Supporting Information

Synthesis of Tin Oxide Nanoparticles from E-waste for Photocatalytic Mixed Dye Degradation under Sunlight

*Mandira Ghosh[a], Debdyuti Mukherjee[b], Celin Selvaraj[a], Pritam Ghosh[c], Sujoy Sarkar[a,d]**

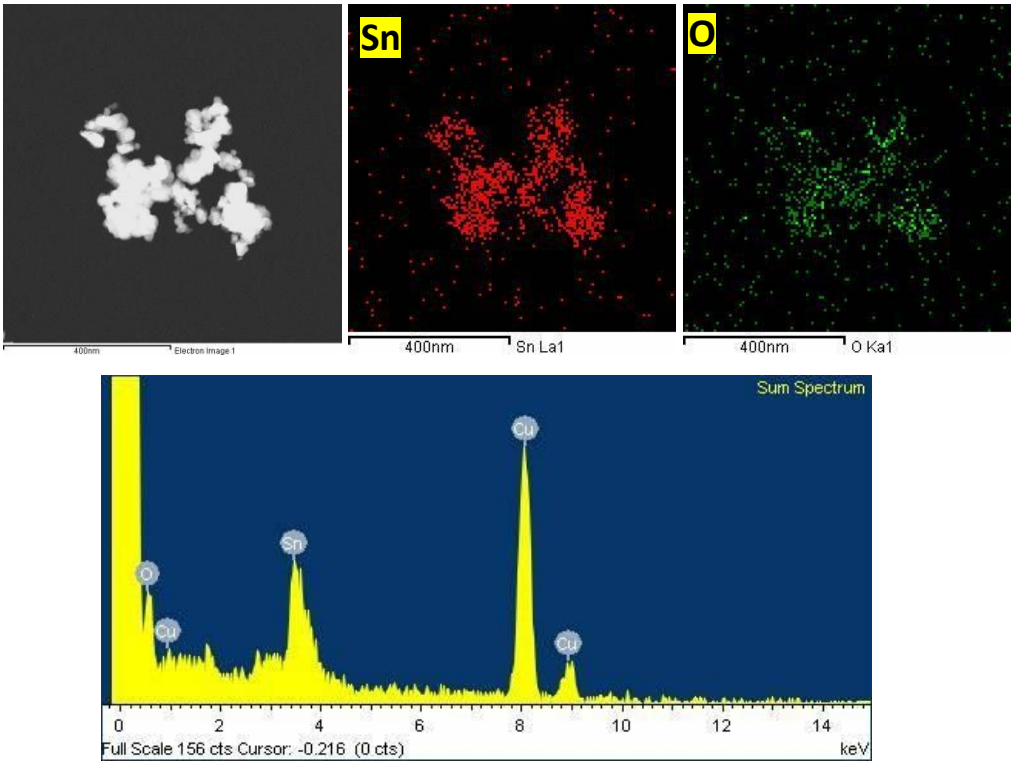
[a] Department of Chemistry, School of Advanced Sciences, Vellore Institute of Technology, Chennai Campus, Vandalur-Kelambakkam Road, Chennai, Tamil Nadu, India 600127

[b] Centre for Fuel Cell Technology (CFCT), International Advanced Research Centre for Powder Metallurgy and New Materials (ARCI), IIT-M Research Park, Taramani, Chennai, Tamil Nadu, India 600113

[c] Department of Chemistry, Humboldt-Universität zu Berlin, Brook-Taylor-Straße 2, 12489 Berlin, Germany.

[d] Electric Vehicle Incubation, Testing and Research Centre (EVIT-RC), Vellore Institute of Technology, Chennai Campus, Vandalur-Kelambakkam Road, Chennai, Tamil Nadu, India 600127

E-mail: sujoy.sarkar@vit.ac.in



Element	Weight %	Atomic %	Net Int.	Error %	Kratio	Z	A	F
O K	17.05	60.40	2831.21	7.46	0.1303	1.4737	0.5186	1.0000
SnL	82.95	39.60	3552.05	3.92	0.7549	0.8981	1.0134	1.0000

Figure S1: Elemental mapping and EDX of as-synthesized SnO_2 nanoparticles. Atomic % of Sn and O is tabulated.

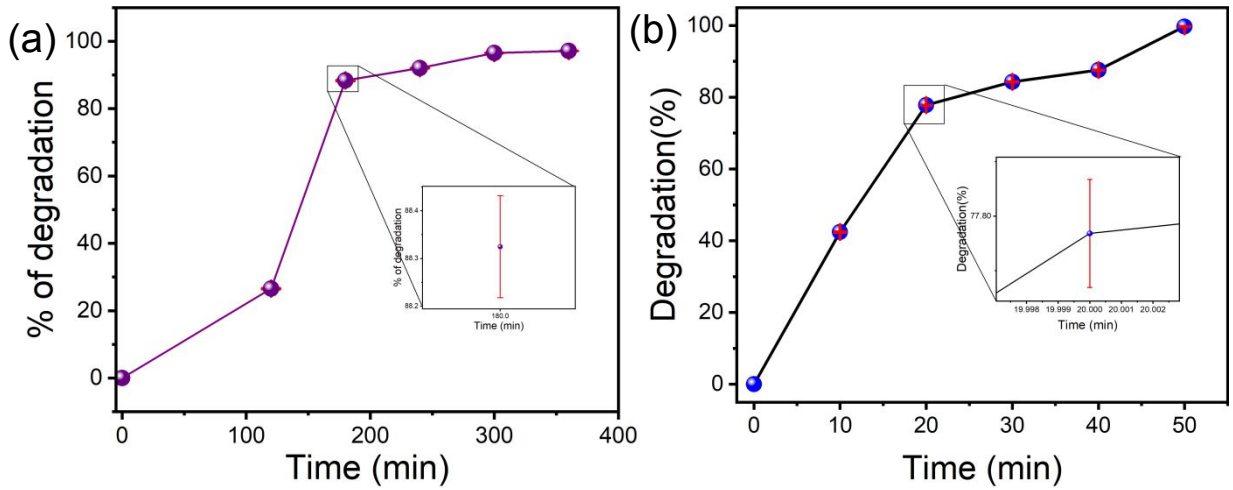


Figure S2: Photocatalytic dye degradation reactions are repeated three times for (a) MB and (b) EY. The error bar is zoomed in and kept inside.

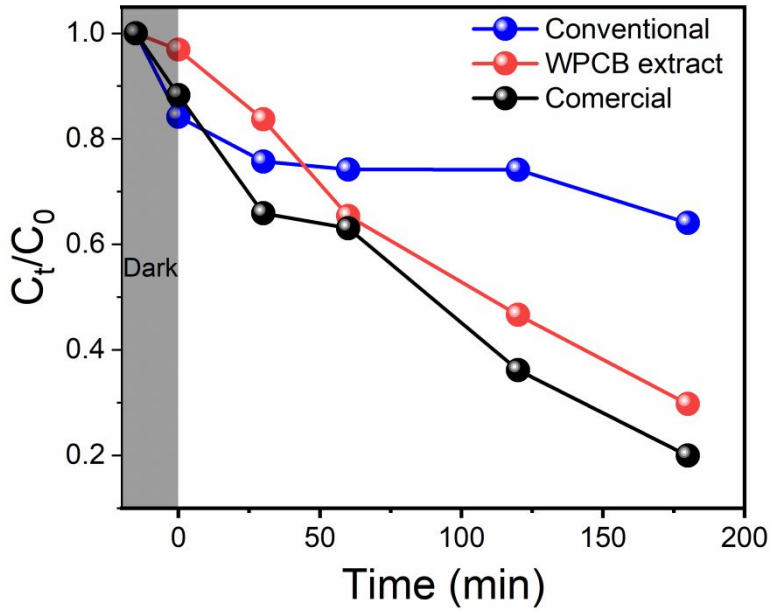


Figure S3: Photocatalytic activity of MB degradation under sunlight compared with as-synthesized SnO_2 nanoparticles, commercial SnO_2, and SnO_2 prepared by conventional method (Hydrothermal).

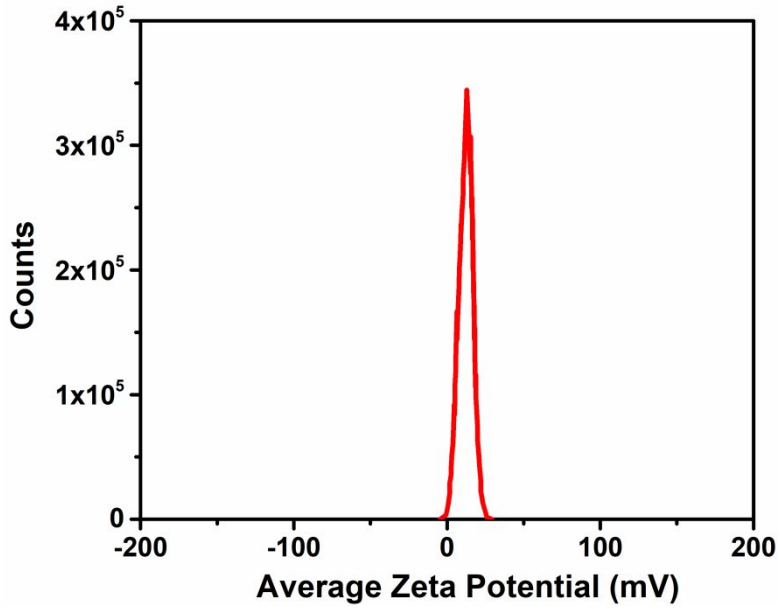


Figure S4: Zeta potential of as-synthesized SnO_2 nanoparticles.

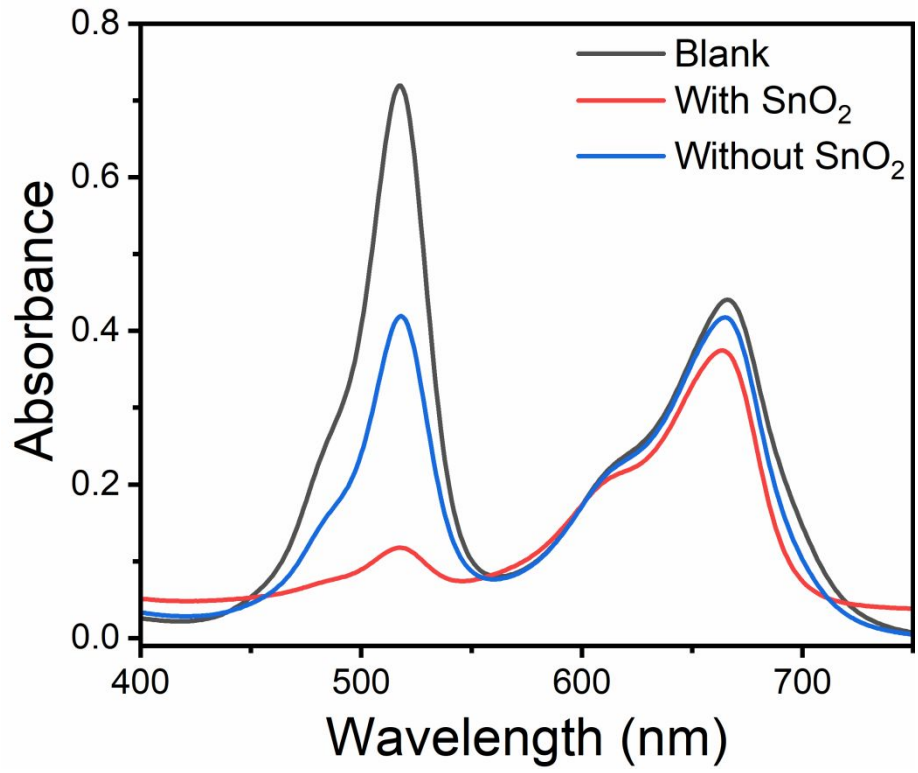


Figure S5: Photothermal effect on mixed dye (MB and EY) degradation under sunlight.

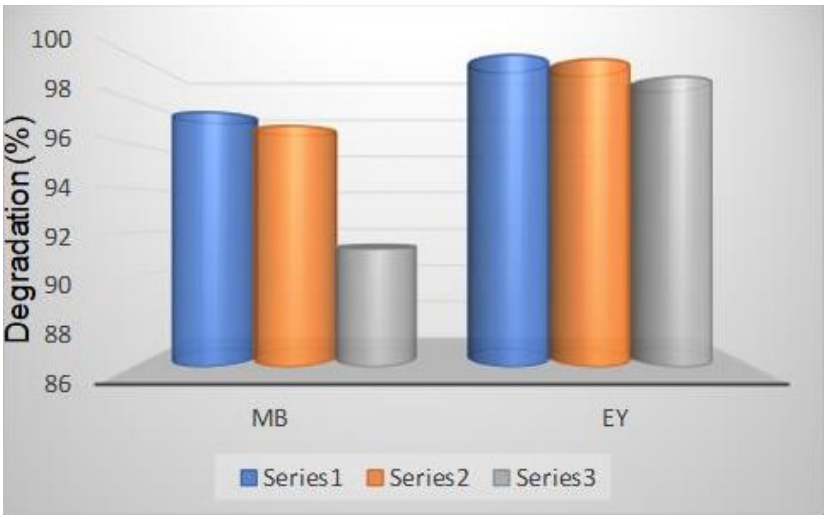


Figure S6: Reusability of the photocatalyst (SnO_2 NPs) in MB and EY dyes under sunlight irradiation.

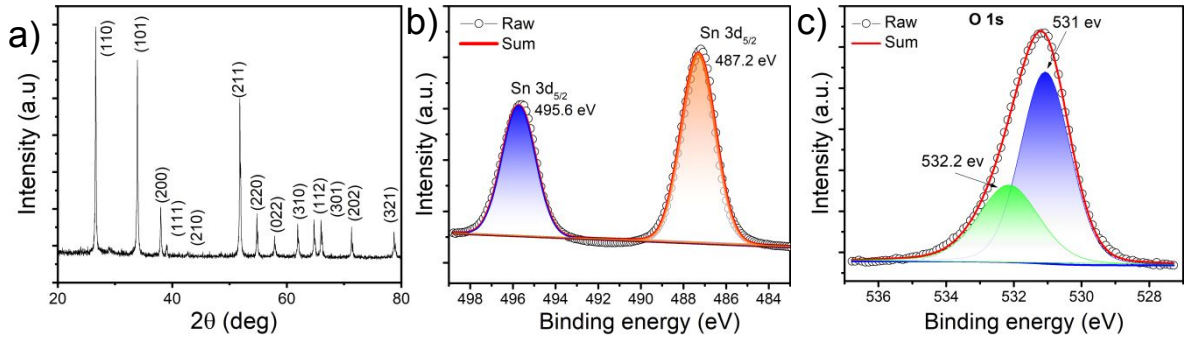


Figure S7: (a) XRD pattern and high-resolution XPS of SnO_2 after recycling; (b) Sn 3d and (c) O 1s.

DFT calculation

Table S1. Eosin Y single negative
total energy = -11436.19787843786 Hartree
36

Br	8.3006022	7.5458619	3.2121600
Br	4.1376768	11.0879769	4.9488010
Br	9.8486302	4.1692881	5.7815506
Br	7.7144255	3.0180430	10.9791066
O	7.7954899	6.3675380	5.9374872
O	6.2647688	9.8522694	3.1293976
O	9.4778521	2.7606386	8.4925567
O	3.8083517	5.6439089	7.1881042
H	3.2915566	5.1737223	6.5014199
O	1.7710751	6.3820290	7.7494989
C	6.9649355	7.4195951	5.7323722
C	6.0319352	7.8046810	6.7474108
C	5.9815086	7.0595013	7.9409989
C	6.8556811	5.9733558	8.1271524
C	7.7739850	5.6386931	7.0805839
C	7.0467220	8.0962012	4.5313765
C	6.2053089	9.2380135	4.2033826
C	5.2736766	9.5929398	5.2854049
C	5.1918410	8.9270561	6.4757093
H	4.4806062	9.2481735	7.2365198
C	5.0362658	7.4555565	9.0241192
C	3.6508576	7.1755138	8.9968448
C	2.8277363	7.6558849	10.0290103
H	1.7603039	7.4355684	9.9845415
C	3.3589859	8.3856304	11.0913554
H	2.7054627	8.7444561	11.8895886
C	4.7315261	8.6519538	11.1266836
H	5.1622115	9.2228176	11.9527084
C	5.5581890	8.1931137	10.0977432
H	6.6270255	8.4159820	10.1170745
C	2.9725672	6.3825918	7.9259862
C	8.6467567	4.5753555	7.1978841
C	8.7001258	3.7170517	8.3727441
C	7.7262153	4.0995124	9.4075166
C	6.8627174	5.1520750	9.2956752
H	6.1623325	5.3783457	10.0992925

Table S2. Eosin Y two negative
total energy = -11435.73175127406 Hartree

35

Br	8.4041776	7.6161794	3.2628068
Br	4.2371402	11.1802458	4.9458391
Br	9.8150550	4.1560465	5.8015343
Br	7.5537935	2.9741515	10.9386908
O	7.7798698	6.3714147	5.9328993
O	6.4179736	9.9666617	3.1721235
O	9.3647057	2.7132729	8.4837048
O	3.8536430	5.7291510	7.1553152
O	1.8464551	5.8538839	8.1569974
C	6.9773913	7.4474163	5.7339614
C	6.0245301	7.8267254	6.7266483
C	5.9062580	7.0505793	7.8999207
C	6.7793332	5.9582494	8.0911329
C	7.7157849	5.6273342	7.0656563
C	7.1126580	8.1561984	4.5534001
C	6.3074961	9.3218793	4.2270048
C	5.3445645	9.6596403	5.2837220
C	5.2099602	8.9637870	6.4534216
C	5.0044922	7.4928930	9.0026087
C	3.6601155	7.0859031	9.0840788
C	2.8705120	7.5544725	10.1431346
C	3.3955804	8.4099926	11.1141199
C	4.7346071	8.8110482	11.0311426
C	5.5329548	8.3540358	9.9786493
C	3.0610464	6.1383737	8.0400507
C	8.5770050	4.5520251	7.1927674
C	8.5970258	3.6801912	8.3560998
C	7.6074952	4.0660273	9.3710823
C	6.7566313	5.1300161	9.2509310
H	4.4705138	9.2647667	7.1953649
H	1.8310510	7.2229602	10.1789219
H	2.7658265	8.7643504	11.9347435
H	5.1593407	9.4800547	11.7841298
H	6.5778112	8.6672869	9.9095733
H	6.0409979	5.3596314	10.0402169

Table S3. MB1+ single positive
total energy = -1181.65969045672 Hartree
38

S	-0.5685705	3.6651897	1.4950297
C	0.0600538	5.8915345	2.8611544
C	0.3630022	7.2734138	3.0287648
C	0.3821824	8.1075192	1.8525432
C	0.1168199	7.5831895	0.6184984
C	-0.1905480	6.1969053	0.4252323
N	-0.4353025	5.7789624	-0.8166666
C	-0.2075068	5.3686973	1.6067968
C	-0.7331445	4.5203265	-1.1390966
C	-0.8378721	3.4199386	-0.2114653
C	-1.1533154	2.1406946	-0.6385210
C	-1.3868506	1.8658757	-2.0166976
C	-1.2841790	2.9605021	-2.9498931
C	-0.9721590	4.2197884	-2.5197386
N	-1.6945816	0.6225734	-2.4398312
C	-1.9335832	0.3528278	-3.8563687
C	-1.7949622	-0.4773358	-1.4848370
N	0.6243975	7.7896064	4.2472811
C	0.9355196	9.2088500	4.4068121
C	0.6026783	6.9341357	5.4303314
H	0.0351924	5.2262104	3.7217257
H	0.6094469	9.1677523	1.9377070
H	0.1311839	8.2144738	-0.2716735
H	-1.2205917	1.3441639	0.0996319
H	-1.4551211	2.7924661	-4.0108096
H	-0.8943033	5.0481981	-3.2260048
H	-2.7852704	0.9418578	-4.2360381
H	-2.1666530	-0.7113664	-3.9807574
H	-1.0421714	0.5863512	-4.4624758
H	-0.8378649	-0.6338043	-0.9585888
H	-2.0498709	-1.3980179	-2.0229989
H	-2.5811584	-0.2813928	-0.7358143
H	1.8429520	9.4837496	3.8433004
H	1.1121550	9.4164198	5.4688816
H	0.0994546	9.8410701	4.0636909
H	-0.3923757	6.4788736	5.5719361
H	0.8370393	7.5383756	6.3147823
H	1.3512284	6.1274208	5.3499468