

Upcycling of PET-based plastic bottles into carbon dots for photocatalytic degradation of reactive black five using response surface methodology

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Fig S1: PET bottle waste in crushed form serves as the raw material for producing carbon dots.

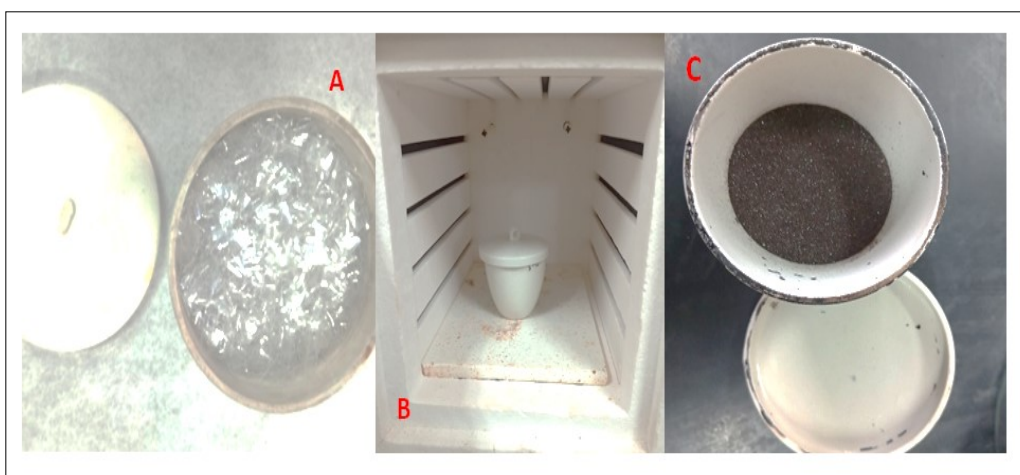


Fig S2: Calcination step in the synthesis of carbon dots from PET waste. (A) PET plastic shredded, (B) treatment in a muffle furnace, (C) Final black carbonaceous thermally treated residue



Fig S3: Sonication process for synthesizing carbon dots (A), their dispersion seen under daylight (B), and the characteristic green fluorescence of carbon dots under UV light (C)

Table S1: The calibration of Reactive Black 5 (RB5) at its λ max absorbance ($n = 3$) of the standards (0-30 mg/L) with the mean absorbance (Mean A) and a standard deviation (SD).

RB5 (mg/L)	Absorbance 1	Absorbance2	Absorbance3	Mean A	SD (n=3)
0	0.00521	0.01545	0.00426	0.00831	0.00620
5	0.09744	0.09550	0.09942	0.09745	0.00196
10	0.19351	0.19774	0.20323	0.19816	0.00487
15	0.31827	0.30226	0.30037	0.30697	0.00983
20	0.40582	0.41827	0.39045	0.40485	0.01394
25	0.50291	0.49760	0.50154	0.50068	0.00276
30	0.60548	0.60219	0.59578	0.60115	0.00493

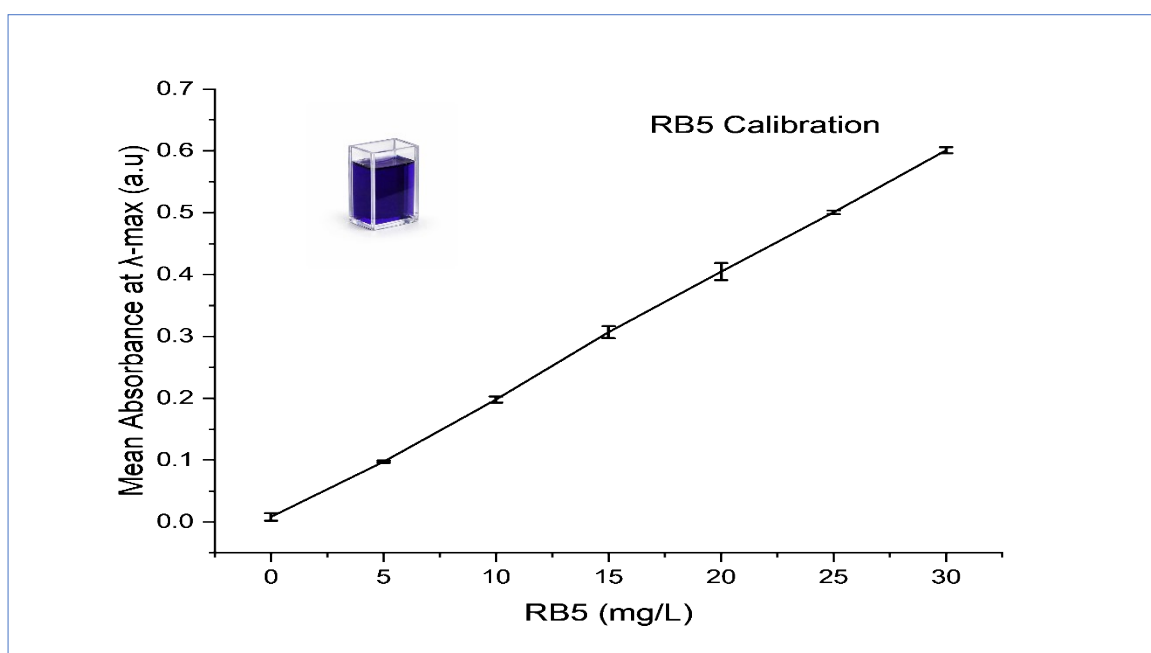


Fig S4: Calibration curve of RB5 absorbance at lambda max

Table S2: RSM experimental design for optimization of photocatalytic degradation of RB5

Factor	Name	Units	Type	Minimum	Maximum	Coded Low	Coded High	Mean	Std. Dev.
A	Carbon dots dose	g/L	Numeric	0.2000	0.8000	-1 ↔ 0.20	+1 ↔ 0.80	0.5000	0.1964
B	Dye concentration	mg/L	Numeric	10.00	50.00	-1 ↔ 10.00	+1 ↔ 50.00	30.00	13.09
C	pH		Numeric	5.00	11.00	-1 ↔ 5.00	+1 ↔ 11.00	8.00	1.96
D	Time	Minutes	Numeric	30.00	120.00	-1 ↔ 30.00	+1 ↔ 120.00	75.00	29.46

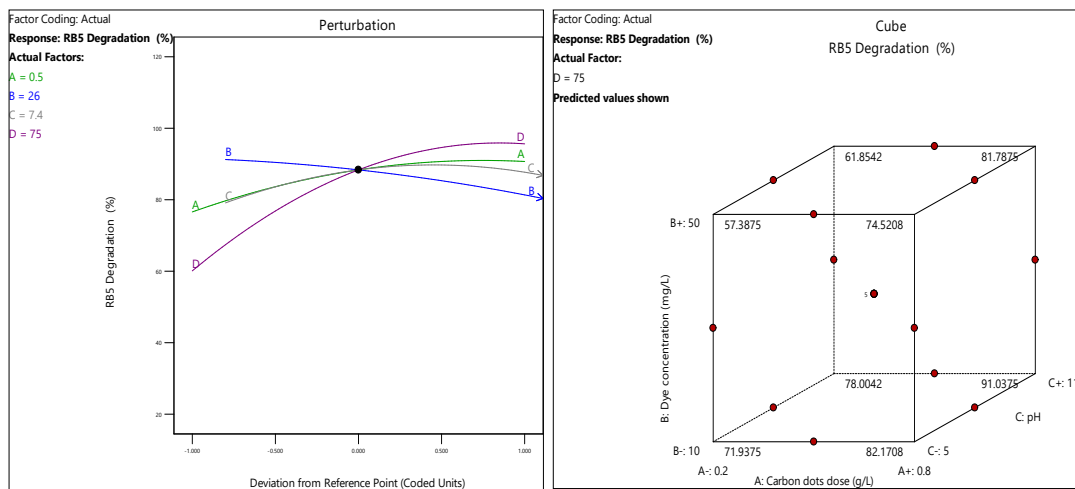


Fig S5: A disturbance plot of the relative sensitivity of RB5 degradation (%) to factors A, B, C, and D about the reference conditions. A cube plot of the predicted RB5 degradation (%) under the model at the corners of the experimental design space

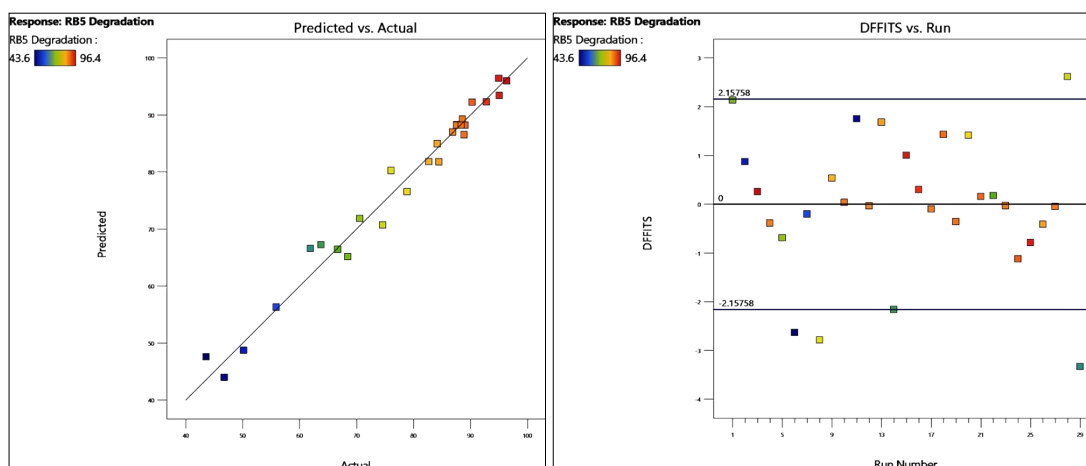


Fig S6: Diagnostic plots of the RB5 degradation model with DFFITS against the run number (left) to indicate influential observations and predict against actual values (right) to measure the overall fit of the model

Table S3: Pseudo–first-order kinetic parameters for RB5 photodegradation at different predicted degradation times for 75 minutes.

Predicted degradation (%)	C_t/C_0	$\ln(C_0/C_t)$	K_{app} (min^{-1})	$t_{1/2}$ (min)
57.3875	0.4261	0.853	0.01137	60.9
71.9375	0.2806	1.2707	0.01694	40.9
74.5208	0.2548	1.3673	0.01823	38
82.1708	0.1783	1.7243	0.02299	30.1
91.0375	0.0896	2.4121	0.03216	21.6

Table Ssupplementarysupplementary4: Fit Summary, Response: RB5 Degradation of RSM

Source	Sequential p-value	Lack of Fit p-value	Adjusted R^2	Predicted R^2	
Linear	< 0.0001	< 0.0001	0.7926	0.7586	
2FI	0.9153	< 0.0001	0.7505	0.6367	
Quadratic	< 0.0001	0.0014	0.9580	0.8799	Suggested
Cubic	0.8792	0.0002	0.9366	-0.9264	Aliased