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Solar-driven photodegradation of 17-β-estradiol and Ciprofloxacin from waste water and CO_2 conversion using sustainable Coal-char/polymeric-g-C_3N_4/RGO metal free nano-hybrids

Amit Kumar[a]*, Ajay Kumar[a], Gaurav Sharma[a], Mu Naushad[b], Florian J Stadler[d]

*[a]*School of Chemistry, Shoolini University, Solan, Himachal Pradesh, India-173229*
[b]Department of Chemistry, College of Science, Building#5, King Saud University, Riyadh, Saudi Arabia-11451
[d]College of Materials Science and Engineering, Shenzhen Key Laboratory of Polymer Science and Technology, Shenzhen University, Shenzhen, 518060, PR China

Email: mittuchem83@gmail.com

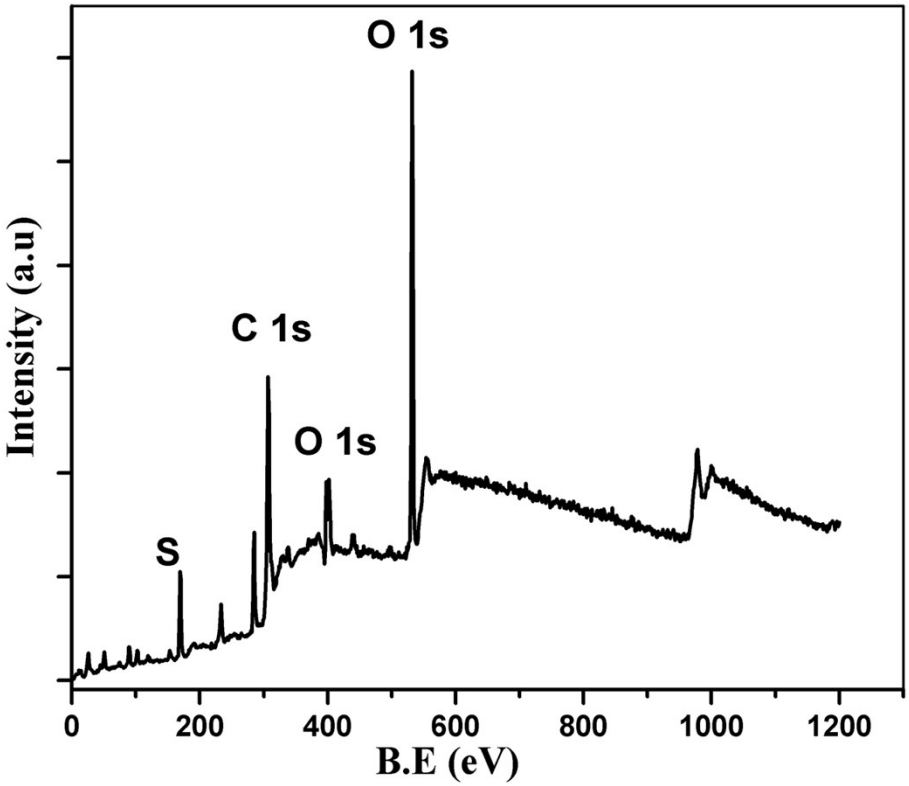

Figure S1 XPS spectrum of RPC

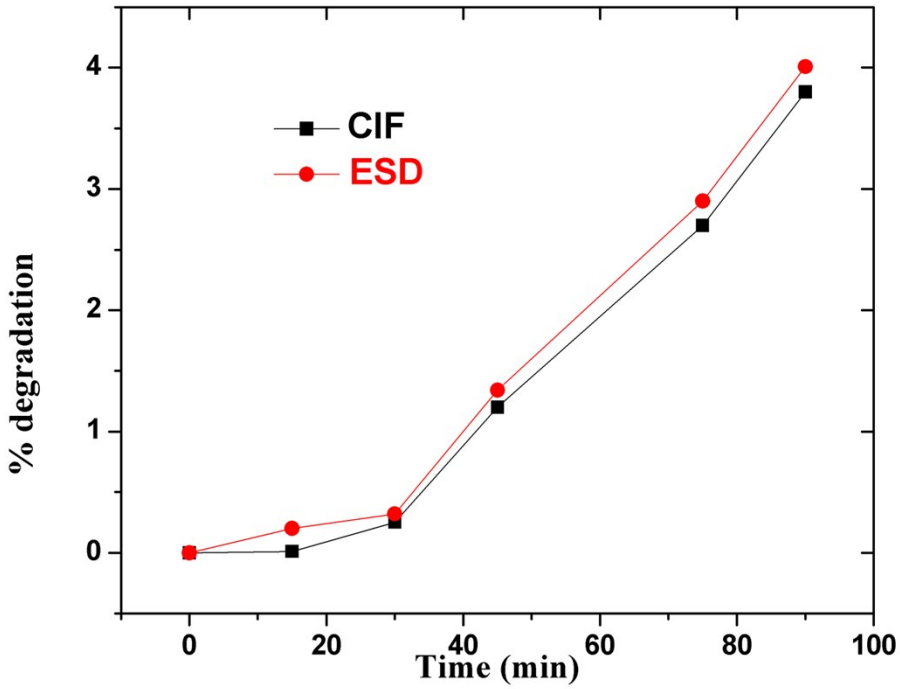

Figure S2 Photolysis of CIF and ESD under solar light

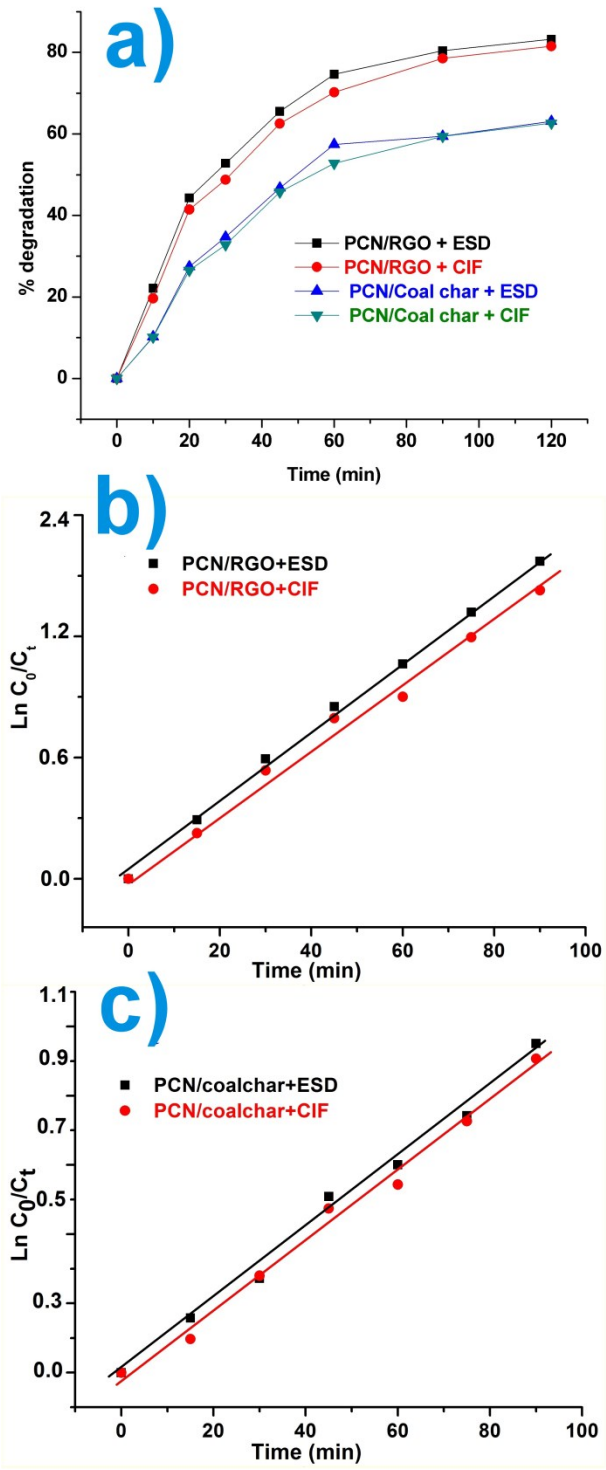

Figure S3 (a) Degradation of ESD and CIF in presence of binary photocatalysts (b) Reaction kinetics for degradation in presence of PCN/RGO (c) Reaction kinetics for degradation in presence of PCN/Coal char

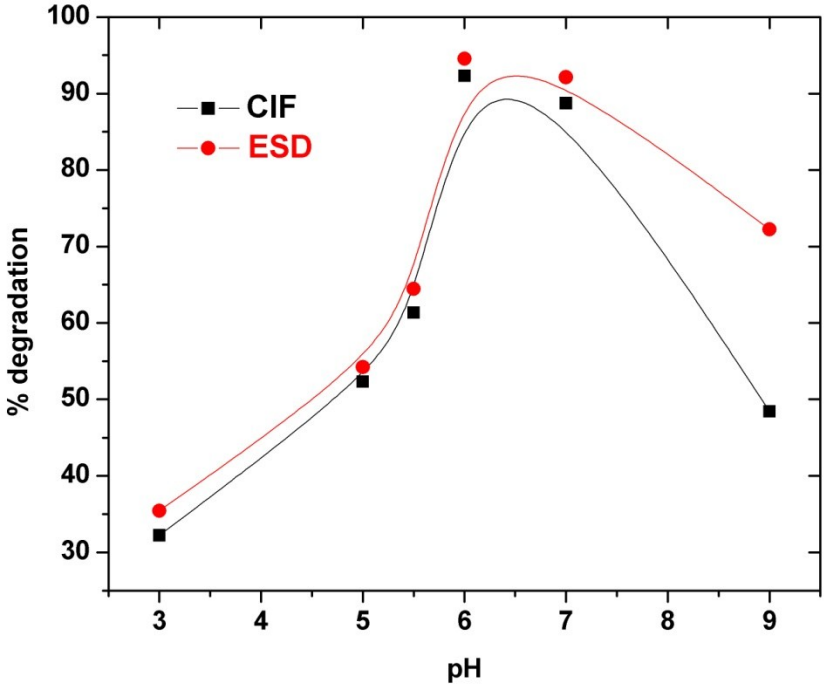

Fig S4 Effect of pH on photodegradation of ESD and CIF in presence of RPC

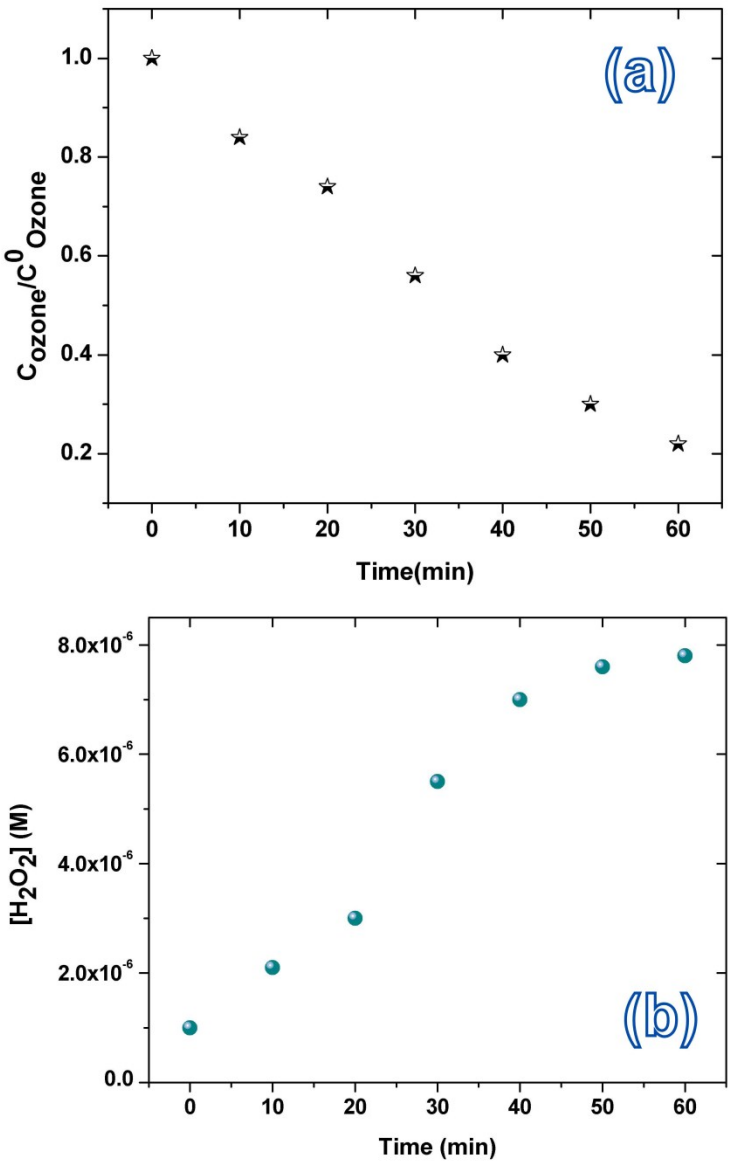

Figure S5 (a) Time-evolution of aqueous ozone concentration during the course of batch ozone decomposition experiments (b) Concentration of H_2O_2 evolved during phot-decomposition of ozone

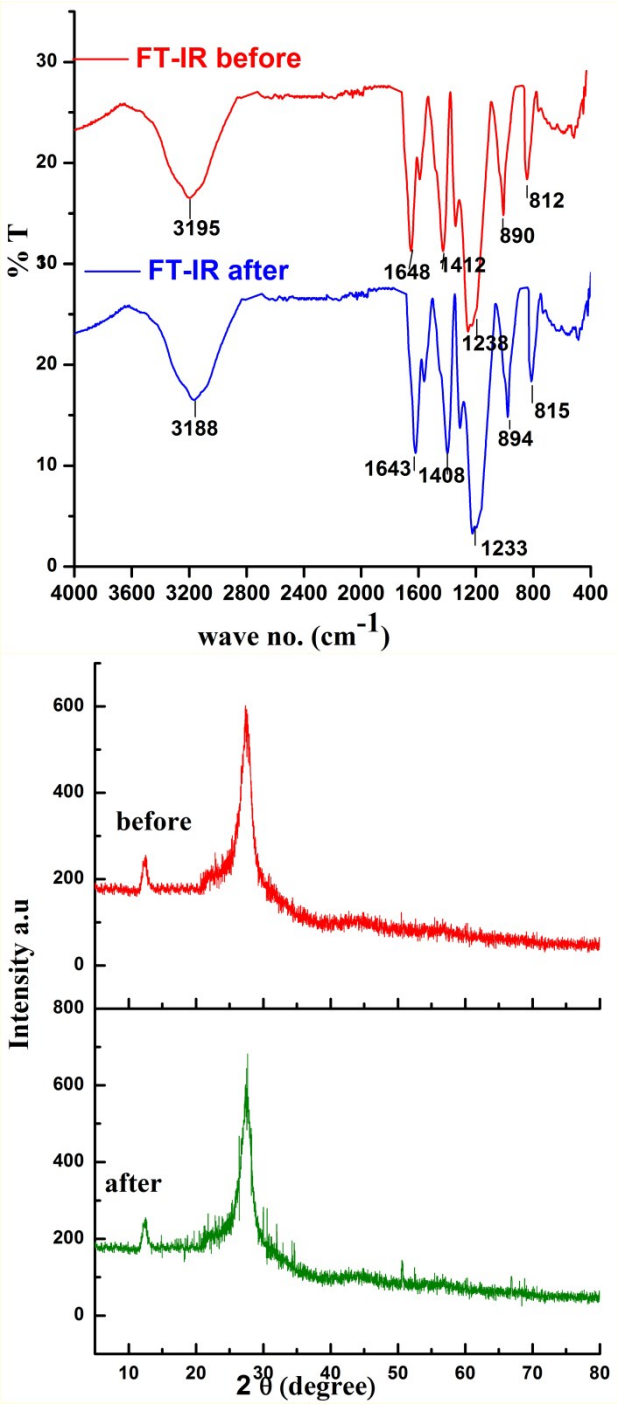

Figure S6 (a) FTIR spectrum & (b) XRD pattern of RPC after recycling

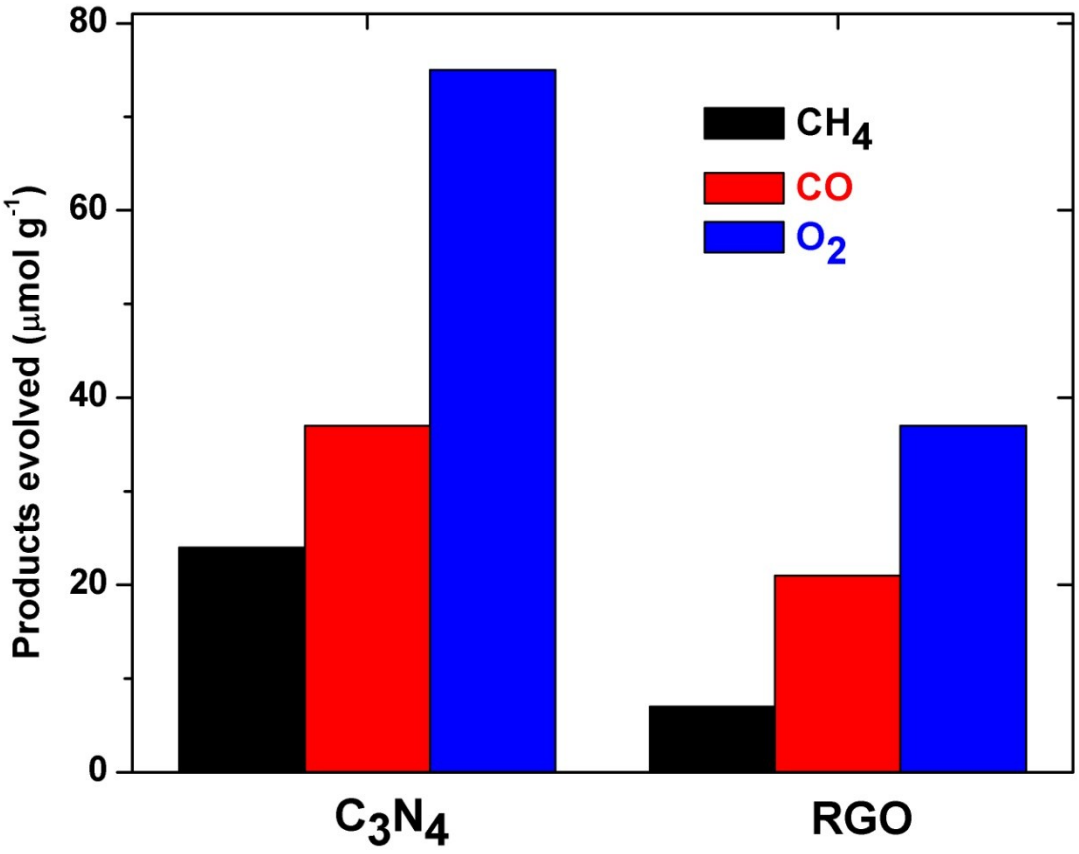

Figure S7: Product amounts evolved during the photo-catalytic CO_2 conversion by $C_3N_4$and RGO

2.3 S Coal char production from Bio-fuel reactor

The biofuel was obtained from a mixture in the ratio (1: 1: 1: 1): 1 (coffee grounds: eucalyptus sawdust: soybean oil: lime): sand (mass ratio). To this mixture calcium oxide (up to 20% in mass) and water was added to produce a crushed mass in order to catalyze the cracking process. The sand has the purpose of facilitating the heat exchange and increase the diffusivity of the reaction product in the bed, avoiding abrupt vaporization, which causes clogging in the system. The crushed mass was filled in a ceramic taped crucible and kept in an electric muffle furnace and pyrolyzed at 500 ˚C in electrically heated stainless steel reactor with a heating rate 5 °C/min in nitrogen atmosphere for 5h.

The products are: Bio-fuel from pyrolysis- isolated at 100 °C) and Bio-fuel from pyrolysis- isolated at 5 °C , Bio-fuel after Cracking- isolated at 100 °C, Bio-fuel after Cracking isolated at 5

°C. The pyrolysis process also produced significant organic compounds such as furanmethanol, hexanol, benzofuran of high commercial value.

The average yield of the pyrolysis process is approximately 30% oil fractions, 30% aqueous fractions, and 20% gas phase and 20% coal-char.

2.8 S1 Radical scavenging experiment

The radical trapping experiments were performed to trap active species involved in present photodegradation experiment. The well-known radical scavengers 4-hydroxy-2,2, 6,6-tetramethylpiperidinyloxy (TEMPOL), triethanolamine (TEOA) and ammonium oxalate (AO) were employed which selectively scavenge $O_2^{\bullet -}$, h^+ and $HO^{\bullet}$.

2.8 S2 Stability and Reusability

The stability and reusability of a composite through the whole photocatalytic activity is an important aspect to evaluate its performance. Thus the photocatalytic efficiency of RPC was investigated by studying ESD and CIF photodegradation for five consecutive cycles. The XRD and FTIR study of RPC were also carried out after the photocatalytic degradation of respective pollutants to check the stability.

Table S1: Optical parameters

Photocatalysts	**X (PAE)**	**E_{VB} (eV)**	**E_{CB} (eV)**	**Eg (eV)**
PCN	4.64	1.25	-0.97	2.47
g-C_3N_4	4.64	1.51	-1.23	2.75
RPC	-	-	-	2.20
RGO	-	-	-	-0.08 (Fermi level)

Table S2: Kinetics parameters for adsorption of CIP and ESD

Pollutant	**Pseudo-second order**		
	q_2 (mmol/g)	**k_2 (g/(mmol/min))**	**R^2**
CIP+RPC	47.16	0.0070	0.996
ESD+RPC	44.84	0.0059	0.994