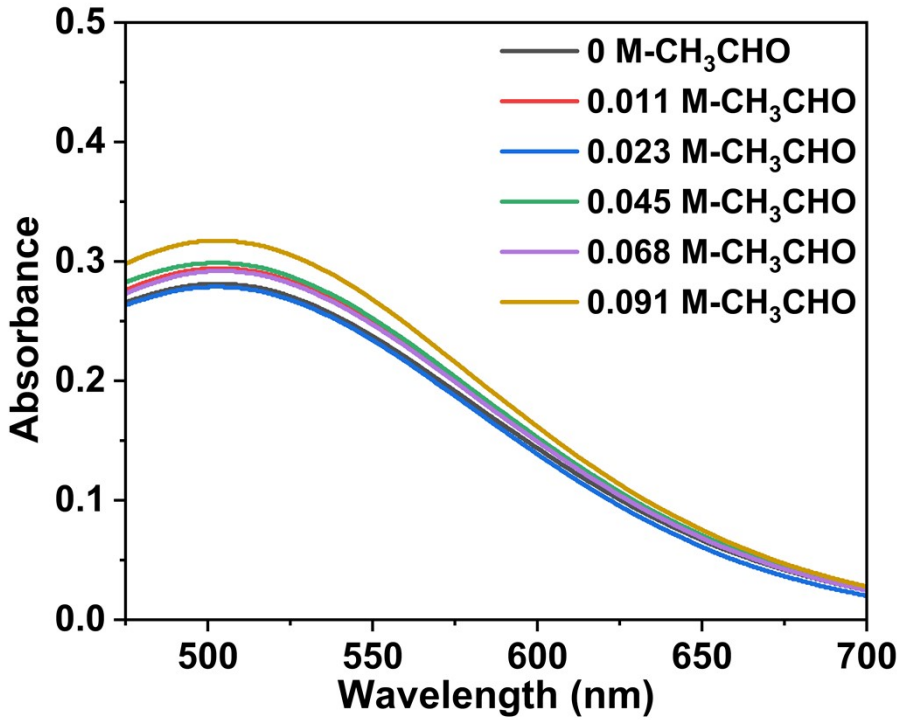

Fig. S7 UV-Vis spectra of acetate derivative solution with varying acetaldehyde concentrations.

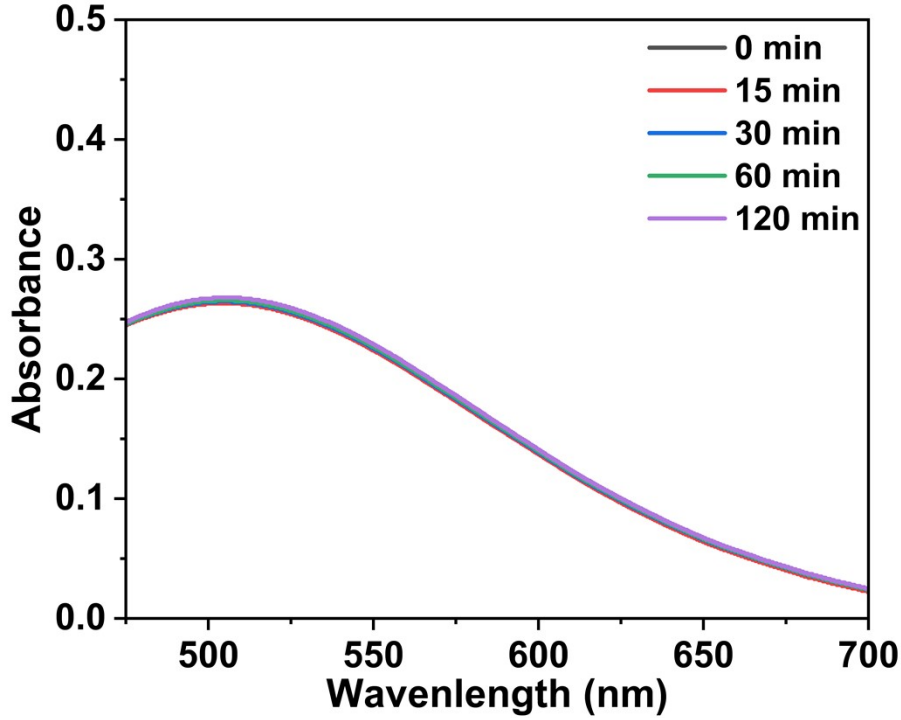

Fig. S8 UV-Vis spectra of acetate derivative solution with varying time.

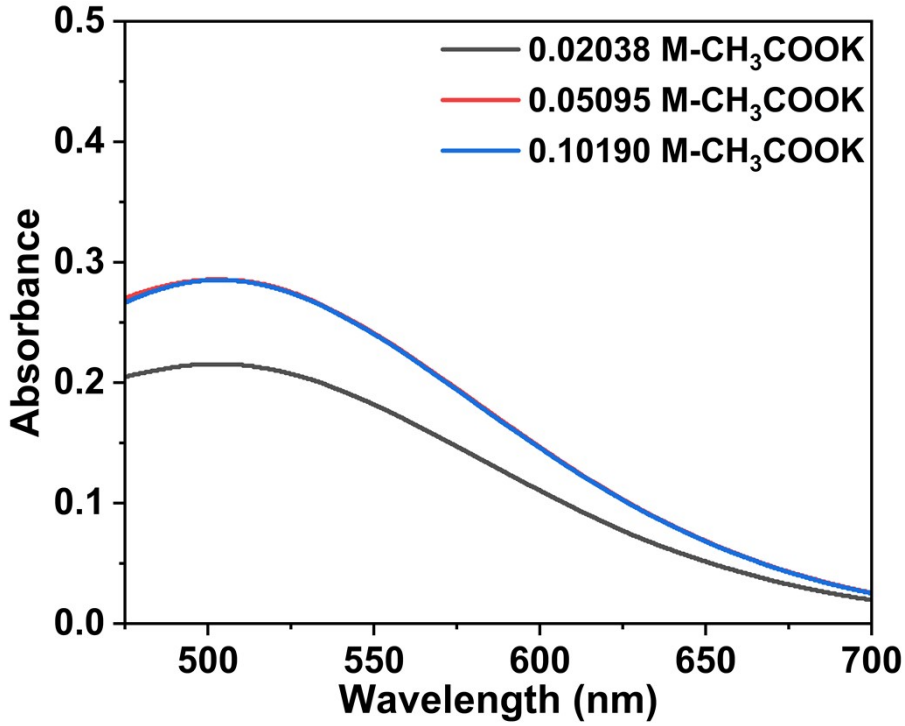

Fig. S9 UV-Vis spectra of acetate derivative solution with different acetate concentrations in a mixed solution of 1 mol·L^{-1} KOH + 1 mol·L^{-1} ethanol.

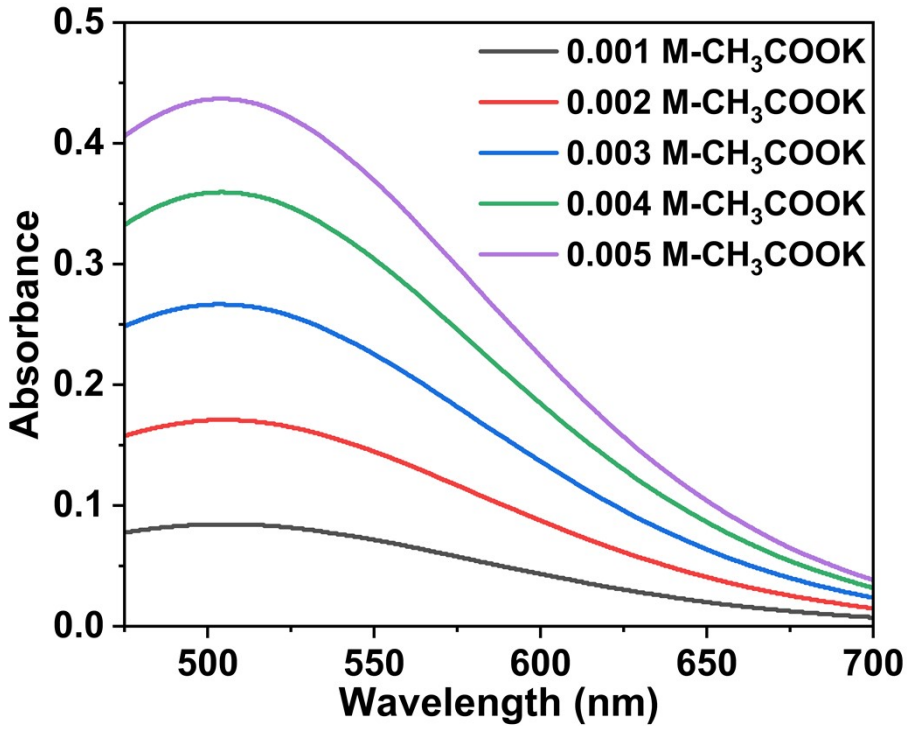

Fig. S10 UV-Vis spectra of acetate derivative solution with varying acetate concentrations.

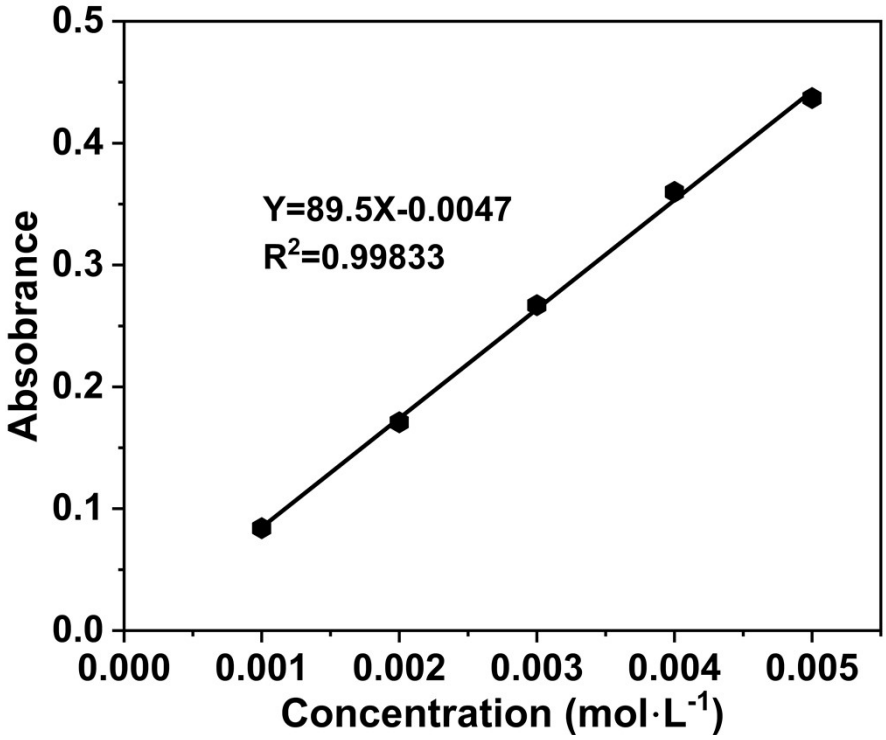

Fig. S11 Linear relationship between absorbance at 505 nm and acetate concentrations (0.001–0.005 mol·L^{-1}). The calibration curve was established by fitting the processed datasets shown in **Fig. S10**. This curve was subsequently applied to quantify acetate in real samples obtained at applied potentials of 1.47 and 1.52 V vs. RHE.

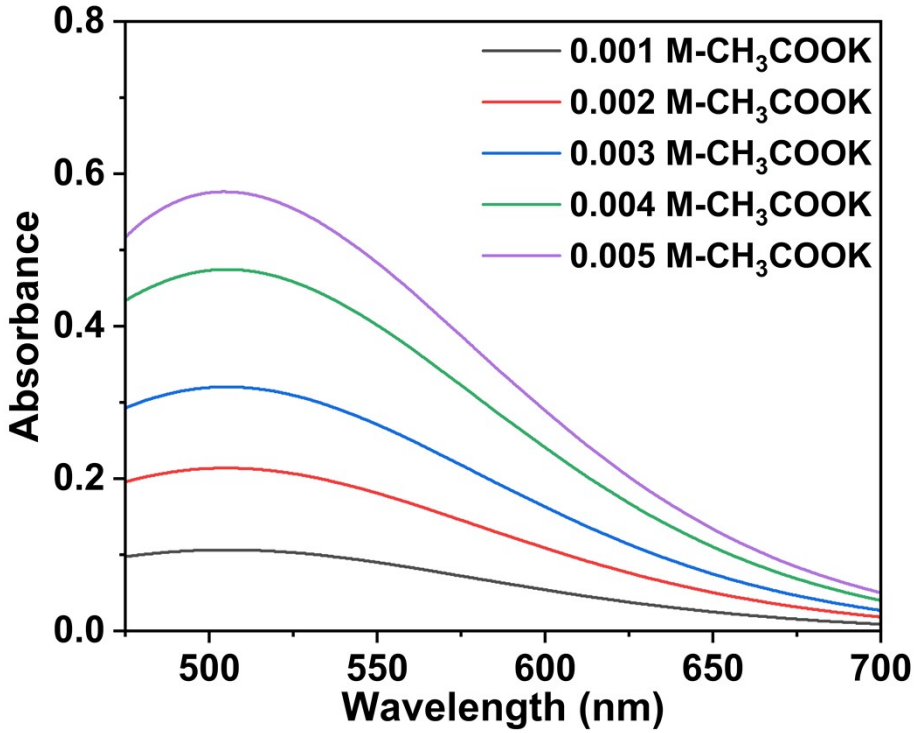

Fig. S12 UV-Vis spectra of acetate derivative solution with varying acetate concentrations.

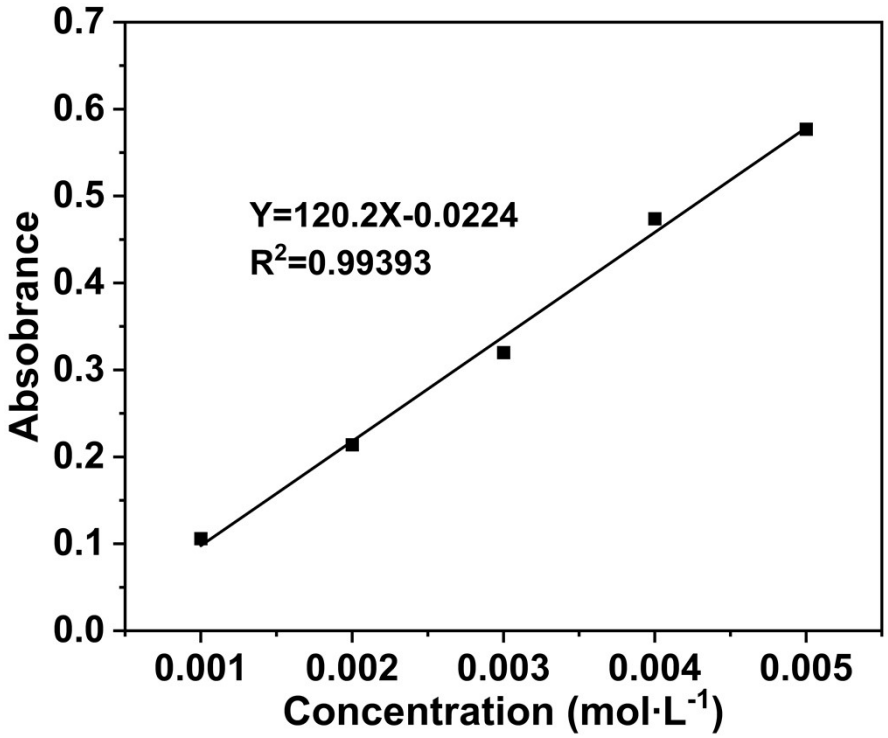

Fig. S13 Linear relationship between absorbance at 505 nm and acetate concentrations (0.001–0.005 mol·L^{-1}). The calibration curve was established by fitting the processed datasets shown in **Fig. S12**. This curve was subsequently applied to quantify acetate in real samples obtained at applied potentials of 1.42 and 1.57 V vs. RHE.

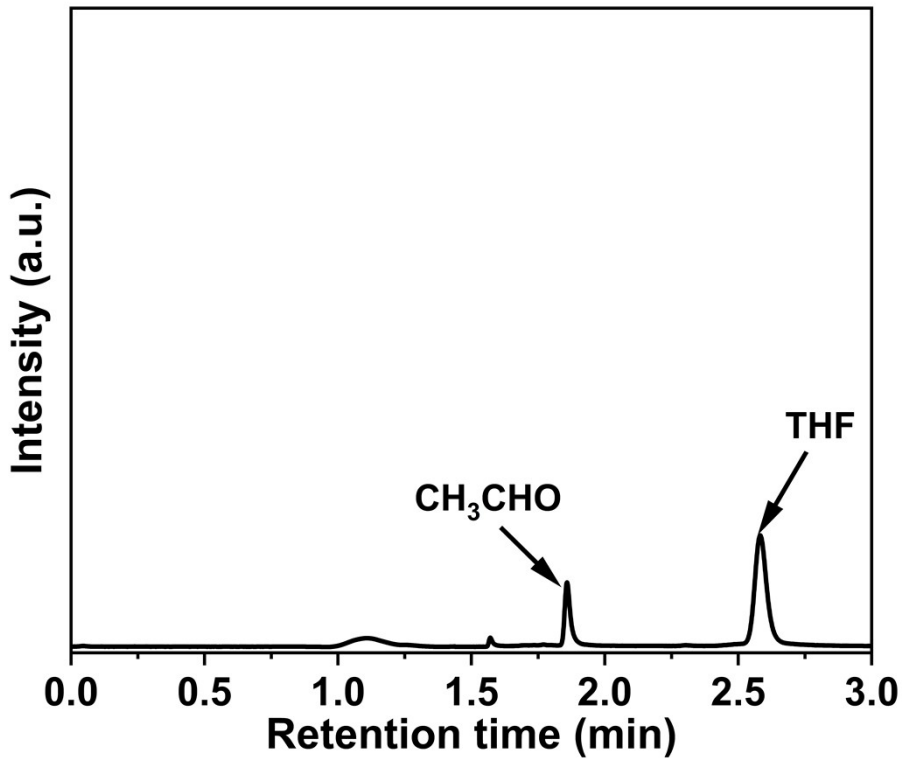

Fig. S14 Gas chromatogram of 0.1 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

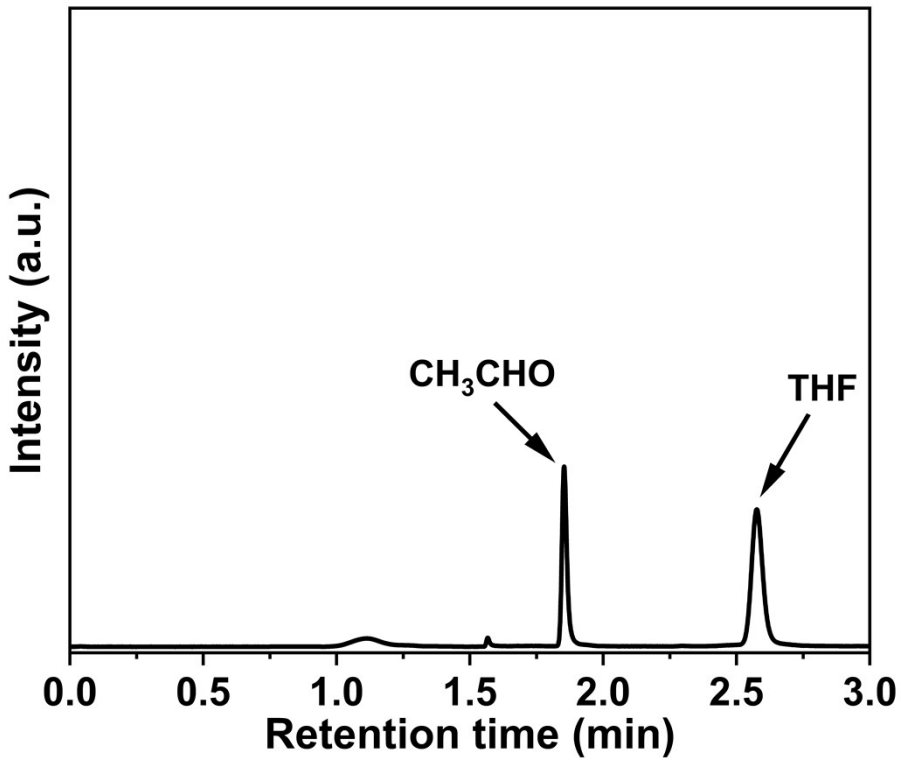

Fig. S15 Gas chromatogram of 0.2 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

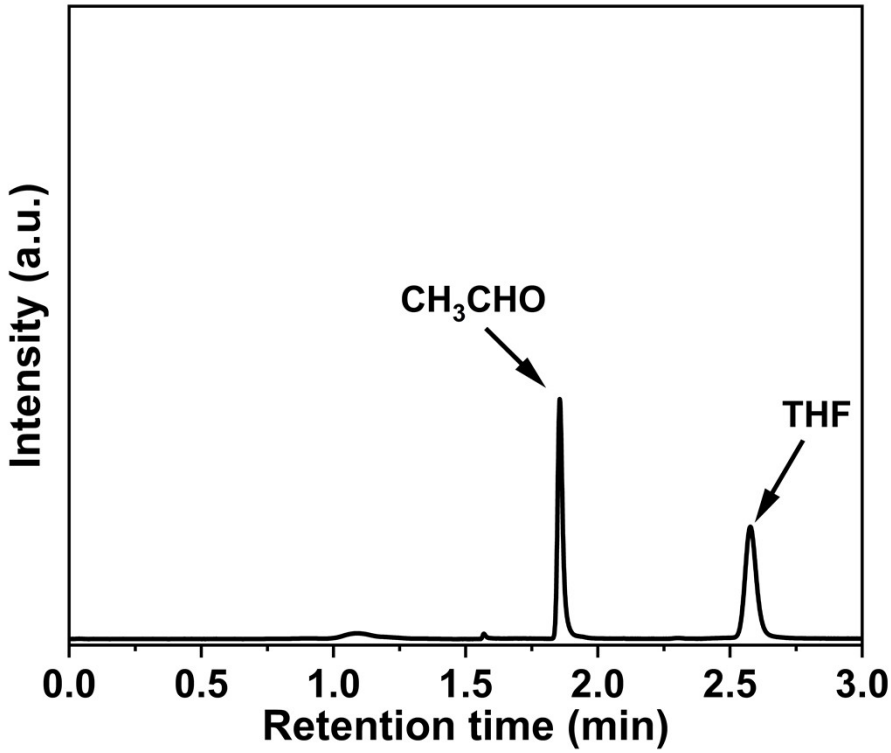

Fig. S16 Gas chromatogram of 0.3 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

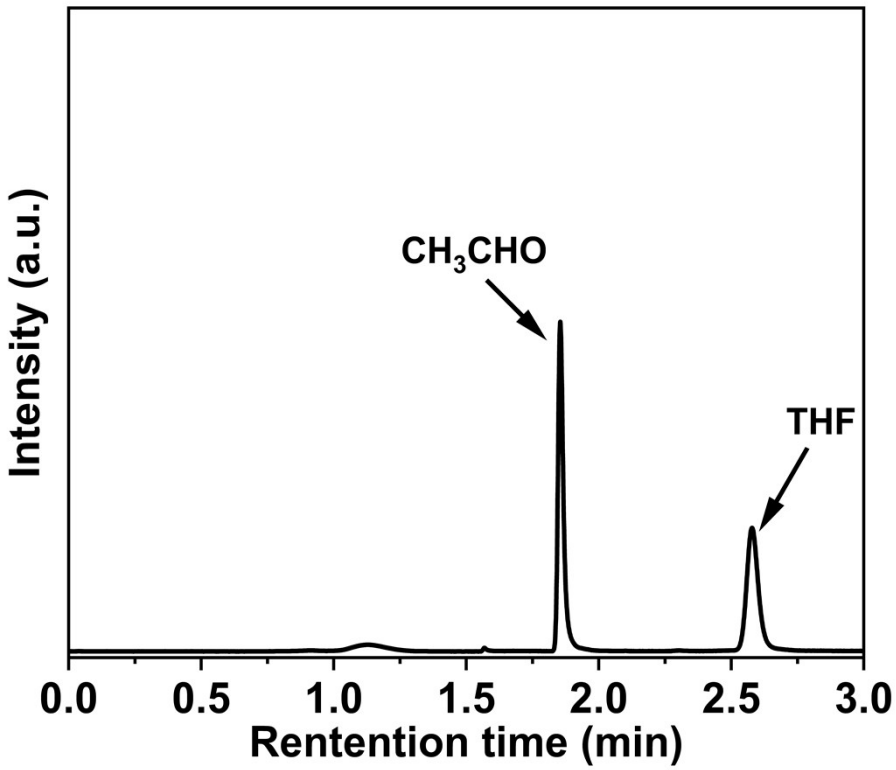

Fig. S17 Gas chromatogram of 0.4 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

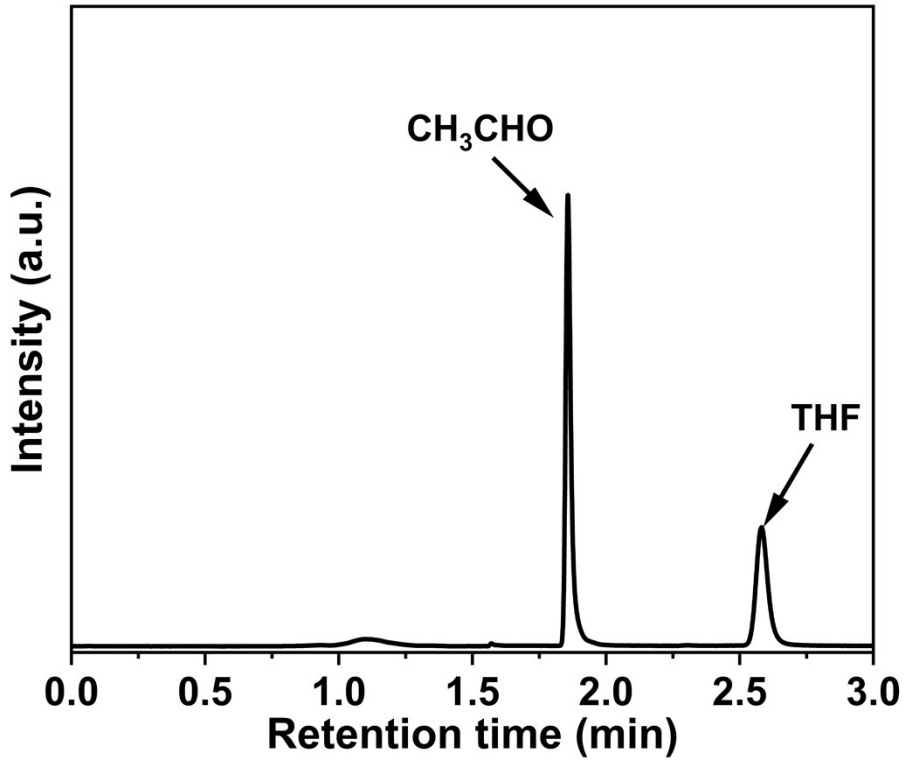

Fig. S18 Gas chromatogram of 0.5 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

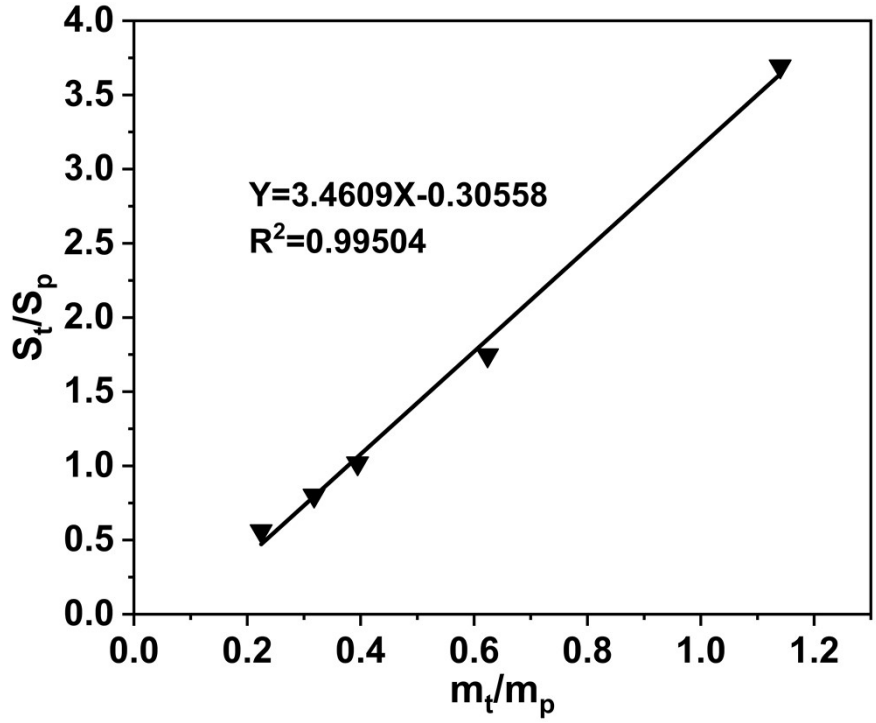

Fig. S19 Linear relationship between m_t (internal standard mass)/m_p (product mass) and S_t (internal standard peak area)/S_p (product peak area). The calibration curve was established by fitting the processed datasets shown in **Fig. S14–S18**. This curve was subsequently applied to quantify acetaldehyde in real samples obtained at applied potentials of 1.47 and 1.52 V vs. RHE.

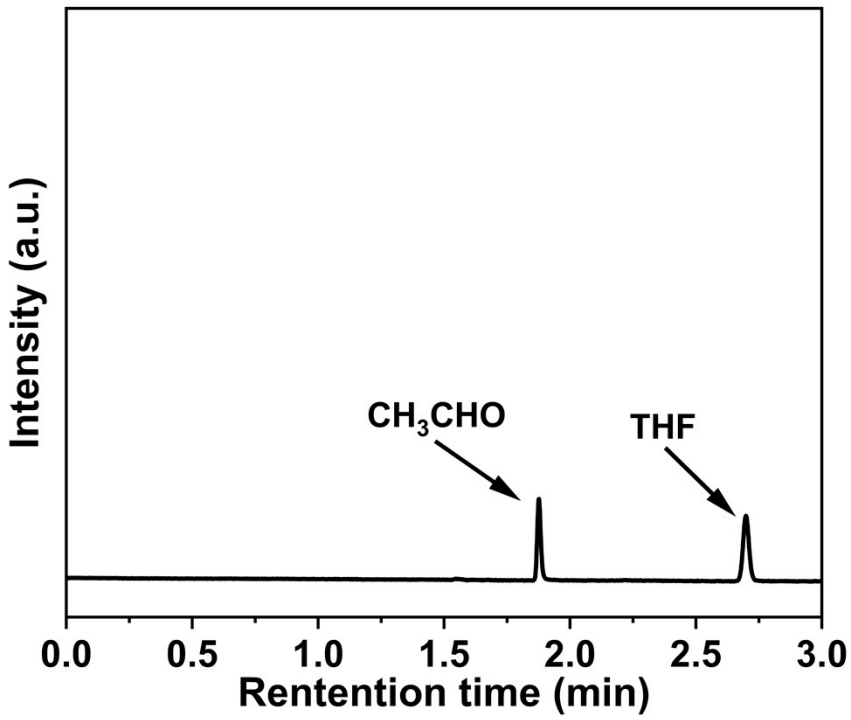

Fig. S20 Gas chromatogram of 0.1 mg·g^{-1} acetaldehyde using THF as an internal standard.

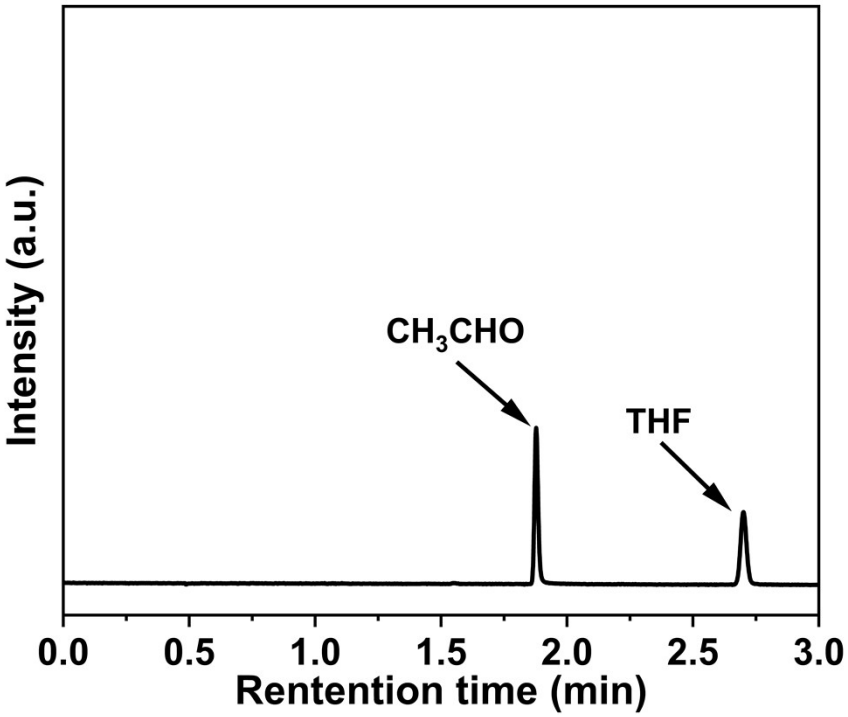

Fig. S21 Gas chromatogram of 0.2 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

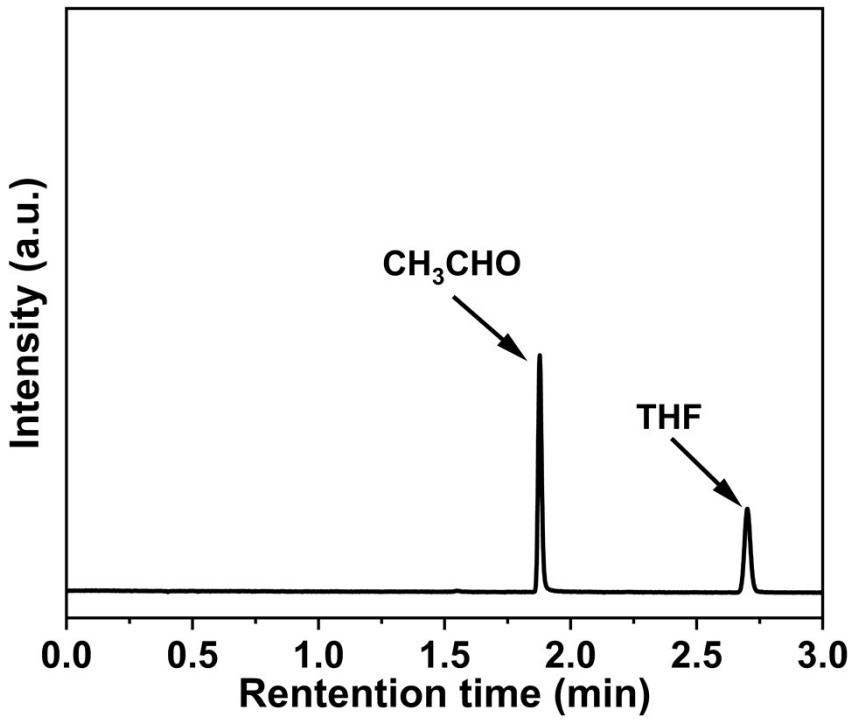

Fig. S22 Gas chromatogram of 0.3 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

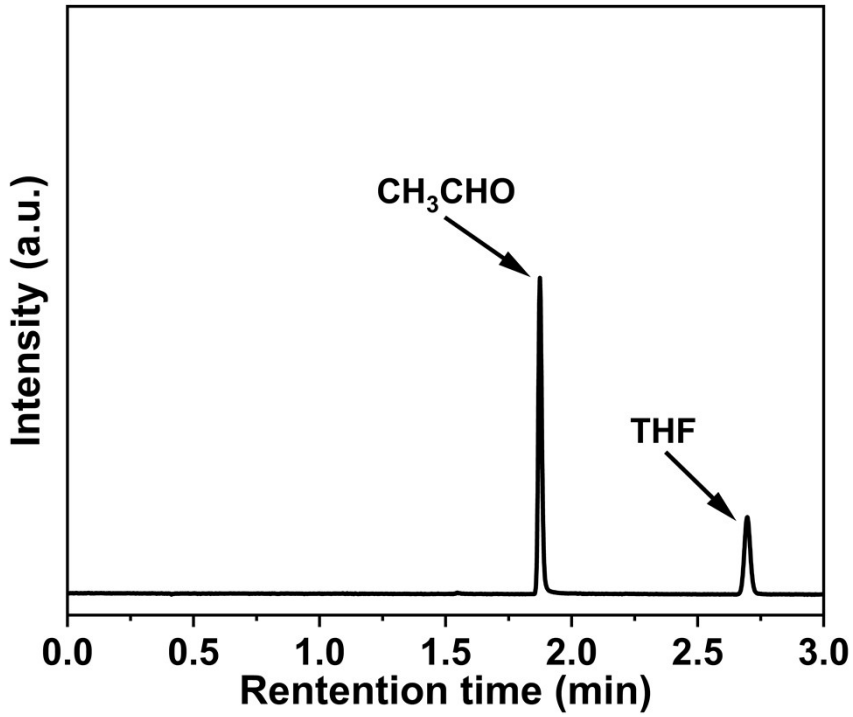

Fig. S23 Gas chromatogram of 0.4 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

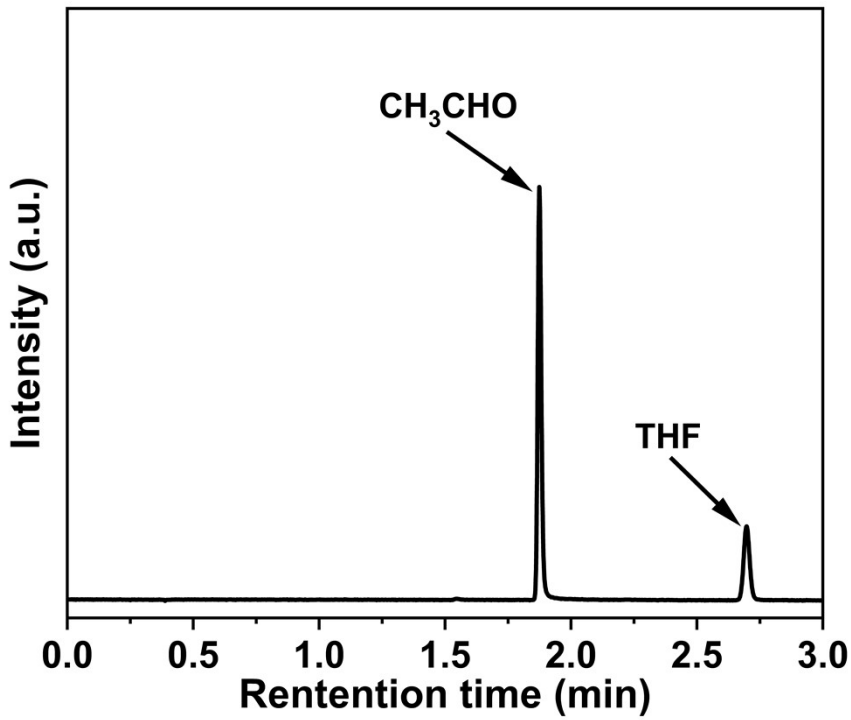

Fig. S24 Gas chromatogram of 0.5 $mg \cdot g^{-1}$ acetaldehyde using THF as an internal standard.

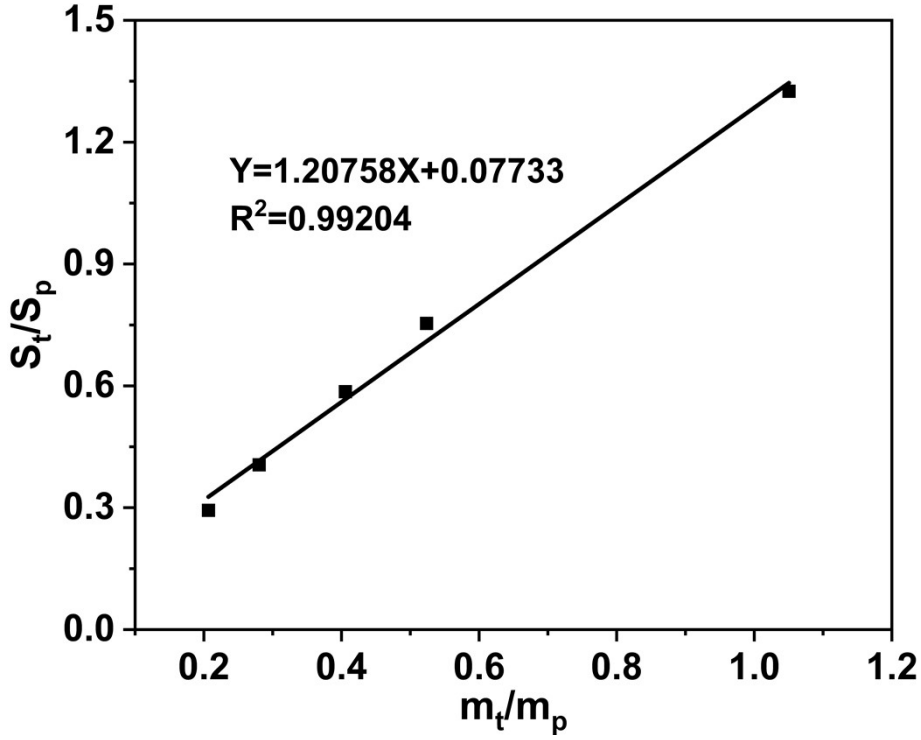

Fig. S25 Linear relationship between m_t (internal standard mass)/m_p (product mass) and S_t (internal standard peak area)/S_p (product peak area). The calibration curve was established by fitting the processed datasets shown in **Fig. S20–S24**. This curve was subsequently applied to quantify acetaldehyde in real samples obtained at applied potentials of 1.42 and 1.57 V vs. RHE.

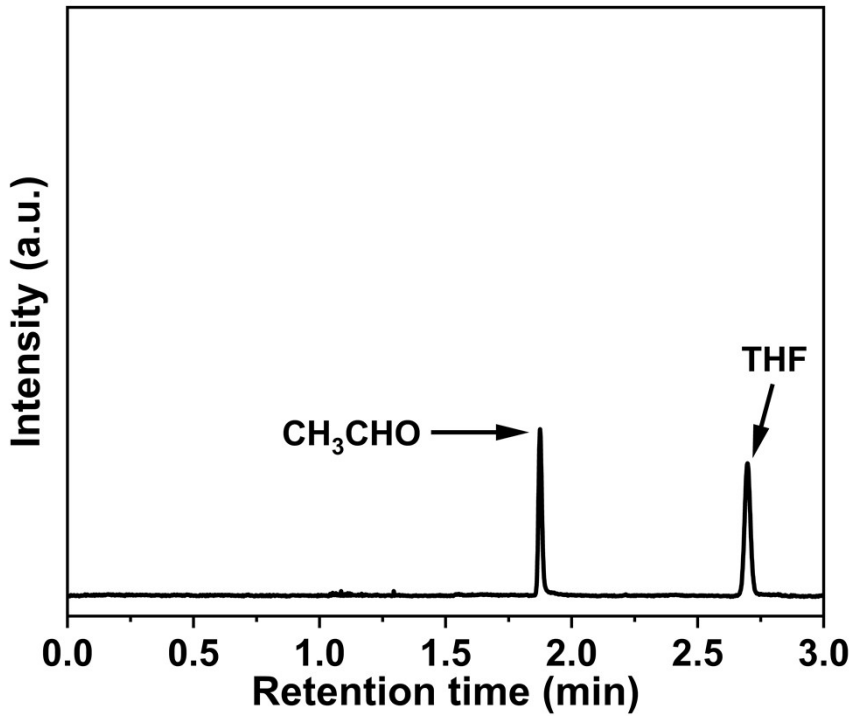

Fig. S26 Gas chromatogram of acetaldehyde in the products generated at a potential of 1.42 vs. RHE using THF as an internal standard.

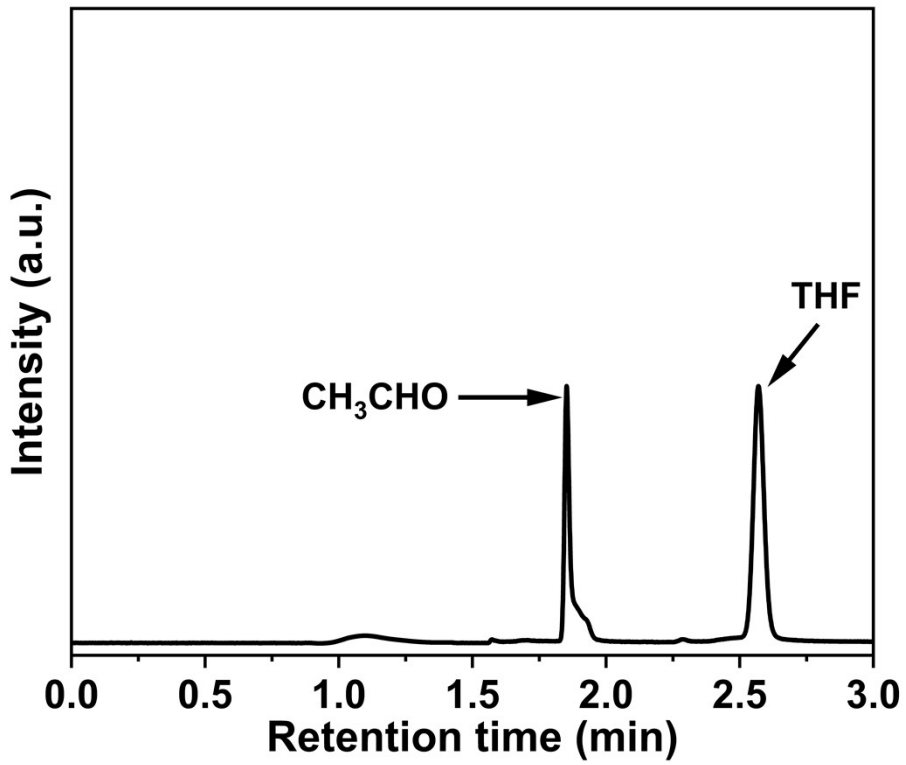

Fig. S27 Gas chromatogram of acetaldehyde in the products generated at a potential of 1.47 vs. RHE using THF as an internal standard.

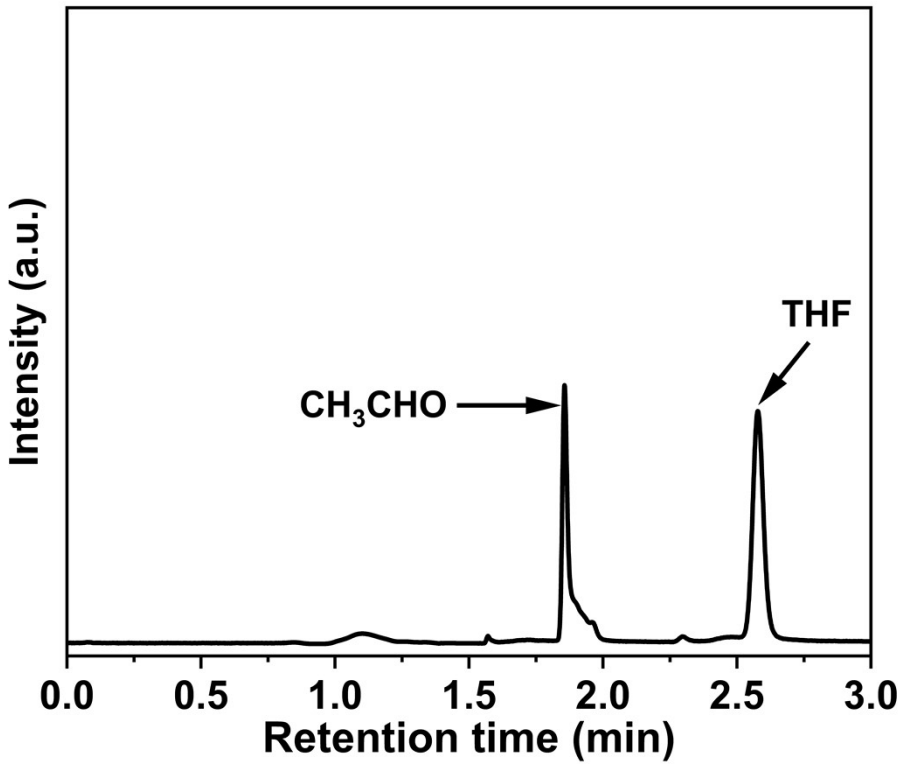

Fig. S28 Gas chromatogram of acetaldehyde in the products generated at a potential of 1.52 vs. RHE using THF as an internal standard.

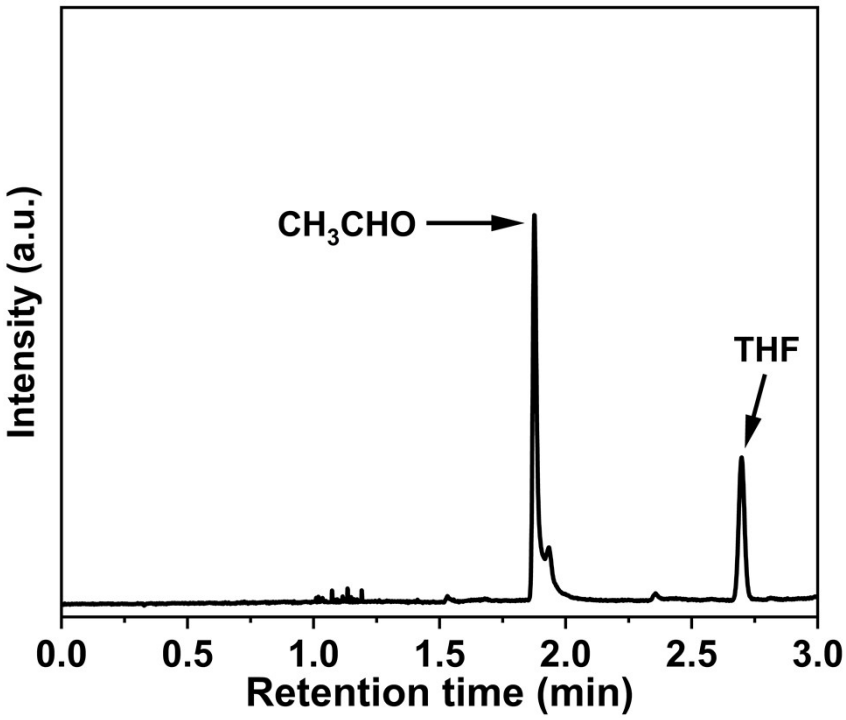

Fig. S29 Gas chromatogram of acetaldehyde in the products generated at a potential of 1.57 vs. RHE using THF as an internal standard.

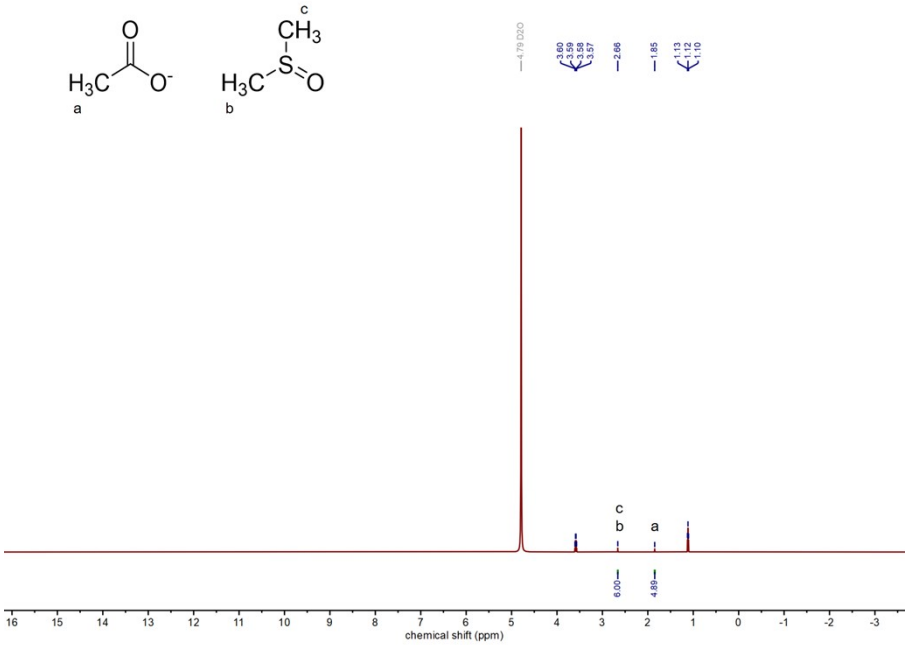

Fig. S30 ^{1}H NMR (600 MHz, 298 K) spectrum of the sample generated at 1.57 V vs. RHE, diluted fivefold with D_2O, using DMSO as an internal standard.

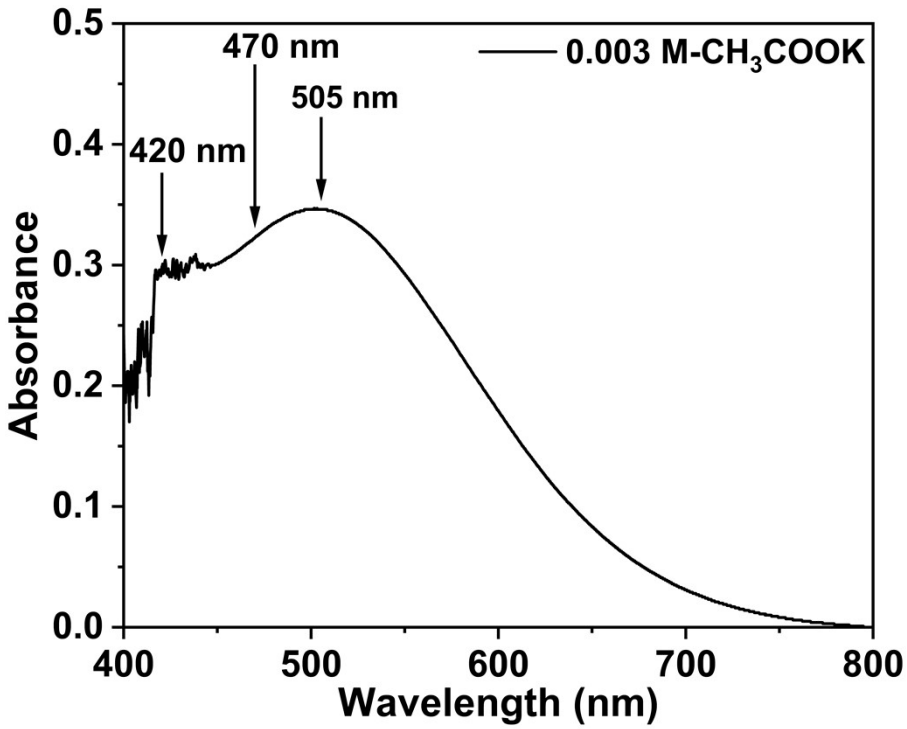

Fig. S31 UV-Vis absorption spectra of a sample containing 0.003 mol·L^{-1} acetate, 0.1 mol·L^{-1} NH_2OH·HCl, 0.4 mol·L^{-1} DCC, and 0.3 mol·L^{-1} $FeCl_3$, reacted at 60 °C in a reaction.