Supplementary Materials

S1. Experimental Procedures

S1.1. Chemical Composition

The chemical composition of N80 steel is shown in Table S1.

Table S1. Chemical composition of N80.

Composition	Contents (wt %)
Fe	97.468
C	0.42
Si	0.24
Mn	1.55
P	0.012
S	0.004
Cr	0.051
Mo	0.18
Ni	0.005
Ti	0.01
Cu	0.06

S1.2. Electrochemical Measurements

The corrosion rate on the surface of N80 steel is evaluated by electrochemical measurement in 15% HCl at 60 °C. A conventional three-electrode system is used in all electrochemical measurements, which includes a working electrode, a saturated calomel electrode, and a platinum electrode. The scanning rate of the CV measurement is 100 mV·s^{-1}, the potential range is from −0.2 to +0.6 V vs. E_{oc}, and the number of cycles is 30 at 50 Hz.

S1.3. Preparation of $C_{15}H_{15}NO$

First, a certain amount (based on the concentration of Mannich base) of aniline and absolute ethyl alcohol was added to a three-necked flask equipped with a magnetic stirrer, a reflux condenser, and a thermometer. Under constant stirring, hydrochloric acid was added to the flasks to adjust the PH value. After that, a certain amount of acetophenone and formaldehyde solutions was added to the flask, and the temperature was increased to 60 °C by heating. Red brown liquid was obtained after 8 h reflux.

S2. Results in Support Information

Table S2. Corrosion kinetics parameters of N80 steel with and without the inhibitor in 15% HCl solution at 60 °C under the environment of N_2.

HCl/ mol·L^{-1}	$C_{15}H_{15}NO$/ mol·L^{-1}	Na_2WO_4/ mol·L^{-1}	β_a/mV	β_c/mV	E_{corr}/V	$I_{corr} \times 10^{-5}$/ A·cm^{-2}	η/%
	0	0	106.26	246.62	−0.37	86.98	0
	0.0002	0	70.72	273.33	−0.37	31.37	63.93
	0	0.0002	70.94	260.51	−0.37	33.26	61.76
	0.004	0.0002	71.37	81.89	−0.42	15.74	81.90
4.865	0.002	0.0002	64.21	285.29	−0.37	11.79	86.45
	0.0004	0.0002	64.17	127.84	−0.36	12.46	85.67
	0.00025	0.0002	63.73	47.01	−0.42	10.92	87.45
	0.0002	0.0002	44.10	28.92	−0.39	3.31	96.19
	0.00013	0.0002	83.84	57.91	−0.43	6.49	92.54

Table S3. The corrosion inhibition efficiency of different inhibitors in 15% HCl for N80 steel under the same experimental conditions in the literature.

Corrosion Inhibitor		Concentration (mmol·L^{-1})	Corrosion Media	Material	Experiment Temperature	Corrosion Inhibition Efficiency
$C_{15}H_{15}NO + Na_2WO_4$		0.2	15% HCl	N80 steel	60 °C	96.19%
Furfuryl alcohol [40]		80	15% HCl	N80 steel	60 °C	81.80%
Imidazoline compounds	OAEOI [41]	0.15	15% HCl	N80 steel	50 °C	76.43%
	AEOI [42]	0.15	15% HCl	N80 steel	50 °C	70.37%
Isatin compounds	PAMTOI [42]	0.2	15% HCl	N80 steel	60 °C	76.36%
	MMTOI [43]	0.2	15% HCl	N80 steel	60 °C	68.89%
Na_2MoO_4 + BTA [43]		4:1	0.01mol·L^{-1} NaCl + 0.11mol·L^{-1} $NaHCO_3$	Q235	–	96.35%
SM + SP + BTA [44]		1.29 0.81 0.67	ASW	mildsteel	–	76.00%

OAEOI:1-(2-oleylamidoethyl)-2-oleylimidazoline; AEOI:1-(2-aminoethyl)-2-oley-limidazoline; PAMTOI:1-diphenylaminomethyl-3-(1-*N*-dithiooxa-mide) iminoisatin; MMTOI: 1-morpholinomethyl-3-(1-*N*-dithiooxamide) iminoisatin; BTA:1H-benzotriazole; SM: Na_2MoO_4; SP: Na_3PO_4; ASW: Artificial Sea Water.

Table S4. Binding energy of Fe 2*p* on the surface of N80 steel under different inhibitors.

Different Ratios	Binding Energy of Fe 2*p* (eV)
$C_{15}H_{15}NO$	707.19
Na_2WO_4	709.13
20:1	710.28
10:1	710.84
2:1	710.52
1.25:1	710.54
1:1	711.5
0.67:1	711.18

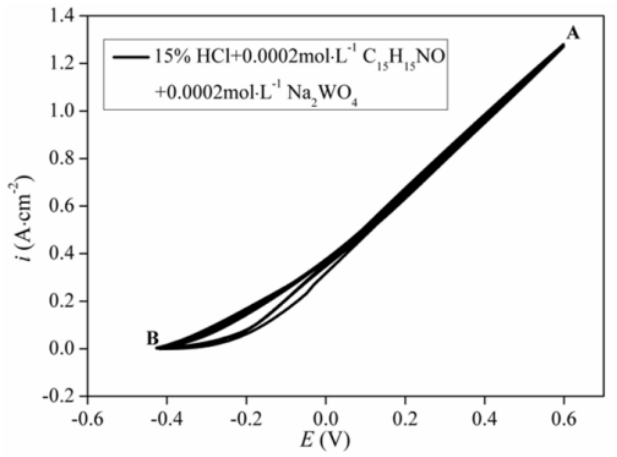

Figure S1. Cyclic voltammetry of N80 steel at a mixed corrosion inhibitor ratio of 1:1 in 15 % HCl solution at 60 °C under the environment of N_2.

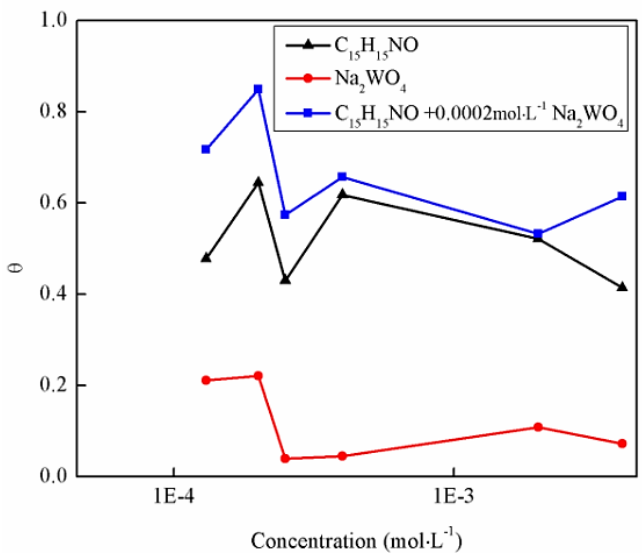

Figure S2. Degree of coverage for N80 steel in 15% HCl solution after adding the inhibitor at 60 °C under the environment of N_2.

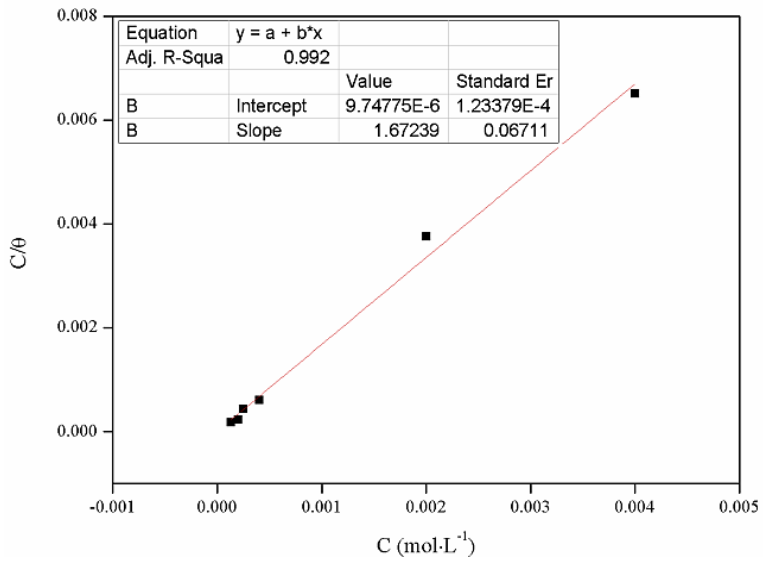

Figure S3. *C*/θ–*C* plots of different ratios of Mannich Base and Sodium Tungstate.

Figure S2 indicates that the inhibitor molecules are adsorbed on the N80 surface and prevent further contact of N80 steel with the solution [45].

$$K = 0.018\exp(-\Delta G_{ads} R^{-1} T^{-1}) \quad \text{(S1)}$$

where R is the gas constant and T is the thermodynamic temperature (K) [46].

Calculated by the above formula, the value of ΔG_{ads} is −40 kJ·mol^{-1}, which implies that the adsorption is spontaneous and the adsorption of $C_{15}H_{15}NO$ and Na_2WO_4 on the metal surface of N80 occurs by chemical adsorption [47].

With the change of etching time, the XPS survey spectra of the N80 steel in the 15% HCl solution with different inhibitors are shown in Figure S4. The peak strength of the main elements of the film does not change greatly, which indicates that the structure of the film on the surface of N80 steel is very stable after being soaked for 12 h in corrosion solution with the corrosion inhibitor added.

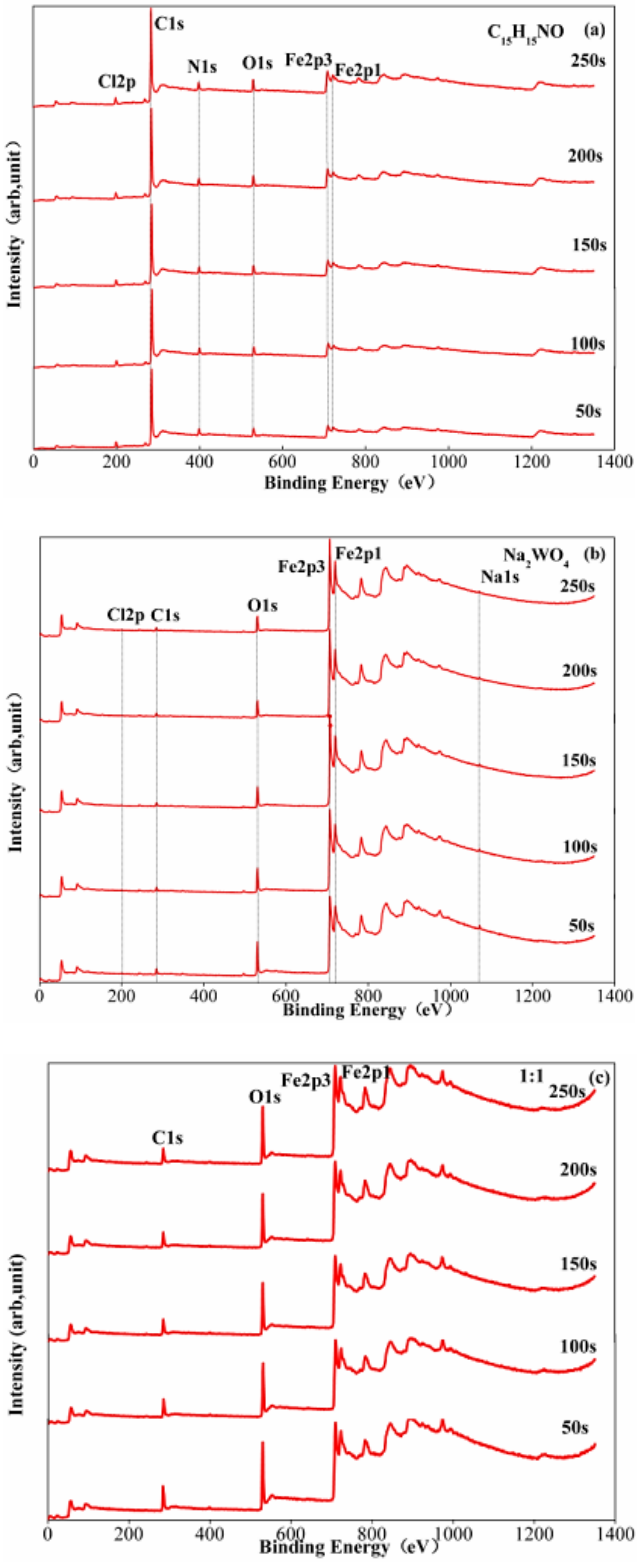

Figure S4. (**a**) XPS survey spectra of 0.0002 mol·L^{-1} $C_{15}H_{15}NO$ with etch time; (**b**) XPS survey spectra of 0.0002 mol·L^{-1} Na_2WO_4 with etch time; (**c**) XPS survey spectra of 0.0002 mol·L^{-1} $C_{15}H_{15}NO$ and 0.0002 mol·L^{-1} Na_2WO_4 with etch time.