Supplementary Information

Fabrication of graphitic carbon nitride synthesized via pyrolysis for environmental remediation: A detailed experimental analysis with different parametric optimizations

S. Ilakiya[1], M. Keerthana[2], N. Ponpandian[2], P. Thangadurai[1,*]

[1]Centre for Nanoscience and Technology, Pondicherry University, Kalapet, Puducherry - 605 014, India.

[2]Department of Nanoscience and Technology, Bharathiar University, Coimbatore - 641046, Tamilnadu, India

*Corresponding author: thangaduraip.nst@pondiuni.edu.in / thangadurai.p@gmail.com

1.0 INTRODUCTION

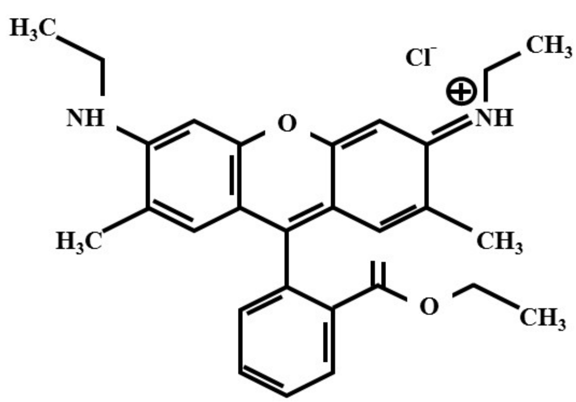

Figure S1. Chemical structure of Rh-6G dye.

2.0 Preparation process of g-C_3N_4

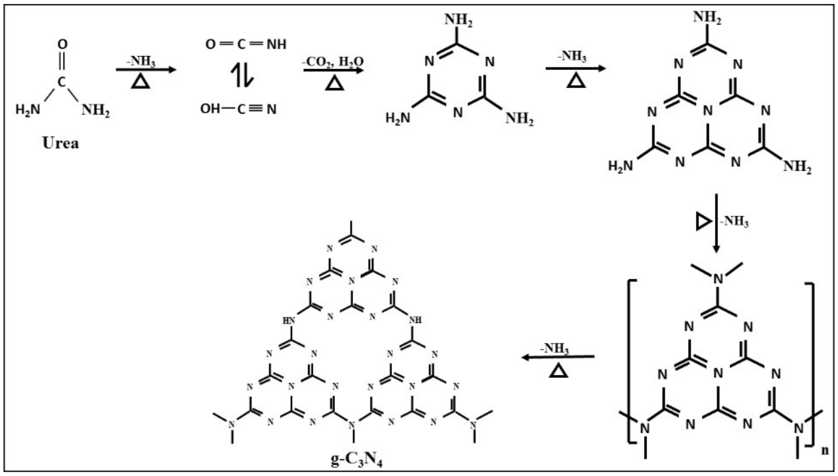

Figure S2. Preparation process of g-C_3N_4 from urea using thermal condensation.

3.0 Microstructure and Composition Analysis

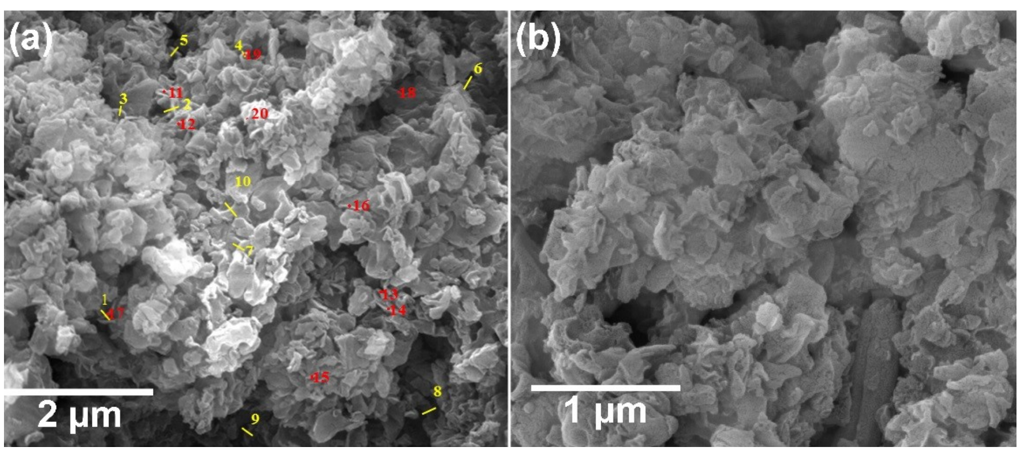

Figure S3. (a) Thickness evaluation and (b) SEM micrographs of g-C_3N_4.

3.1 XPS Analysis

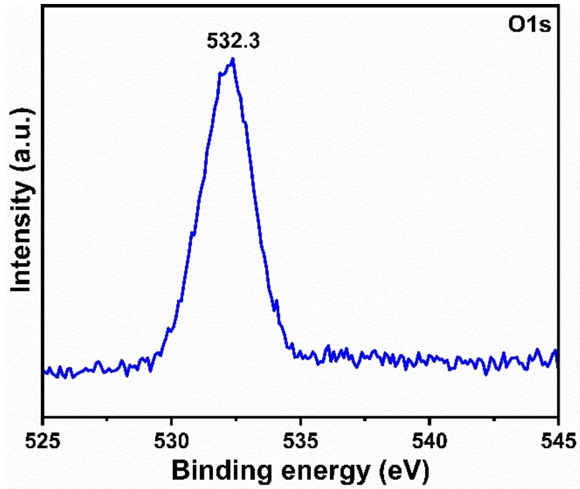

Figure S4. The XPS spectrum of g-C_3N_4 showing the peaks corresponding to the constituent elements O.

4.0 Optimization of Rhodamine-6G dye concentration

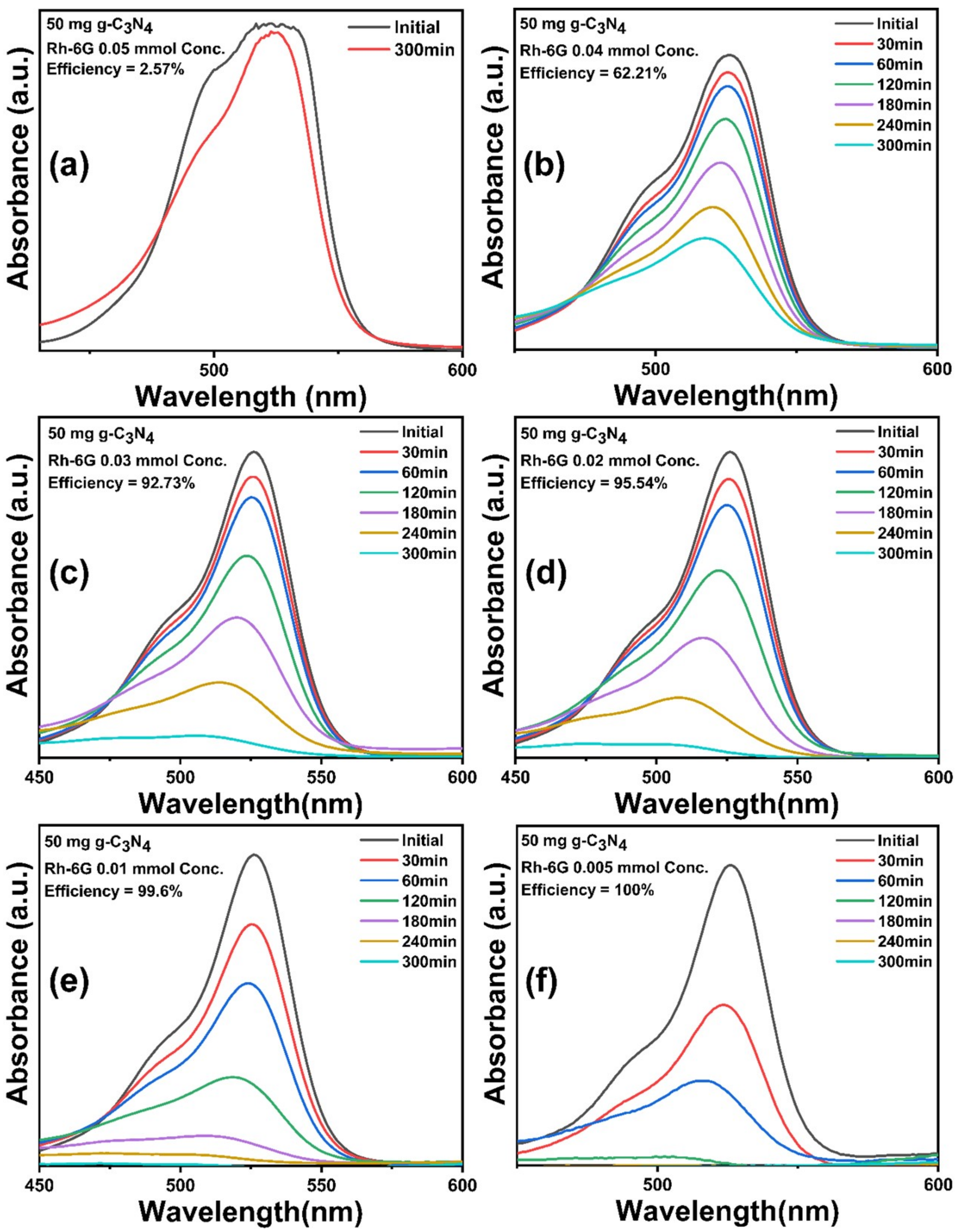

Figure S5: Represents the concentration optimization of g-C_3N_4 photocatalyst in Rh-6G dye under UV light illumination. (a) 0.05 mmol, (b) 0.04 mmol,(c) 0.03 mmol, (d) 0.02 mmol, (e) 0.01 mmol, (f) 0.005 mmol concentrations.

Table T1. The rate constant and degradation efficiency values for concentration and catalyst loading optimization experiment.

Concentration (mmol)	Rate constant	Efficiency (%)	Catalyst (mg)	Rate constant	Efficiency (%)
0.005	1.8852	100	10	0.2292	69.6
0.01	1.2774	99.6	20	0.3078	80.9
0.02	0.564	95.5	30	0.3816	87.1
0.03	0.4776	92.7	40	0.4824	92.4
0.04	0.1944	62.2	50	0.9276	99.6
			60	0.3306	84.5
			70	0.4398	90.2

4.1 Optimization of catalyst loading

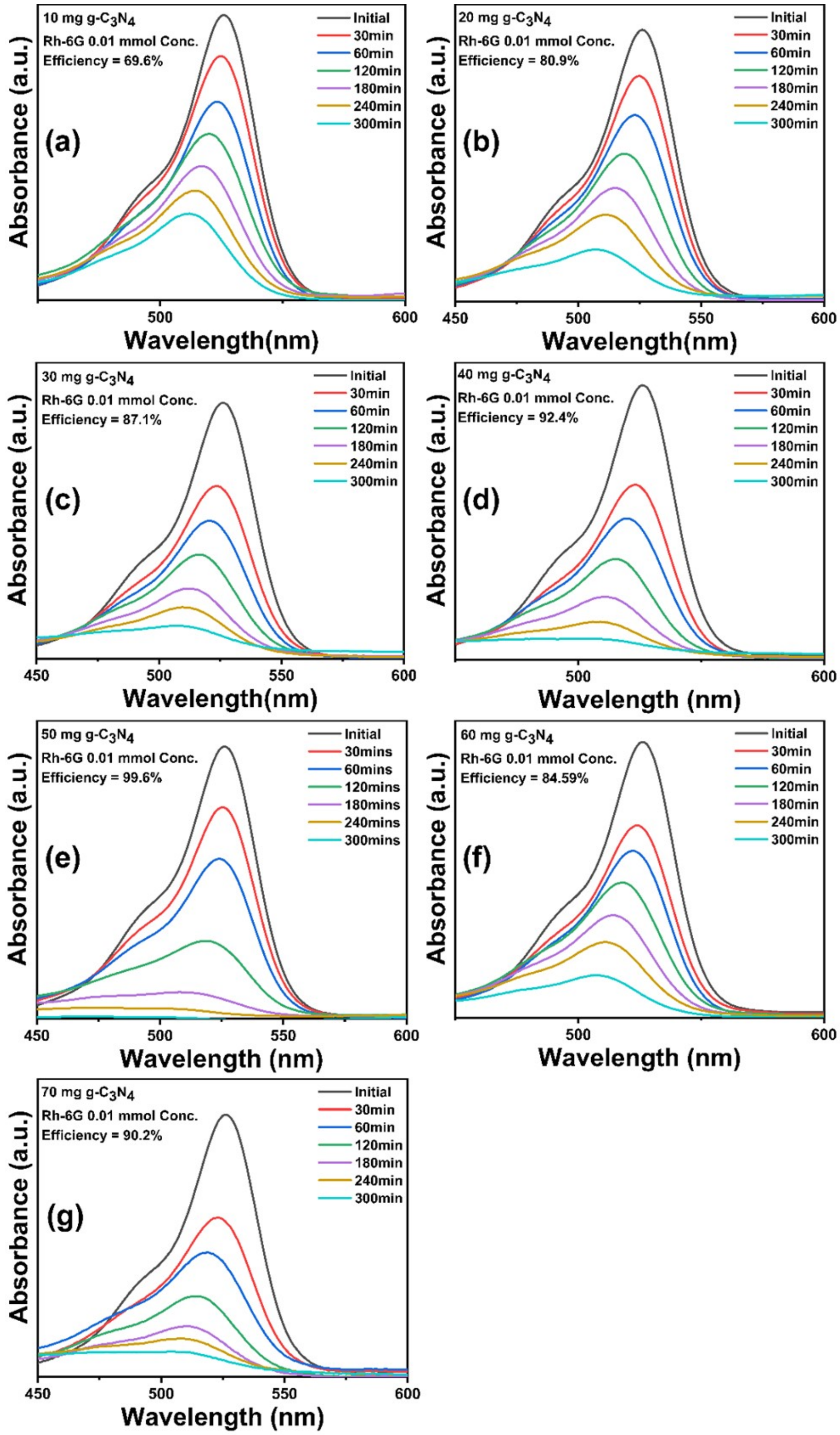

Figure S6: Represents the catalyst optimization of g-C_3N_4 photocatalyst in Rh-6G dye under UV light illumination. (a) 10 mg, (b) 20 mg, (c) 30 mg, (d) 40 mg, (e) 50 mg, (f) 60 mg, (g) 70 mg.

4.2 PHOTOCHEMICAL REACTIONS INVOLVED IN Rh-6G DYE DEGRADATION BY g-C_3N_4

The photochemical reactions involved during the photocatalytic degradation of Rh-6G dye by the g-C_3N_4 nanosheet photocatalyst under the UV light irradiation.

1. The photoexcitation of g-C_3N_4
   g-C_3N_4 + hν → e^- + h^+

2. Ionosorption of oxygen
   $O_2 + e^- \rightarrow {}^\bullet O_2^-$

3. Followed by ionization of water
   $H_2O \rightarrow OH^- + H^+$

4. The hydroxyl ion gets oxidized
   $OH^- + h^+ \rightarrow {}^\bullet OH$

5. The superoxide radical gets protonated
   ${}^\bullet O_2^- + H^+ \rightarrow HO_2^\bullet$

6. Co-scavenging of electron
   $HO_2^\bullet + e^- \rightarrow HO_2^-$

7. Formation of hydrogen peroxide
   $HO_2^- + H^+ \rightarrow H_2O_2$

8. $^\bullet$OH radical formation
   $H_2O_2 + e^- \rightarrow {}^\bullet OH + OH^-$

9. Degradation of dye in water by the active species
   Pollutant + $^\bullet O_2^-$ → Degradation product
   Pollutant + h^+ → Oxidation product

$$\text{Pollutant} + e^- \rightarrow \text{Reduction product}$$

4.3 RADICAL TRAPPING EXPERIMENT ON g-C_3N_4 IN Rh-6G DYE

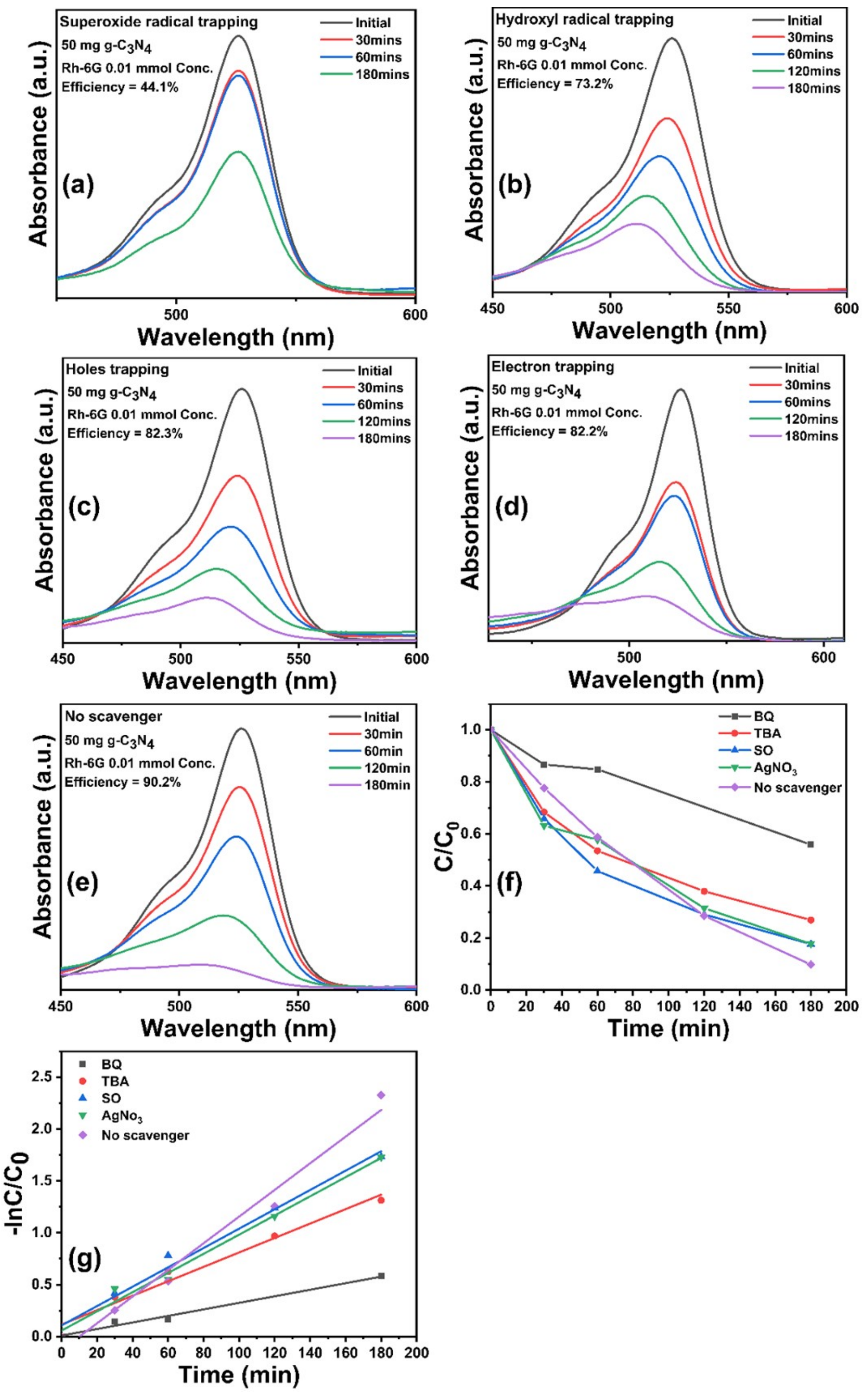

Figure S7: Shows the effect of radical scavenger on Rh 6G photodegradation on g-C_3N_4 photocatalyst under UV light. (a) BQ, (b) TBA, (c) SO, (d) $AgNO_3$, (e) No scavenger, (f) C/C_0, (g) Rate constant.

Table 2. The rate constant values for scavenger test photocatalytic studies.

Scavenger	Rate constant (h^{-1})
BQ	0.189
TBA	0.417
SO	0.5592
$AgNO_3$	0.5544
No scavenger	0.7704

4.4 pH TEST EXPERIMENT ON g-C_3N_4 IN Rh-6G DYE

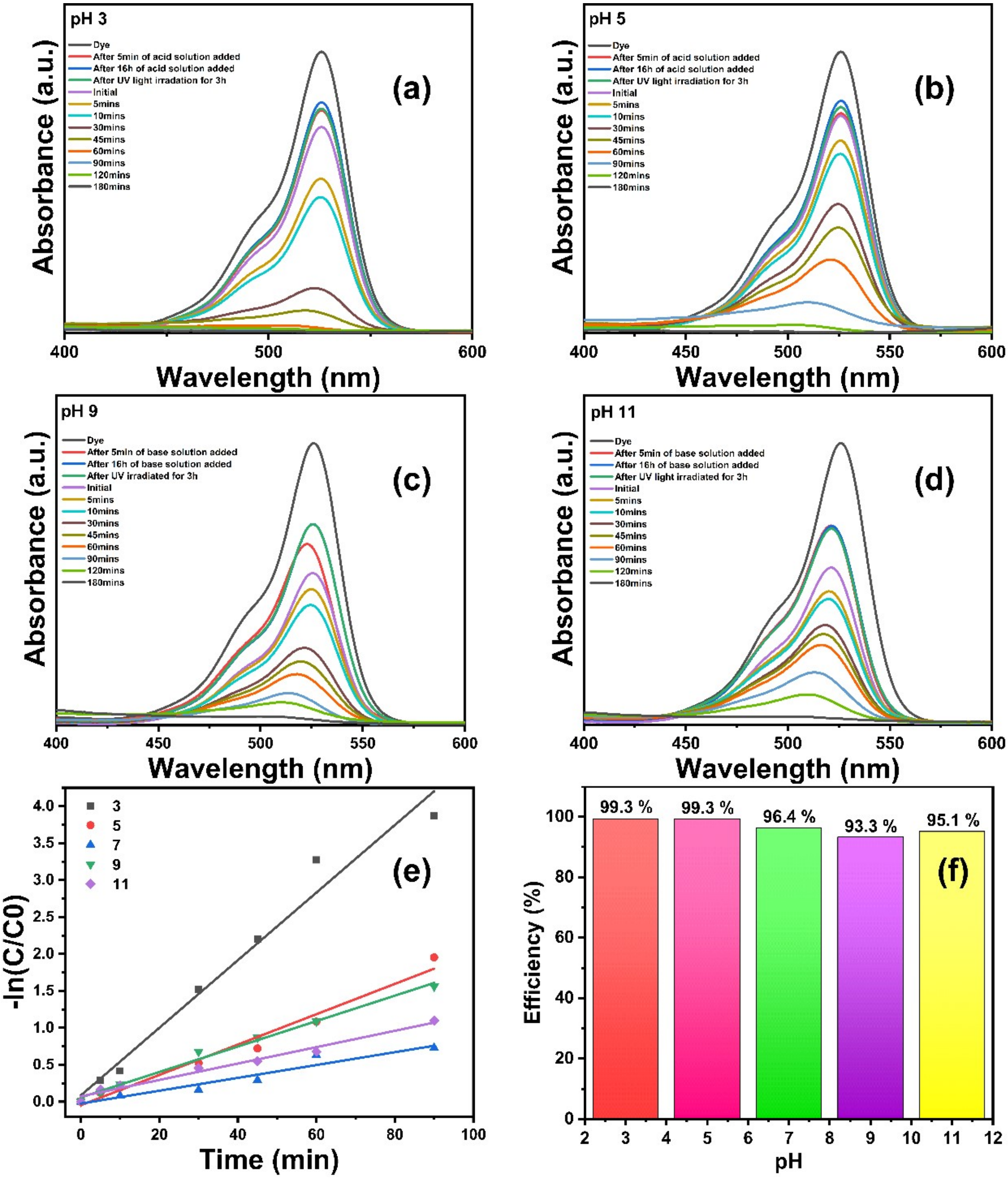

Figure S8: Effect of pH on degradation of Rh-6g using g-C_3N_4 photocatalysts under UV light. (a) pH 3, (b) pH 5, (c) pH 9, (d) pH 11, (e) Rate constant, (f) Efficiency bar graph for 180 min.

4.5 RECYCLE AND STABILITY TEST ON g-C_3N_4 IN Rh-6G DYE

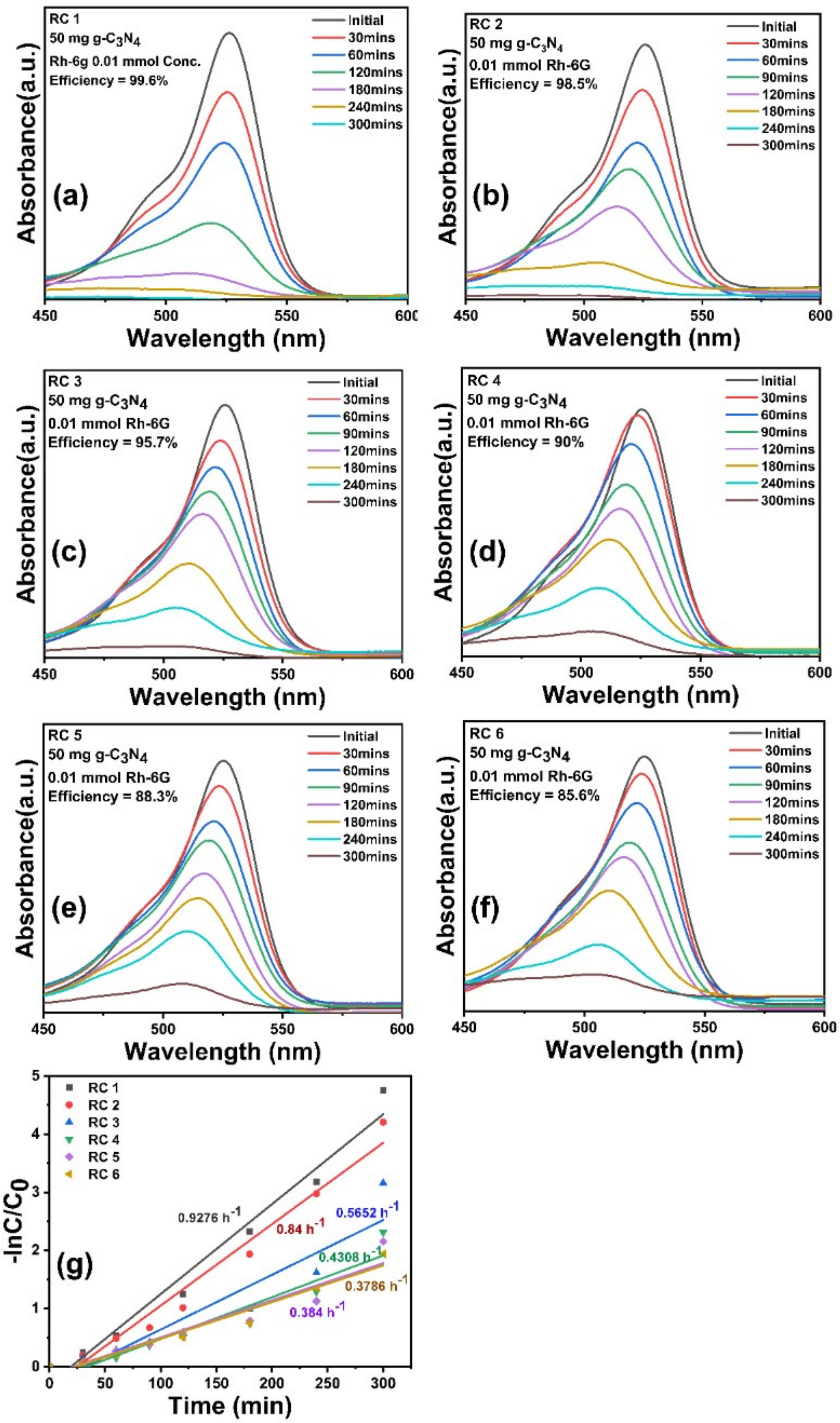

Figure S9: Recyclability of g-C_3N_4 photocatalyst under UV light illumination in six runs of cycles. (a) RC1, (b) RC2, (c) RC3, (d) RC4, (e) RC5, (f) RC6, (g) Rate constant.