The Physicochemical Investigation of Hydrothermally Reduced Textile Waste and Application within Carbon-Based Electrodes

Electronic Supplementary Information

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Plot of carbon % *versus* reaction acid concentration, contrasted against the carbon content of the raw PET fibre. Results determined using a LECO elemental analyser.



Reaction Concentration / M

Raw IR spectra obtained for the PET/cotton mix and each hydrochar.



Wavenumber / cm⁻¹

Raman fingerprint of the crystalline region of the obtained hydrochars. The image is baseline corrected.



SEM images for (A) PET/cotton fibres, and hydrochars synthesized from PET/cotton using (B) 0.05 M, (C) 0.1 M, (D) 0.15 M, (E) 0.2 M, (F) 0.25 M, (G) 0.3 M, (H) 0.35 M, (I) 0.5 M, and (J) $1.0 \text{ M} \text{ H}_3\text{PO}_4$. The scale bar in each image represents 20 μ m.



Surface elemental species present on the PET and hydrochars, measured using EDX spectroscopy. The error bars represent standard deviations from three independent experiments. Top: carbon and oxygen content; bottom: phosphorous content.



Reaction Concentration / M

Differential scanning calorimetry results for terephthalic acid (TPA) and hydrochars. The data is normalized to account for sample mass.



Scan rate study of 1 mM hexamine-ruthenium (III) chloride (in pH 7.4 PBS and 0.1 M KCl) using a CPE working electrode constructed from the 0.3 M hydrochar. The electrode was constructed using a powder made from 50:50 SuperP:hydrochar.



Normalized current sensitivity plotted as a function of reaction concentration. The normalization is applied by dividing each sensitivity value by the reference value in the series (i.e. the conductive carbon CPE).



ESI Table 1

Total carbon analysis of the hydrochars obtained from the reaction of PET/cotton under hydrothermal conditions in various concentrations of H₃PO₄.

Concentration of H ₃ PO ₄	Mass (g)	Total C (%)	Total N (%)
(M)			
PET/Cotton only	0.1379	53.22	0.2872
0.05	0.1507	55.42	0.1601
0.1	0.1506	57.45	0.1834
0.15	0.1508	55.9	0.137
0.2	0.1501	56.84	0.1296
0.25	0.1511	56.68	0.1219
0.3	0.1509	56.13	0.0996
0.35	0.15	55.52	0.1
0.5	0.1496	55.56	0.0393
1.0	0.1379	55.42	0.1601