

Electronic Supporting Information

Green Corrosion Inhibitors from Agri-food Wastes: the Case of *Punica granatum* Extract and its Constituent Ellagic Acid. A Validation Study

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Table S1. Statistical parameters of the calibration plots from UV-visible spectroscopy study (Figure 2) of ellagic acid in 0.05 M HCl solution and in pure water, both containing 1 vol% of methanol.

Medium	Max wavelength	Slope (std. error)	Intercept (std. error)
0.05 M HCl (+ 1 vol% CH ₃ OH)	367 nm	$6.2 \cdot 10^3$ ($5 \cdot 10^2$)	$1.0 \cdot 10^{-2}$ ($4 \cdot 10^{-3}$)
	250 nm	$3.7 \cdot 10^4$ ($4 \cdot 10^3$)	$3 \cdot 10^{-2}$ ($3 \cdot 10^{-2}$)
water (+ 1 vol% CH ₃ OH)	357 nm	$1.15 \cdot 10^4$ ($5 \cdot 10^2$)	$-6 \cdot 10^{-3}$ ($4 \cdot 10^{-3}$)
	274 nm	$2.9 \cdot 10^4$ ($1 \cdot 10^3$)	$-1 \cdot 10^{-2}$ ($1 \cdot 10^{-2}$)
	253 nm	$3.4 \cdot 10^4$ ($2 \cdot 10^3$)	$-2 \cdot 10^{-2}$ ($2 \cdot 10^{-2}$)

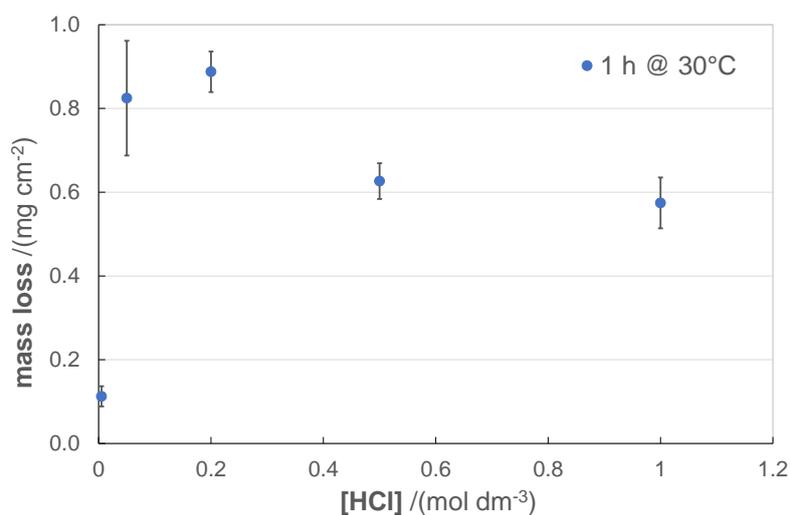


Figure S1. Mass loss of Armco[®] iron coupons as a function of HCl concentration. Solution temperature: 30°C. Immersion time: 1 hour. Bars represent standard deviations from at least two independent measures.

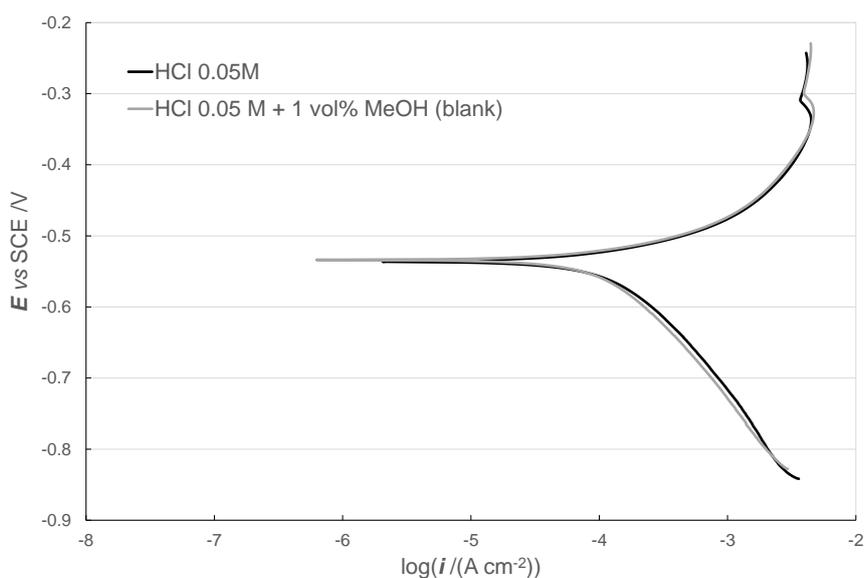


Figure S2. Voltammogram traces (scan rate 0.5 mV s^{-1}) of Armco[®] iron electrodes in aerated HCl 0.05 M solution (black line) and with addition of 1 vol% methanol as co-solvent (grey line). The last is the blank reference reported in Figure 3 of the main text. Solution temperature: 30°C .

Table S2. Electrochemical key features obtained from the potentiodynamic polarizations carried out on Armco[®] pure iron electrodes (Figure 3 and Figure 4). All the solutions invariably present 1 vol% methanol as co-solvent.

Solution	Inhibitor	$E_{\text{corr vs. RHE}} / \text{V}^{\text{a}}$	$i_{\text{corr}} / (\mu\text{A cm}^{-2})$
0.05 M HCl	none	-0.22	130
	0.01 mM EA	-0.21	114
	1 mM EA (<i>ex-situ</i>)	-0.21	70
	FPW (0.01 mM EA)	-0.22	157
	FPW (0.1 mM EA)	-0.21	146
0.05 M NaCl	none	-0.07	n.a. ^b
	0.01 mM EA	0.07	n.a. ^b
	FPW (0.01 mM EA)	0.13	n.a. ^b
	FPW (0.1 mM EA)	0.10	n.a. ^b

^aPotential referred to reversible hydrogen electrode (RHE): $E_{(\text{vs RHE})} = E_{(\text{vs SCE})} + 0.244 + 0.059\text{pH}$. ^bNot available because of inapplicability of the Tafel approximation.

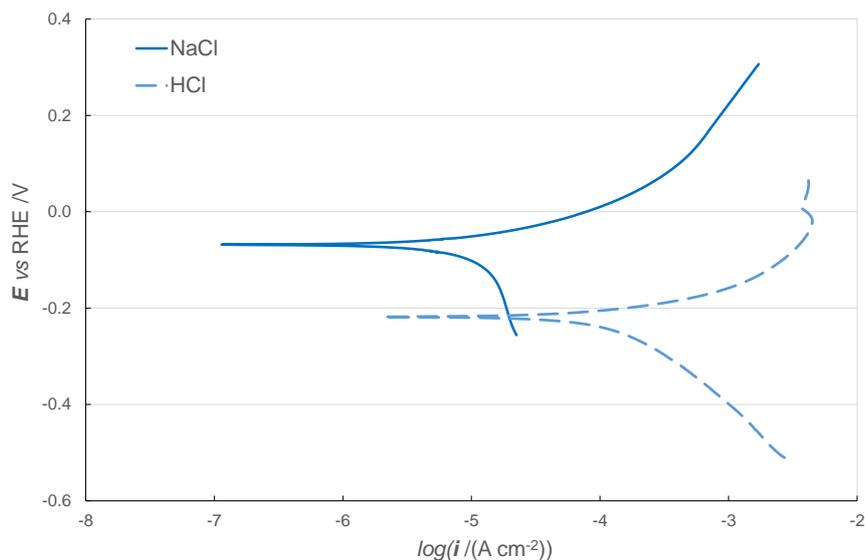


Figure S3. Voltammogram traces (scan rate 0.5 mV s^{-1}) of Armco[®] iron electrodes in aerated 0.05 M HCl (dashed line) and 0.05 M NaCl (solid line) solutions. For sake of clarity, considering the different pH of the solutions, all potentials are referred to reversible hydrogen electrode (RHE) according to the following formula: $E_{(vs \text{ RHE})} = E_{(vs \text{ SCE})} + 0.244 + 0.059\text{pH}$, with 0.244 the potential (in volt) of saturated calomel electrode (SCE) with respect to standard hydrogen electrode (SHE). In this scale of potential, the hydrogen evolution reaction occurs at $E = 0 \text{ V vs RHE}$ independently by the actual concentration of hydrogen ions.

Table S3. pH values of the solutions used in voltammetric investigation. Obtained by a combined glass electrode coupled to a potentiometer.

Tested solution	pH
blank ($0.05 \text{ M NaCl} + 1 \text{ vol\% CH}_3\text{OH}$)	6.2
blank + $10 \mu\text{M EA}$	5.6
blank + 8 mg dm^{-3} FPW extract (ca. $10 \mu\text{M EA}$)	4.9
blank + 80 mg dm^{-3} FPW extract (ca. $100 \mu\text{M EA}$)	4.9

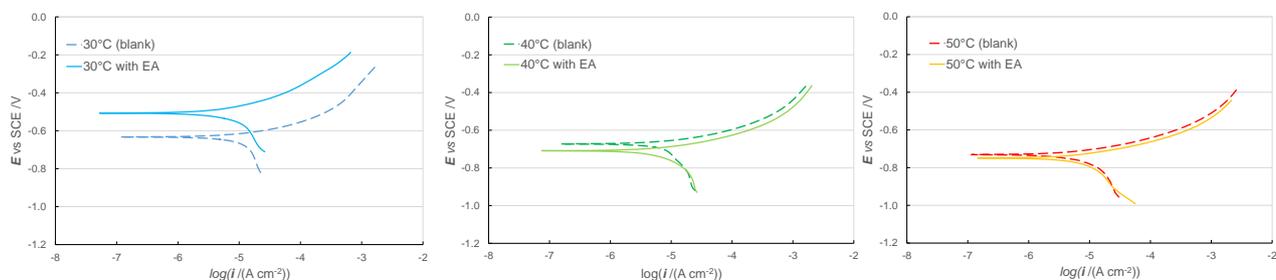


Figure S4. Effect of temperature on Armco[®] iron electrodes in aerated 0.05 M NaCl solution with $10 \mu\text{M EA}$ (solid lines) and without inhibitor (dashed lines). Solution temperature: 30°C (left), 40°C (centre), 50°C (right). Voltammogram traces are recorded at 0.5 mV s^{-1} potential scan rate.