

Supporting Information:

## **Evaluating the effect of iron(III) in the preparation of a conductive porous composite using a biomass waste-based starch template**

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**Table S1. Physical properties of the porous obtained materials at each stage of synthesis.**

Sample	$\rho_{\text{skel}}$ $\text{g}\cdot\text{cm}^{-3}$	$\rho_{\text{bulk}}$ $\text{g}\cdot\text{cm}^{-3}$	$\varepsilon$ %	$V_p$
St	$1.470 \pm 0.010$	$0.140 \pm 0.010$	$90.476 \pm 5.849$	$6.460 \pm 0.417$
St/iron(III)	$1.500 \pm 0.006$	$0.195 \pm 0.003$	$87.000 \pm 1.382$	$4.460 \pm 0.070$
St/iron(III)/PEDOT	$1.337 \pm 0.008$	$0.201 \pm 0.010$	$84.966 \pm 4.257$	$4.227 \pm 0.211$

**Table S2. Physisorption Nitrogen physisorption data of cryogel template and conductive porous composites at different soaking times.**

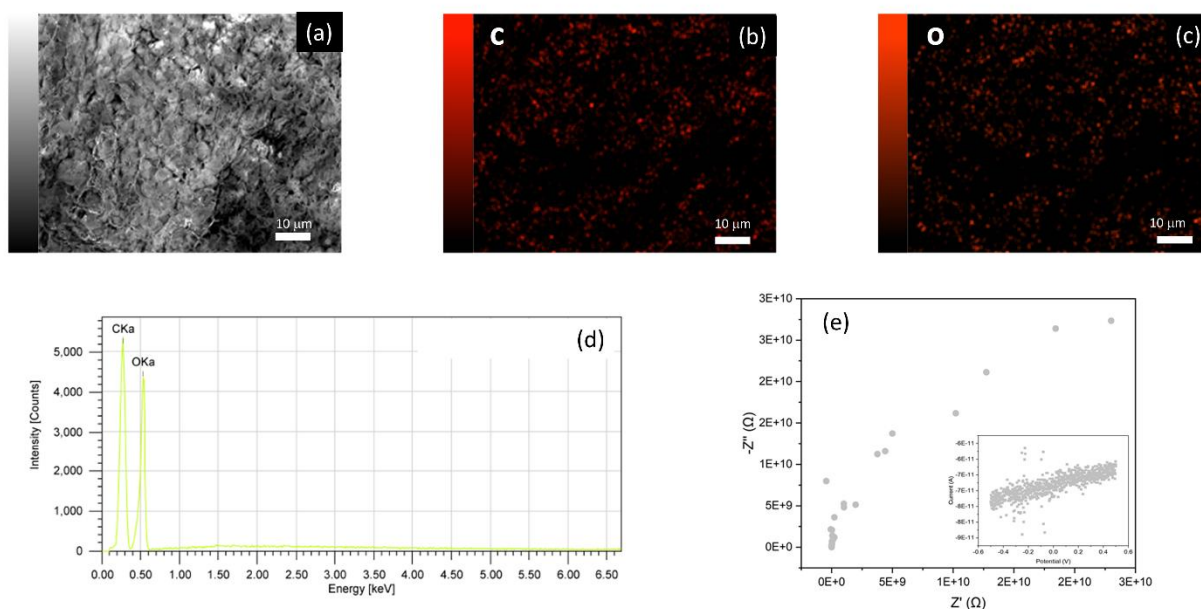
Sample	$V_p$ $\text{Cc}\cdot\text{g}^{-1}$	Pore Radius nm	Surface area $\text{m}^2\cdot\text{g}^{-1}$
St- 0 h	0.003	2.01	6.899
PEDOT-St 0.5 h	0.004	2.01	5.096
PEDOT-St 8 h	0.002	2.02	0.357
PEDOT-St 24 h	0.002	1.63	0.225
PEDOT-St 48 h	0.000	1.17	0.316

**Table S3. Elemental composition of porous structures synthesized with PEDOT at different immersion times in iron(III) solution.**

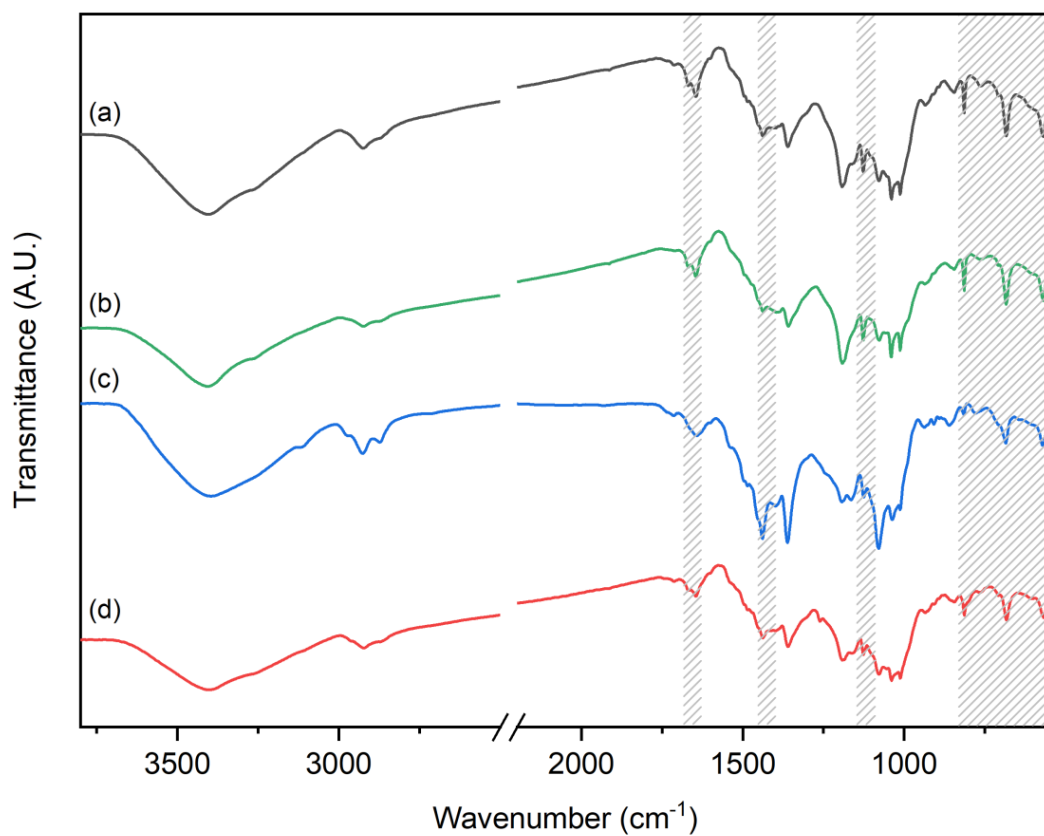
Soaking time in iron(III) solution (hours)	Element (%)			
	N	C	H	S
0.5	0.06	43.09	5.61	10.28
8	0.06	47.20	4.45	18.07
24	0.04	44.81	4.76	14.86
48	0.06	41.65	5.49	9.70

**Table S4. Fitting of electrochemical impedance spectroscopy data using the R(RQ)(RQ) circuit model.**

Circuit element	Immersion time in iron(III) (h)			
	0.5	8	24	48
Rs1 ( $\Omega$ )	2502.2	31137	$9.4186\text{E}^5$	$1.5582\text{E}^5$
Rp1 ( $\Omega$ )	3949.7	$1.482\text{E}^7$	$3.5438\text{E}^7$	$1.993\text{E}^5$
CPE1 (F)	$5.636\text{E}^{-12}$	$1.125\text{E}^{-10}$	$1.277\text{E}^{-10}$	$6.516\text{E}^{-10}$
CPE1.N	0.84	0.83731	0.52077	0.82964
Rs2 ( $\Omega$ )	-	-	1355.9	2627.4
Rp2 ( $\Omega$ )	-	-	$5.2739\text{E}^6$	$1.9695\text{E}^5$
CPE2 (F)	-	-	$5.8335\text{E}^{-12}$	$1.0885\text{E}^{-11}$
CPE2.N	-	-	0.92928	0.81716



**Figure S1.** Starch template chemical and electrical measurements: elemental mapping (a) SEM image, (b) carbon, (c) oxygen (d) energy-dispersive spectroscopy spectra and (e) Nyquist plot (inset shows cyclic voltammetry curve).



**Figure S2.** Infrared spectroscopy of the different samples polymerized after being soaked for (a) 0.5, (b) 8, (c) 24, and (d) 48 hours in an iron(III) solution.