Electronic Supplementary Material (ESI) for Sustainable Energy & Fuels.

Resourceful utilization of methylene blue contaminated water for fabrication of ultra stable supercapacitor device

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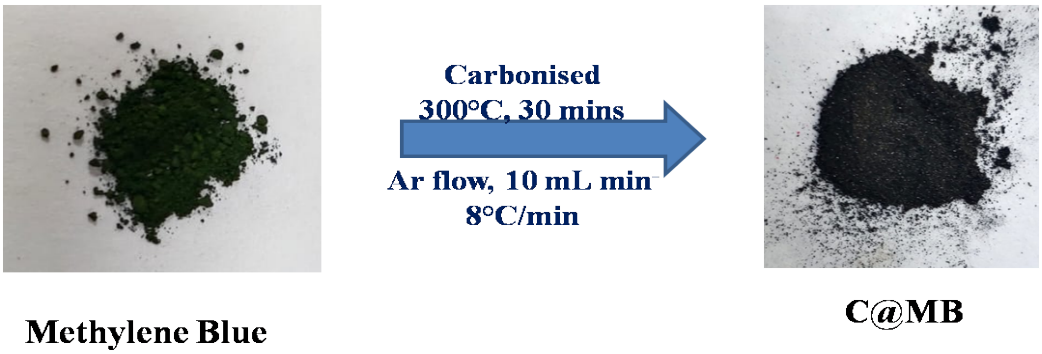

Figure S1. Outline of synthesis of C@MB

S1. Preparation of SnS_2-MB-H:

For find out whether carbon is actually deposited on surface of SnS_2, SnS_2-MB-H was synthesized and characterized. The synthesis process is as follows. SnS_2 was prepared as discussed in section 2.4. SnS_2 as prepared was then saturated with MB through adsorption using the optimized conditions obtained for C-SnS_2 in the adsorption study. The sample thus obtained was heat treated using the same conditions as used for the preparation of C-SnS_2-MB-H as discussed in section 2.6 that is, heating at 300 °C in Ar atmosphere through a heating rate of 8 °C min^{-1}. Thus the sample thus obtained was named **SnS_2-MB-H.**

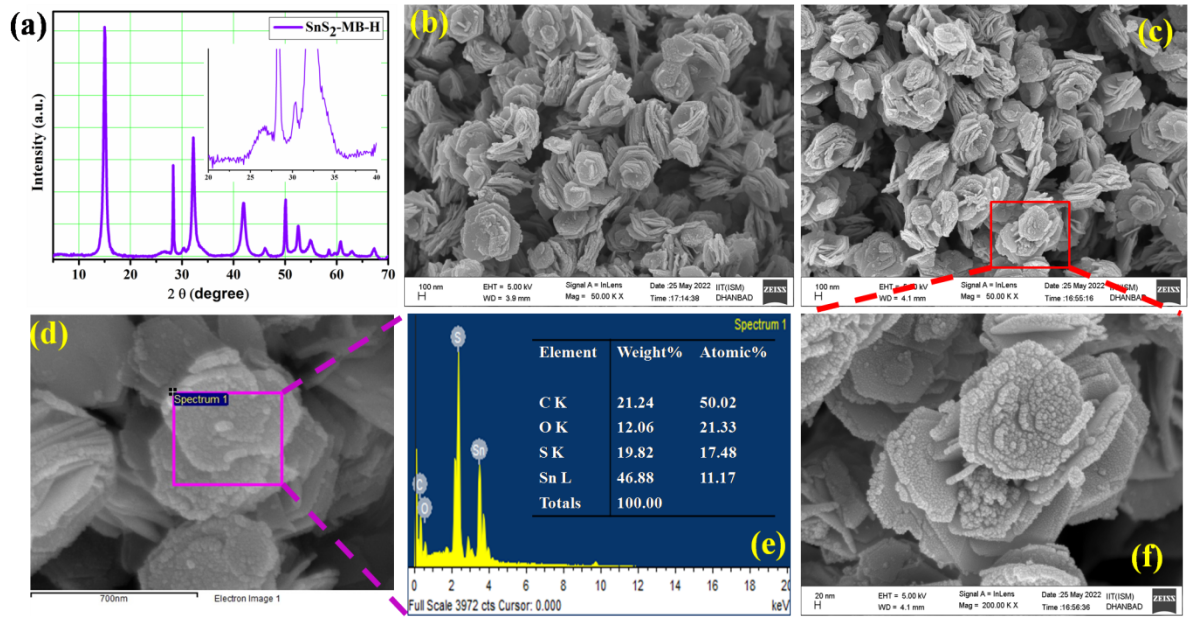

Figure S2. (a) PXRD of SnS_2-MB-H (b) FESEM image of SnS_2 (c) FESEM images of SnS_2-MB-H (d) FESEM images of SnS_2-MB-H where EDX analysis was performed (e) FESEM EDX spectrum of SnS_2-MB-H with inset table showing the respective elemental percentages (f) Magnified FESEM images of SnS_2-MB-H showing the carbon deposition.

Table S1. Raman data of composites

Synthesized material	D band position (cm^{-1})	G band position (cm^{-1})	I_D/I_G
C@grass	1334.82	1573.73	0.944
C@MB	1323.67	1556.17	0.992
C-SnS_2	1330.04	1577.81	0.959
C-SnS_2-MB-H	1330.04	1577.81	0.995

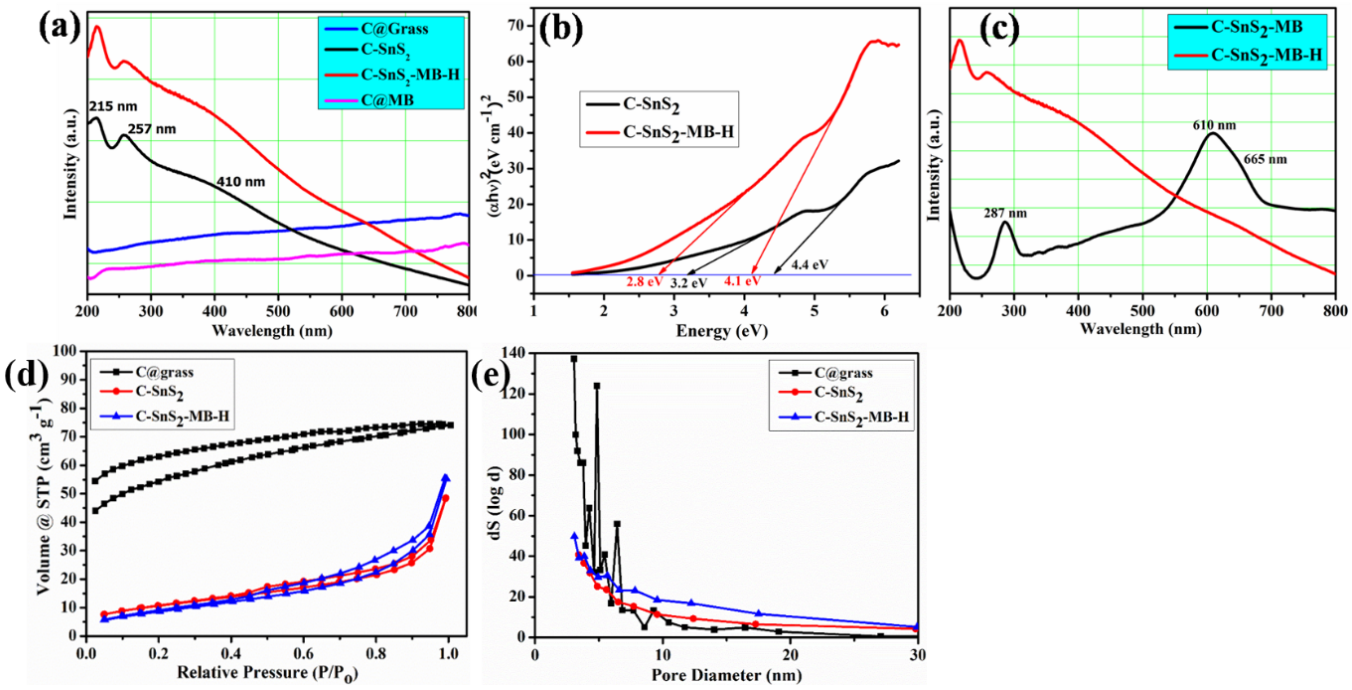

Figure S2. (a) UV-Vis analysis of the synthesized composites (b) Tauc plot of C-SnS_2 and C-SnS_2-MB-H (c) UV-Vis spectra of dispersions of same amount of C-SnS_2-MB and C-SnS_2-MB-H in water (d) BET analysis of the samples (e) Pore size distribution analysis

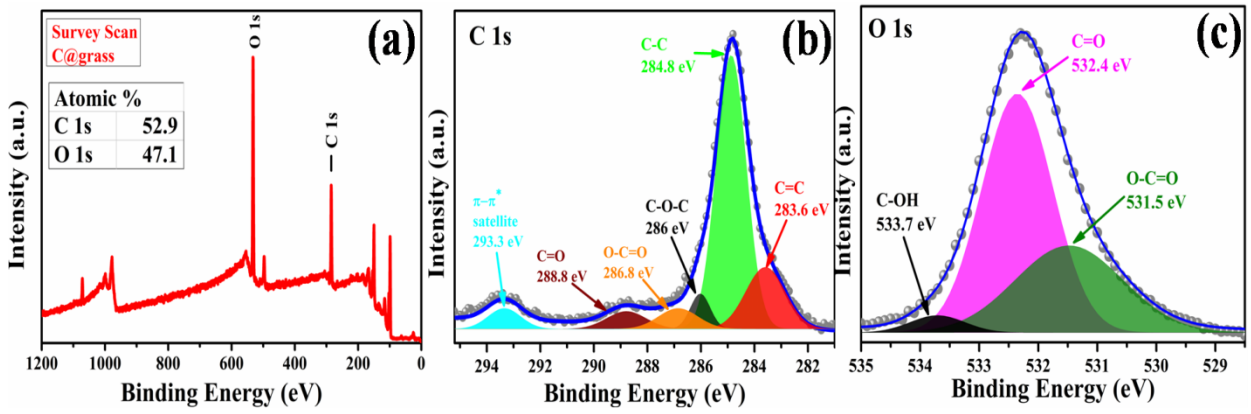

Figure S3. XPS analysis of C@Grass (a) Surface survey plot and core level plots of (b) C1s and (c) O1s

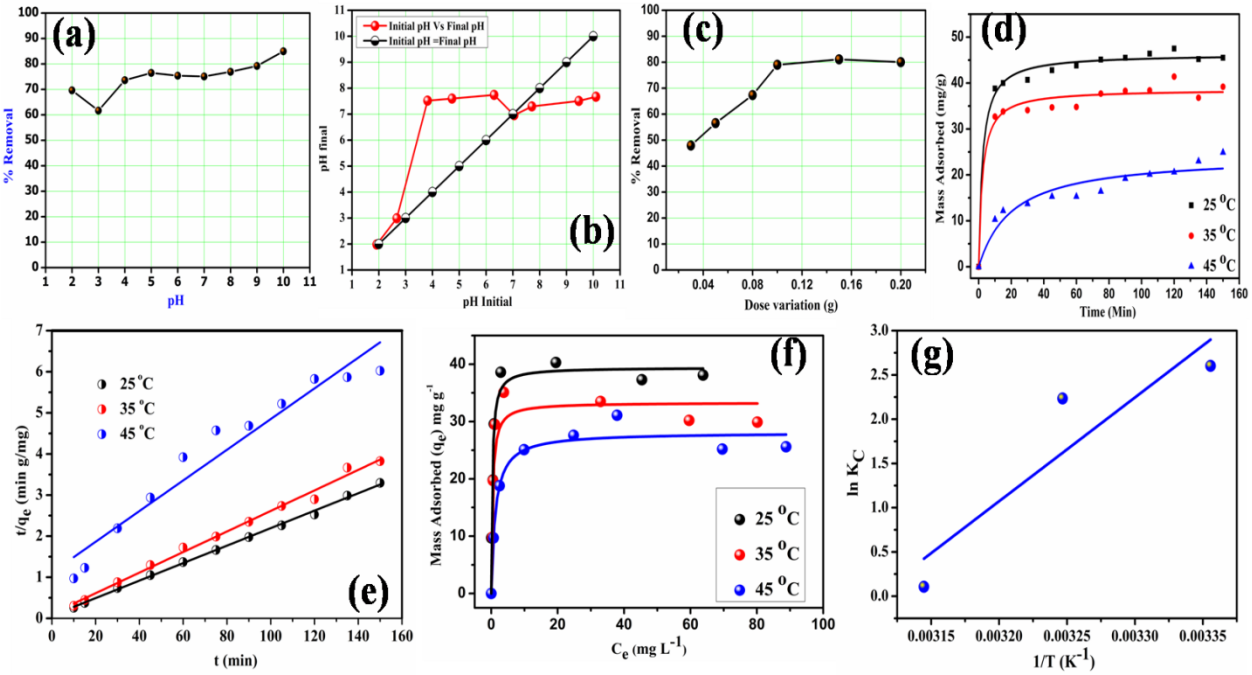

Figure S4. (a) % Removal of MB with pH variation (b) P_{zc} study of C-SnS_2 (c) % Removal of MB with dose varition (d) Effect of contact time on adsorption (e) Fit of the time variation data using pseudo-second-order model (f) Fit of concentration variation data to Langmuir isotherm (g) Plot of ln (K_c) vs 1/T for calculating thermodynamic parameters

Table S2. Fitted data values of Nyquist plot.

Composites	R_s (Ω)	C_{dl} (mF)	R_{CT} (mΩ)	N
C@Grass	4.7	128	1060	0.678
C-SnS_2	3.02	22.7	324	0.541
C-SnS_2-MB-H	3.25	17.0	844	0.546

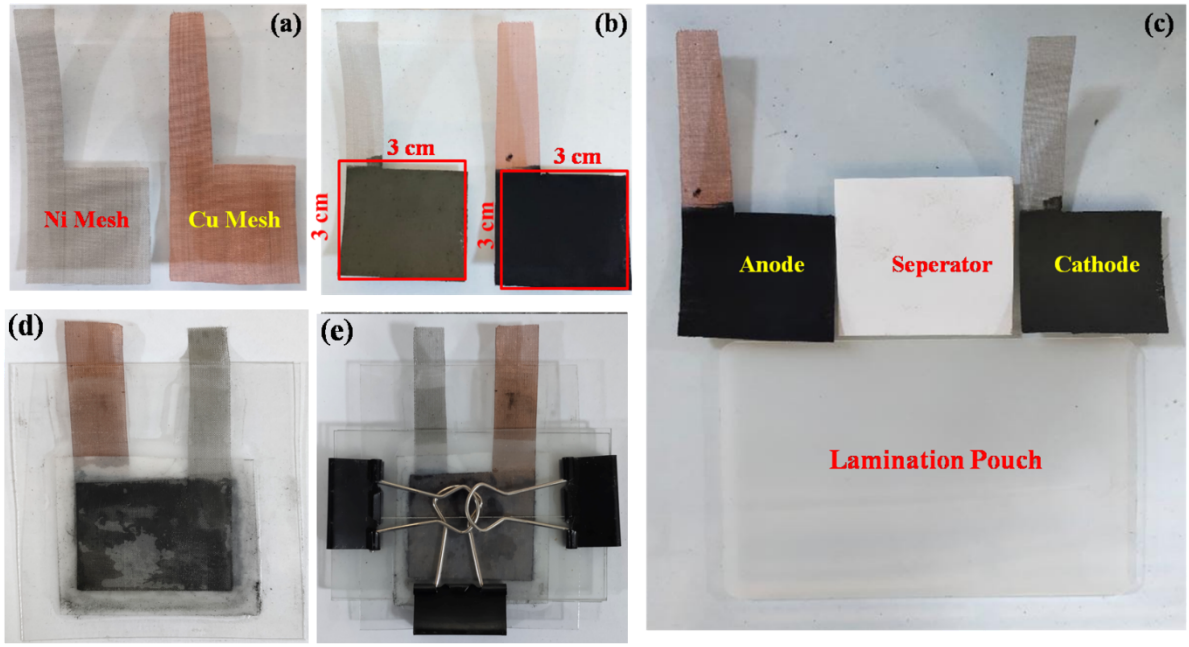

Figure S5. Different stages of fabrication of the device. Digital images of (a) Uncoated current collectors (b) Coated electrodes with 3 cmX 3cm coating (c) essential components of the asymmetric supercapacitor assembly (d) Fabricated device (e) Device as used for testing and 2-electrode analysis.

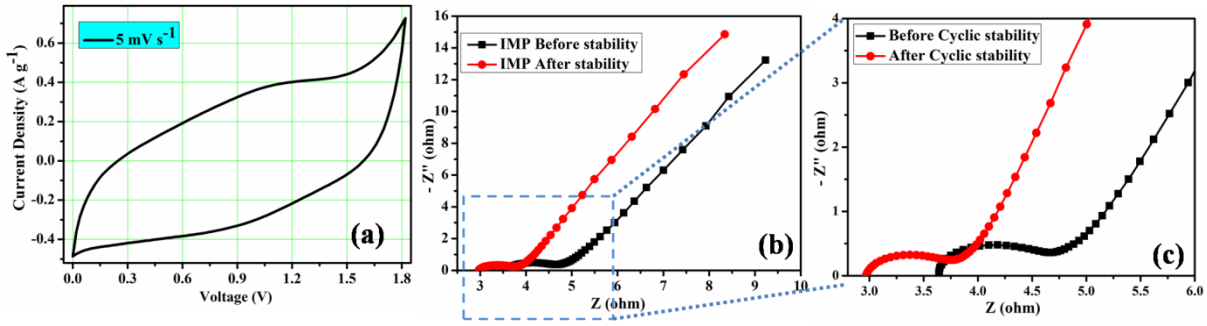

Figure S6. (a) CV of the device fabricated at 5 mV s^{-1} (b) IMP of the device before and after cyclic stability (c) Zoomed version of the IMP data

Table S3. Specific Capacitance, ED and PD of the asymmetric supercapacitor at increasing voltage window

Voltage Window (V)	Specific Capacitance (Fg^{-1})	Energy Density ($Wh\ kg^{-1}$)	Power Density ($kW\ kg^{-1}$)
0.8	46.0	4.1	0.8
1.0	52.9	7.4	1.0
1.2	62.3	12.5	1.2
1.4	71.1	19.4	1.4
1.6	81.4	29	1.6
1.8	98.3	44.3	1.8

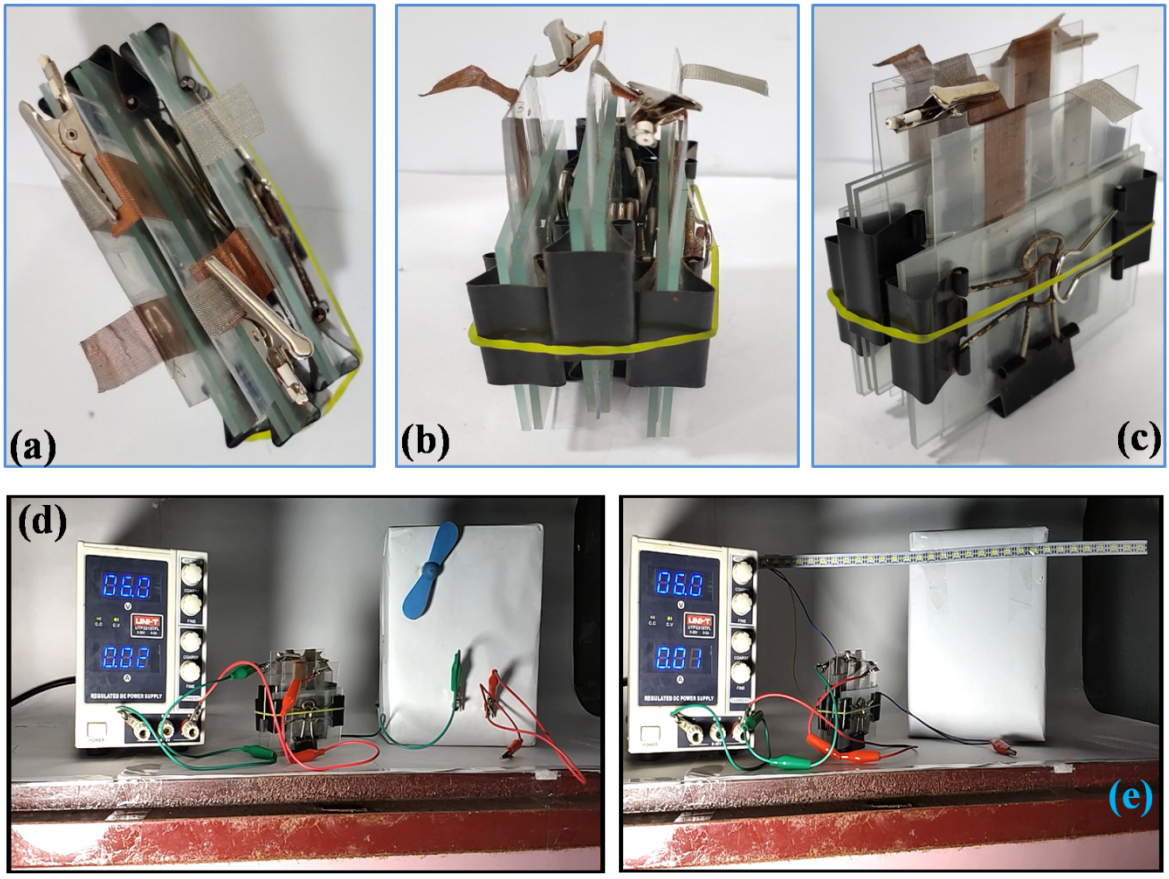

Figure S7. Digital images of the 3 devices combined in series with viewing from (a) Top side (b) Side View (c) Diagonal view (d) Charging setup for operation of DC fan (e) Charging setup for the glowing of LED strip

Table S4. Comparison of the fabricated device with other reported devices.

Sl No	Device	Electrolyte	Specific Capacitance ($F\ g^{-1}$)	Current Density ($A\ g^{-1}$)	Energy Density ($Wh\ kg^{-1}$)	Power Density ($W\ kg^{-1}$)	% Retention	Voltage Window (V)	Ref
1	Ni-SnS_2@$Ni(OH)_2$-CC//AC	2 M KOH	99.3	0.2	33.3	160	106.6 after 1000 cycles	1.6	[1]
2	SnS_2-G//SnS_2-G		262.5	1	23.5	880	-	0.8	[2]
3	SnS_2-SnO_2//SnS_2-SnO_2		31.5	2	6.2	1828	92 after 3000 cycles	0.8	[3]
4	SnS_2//RGO		92.4	1	32.8	3600	93 after 4000 cycles	1.6	[4]
5	MoS_2-SnS_2//MoS_2-SnS_2		422.2	0.5	20.17	3634.5	65 after 1000 cycles	1	[5]
6	PANI/SnS_2@CNTs/CFs symmetric device		368.3	1	38.7	1000	82.6 after 2000 cyles	1.4	[6]
7	C-SnS_2-MB-H//C@Grass		98.3	1	44.2	1800	97 after 10000 cycles	1.8	This work

References

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