

Micellization of starch- poly (1,4-butylene succinate) nano-hybrid for enhanced energy storage.

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Supplementary Information

The specific capacitance, C_{sp} , was calculated using the following equation^{1,2}:

$$C_{sp} = \frac{I\Delta V}{2mv\Delta V}$$

Where $I\Delta V$ is obtained as the area of the CV curve, m is the mass of active material loaded, v is the scan rate in mVs^{-1} , ΔV is the potential window.

The energy density (E_d) was calculated using the following equation^{1,2}:

$$E_d = \frac{1}{2}C_{sp}V^2$$

Where C_{sp} is the specific capacitance and V is the nominal voltage.

Finally, the power density, P_d , was calculated using the following equation^{1,2}:

$$P = \frac{V^2}{4ESR * m}$$

Where V is the nominal voltage, ESR is the equivalent series resistance, and m is the mass of active material loaded.

Table S1: The specific capacitances of the ordinary St-PBS hybrid, St-PBS micelle I, St-PBS micelle II and St-PBS micelle III, calculated from the CV curves obtained from a two-electrode configuration (symmetrical cell), and compared with the three electrode measurements.

	Scan rate (mV/s)	200	100	50	20	10	5
Three electrode configuration	St-PBS (C_{sp}/ Fg^{-1})	42	81	122	187	236	301
	St-PBS Mic I (C_{sp}/ Fg^{-1})	49	89	143	195	250	324
	St-PBS Mic II (C_{sp}/ Fg^{-1})	75	129	247	391	483	584
	St-PBS Mic III (C_{sp}/ Fg^{-1})	48	88	131	190	243	318
Two electrode configuration (Symmetrical Cell)	St-PBS (C_{sp}/ Fg^{-1})	66	83	109	118	132	147
	St-PBS Mic I (C_{sp}/ Fg^{-1})	101	126	144	152	170	182
	St-PBS Mic II (C_{sp}/ Fg^{-1})	106	140	159	181	185	203

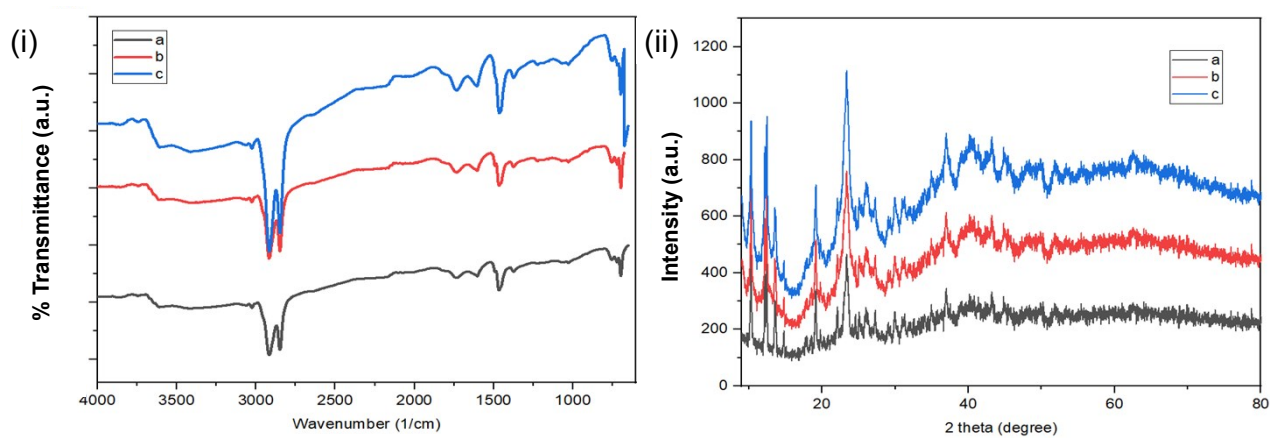


Figure S1: Image (i) presents the FTIR data and image (ii) are the XRD patterns for the St-PBS-I- Fe_3O_4 , St-PBS-II- Fe_3O_4 , and St-PBS-III- Fe_3O_4 .

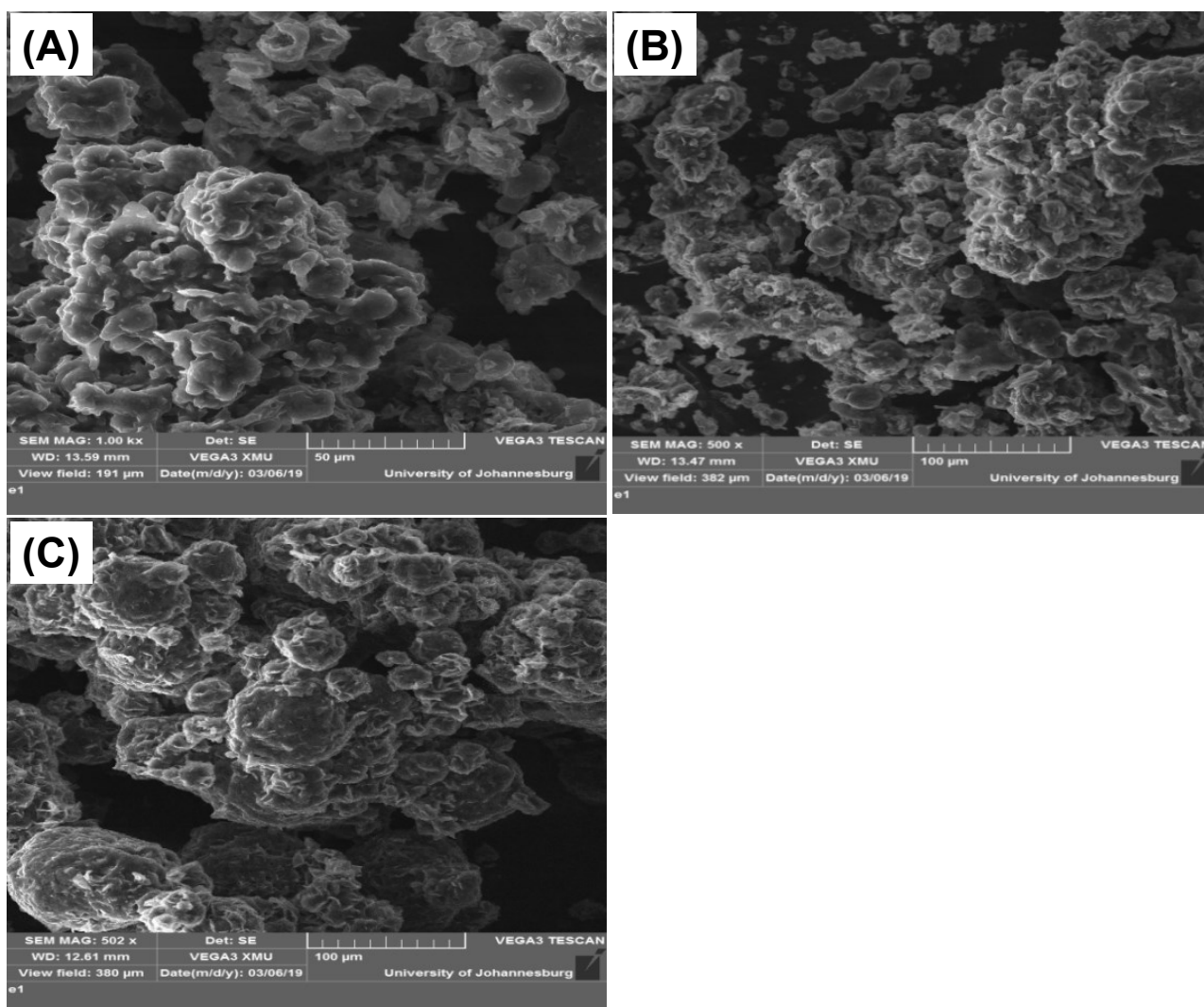


Figure S2: SEM images of the (a) St-PBS-I-Fe₃O₄, (b) St-PBS-II-Fe₃O₄, and (c) St-PBS-III-Fe₃O₄ samples.

Table S2: The specific capacitances of the magnetite incorporated St-PBS micelle I, St-PBS micelle II and St-PBS micelle III, calculated from the CV curves obtained from a two-electrode configuration (symmetrical cell), and compared with the three electrode measurements.

	Scan rate (mV/s)	200	100	50	20	10	5
	Two electrode configuration (Symmetrical Cell)	St-PBS-I-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	107	164	183	237	277
	St-PBS-II-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	124	168	218	263	295	308
	St-PBS-III-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	109	160	202	241	284	291
Three electrode configuration	St-PBS-I-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	86	173	288	435	527	608
	St-PBS-II-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	108	172	309	442	532	631
	St-PBS-III-Fe ₃ O ₄ (C_{sp}/Fg^{-1})	79	154	278	393	484	589

References

- 1 Y. Ko, M. Kwon, W. K. Bae, B. Lee, S. W. Lee and J. Cho, *Nat. Commun.*, 2017, **8**, 536.
- 2 D. Ghosh, S. Giri, M. Moniruzzaman, T. Basu, M. Mandal and C. K. Das, *Dalt. Trans.*, 2014, **43**, 11067–11076.