Supporting information

S1. Nicotine degradation by GO system under UV light illumination

1mM nicotine solution (pH 7) was considered as an initial concentration and used 3mg of GO samples. The solution was irradiated under UV-light. After a time interval the optical density of the solution was measured using UV-visible spectroscopy at a wavelength (λ=) 259 nm. This experiment was done at 30 ^{O}C. In the figure S1, there is no significant decrement of the optical density peak after 180 min.

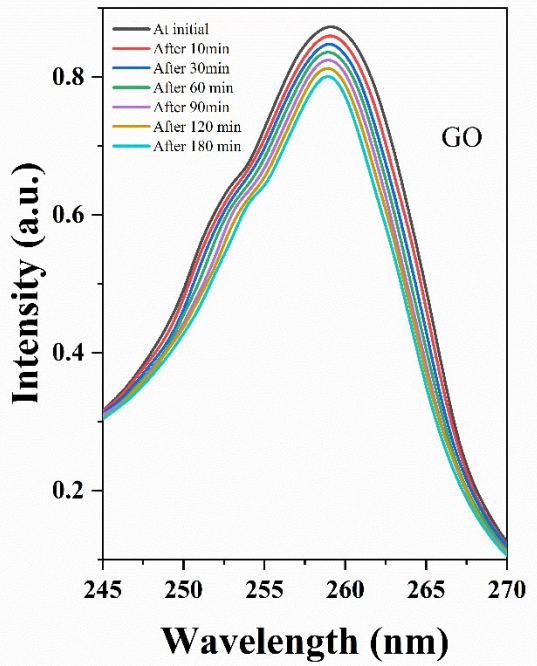

Figure S1: Nicotine degradation by GO samples by measuring the optical density at λ=259nm against irradiation time. Experimental conditions: intitial concentration of solution:1mM, pH:7.0, Temperature: 30 ^{o}C; Amount of GO: 3mg.

S2. O_2•- generation kinetics of GO rGO and rGO-TiO_2 systems under UV irradiation.

XTT solution (100 μM) was used to detect the O_2•$^{-}$. After reaction with O_2•$^{-}$, XTT-formazan are produced which give an absorption peak at wavelength (λ) 470 nm. Here we

have used 3mg of the synthesized rGO-TiO_2 and TiO_2 NPs in 50mL of XTT solution and kept under light and UV-irradiation for 20h at 30 ^oC temperature.

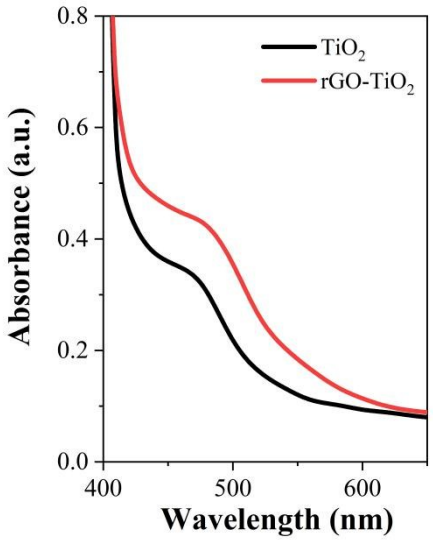

Figure S2: O2●- generation kinetics of rGO-TiO_2 system and TiO_2 NPs under UV irradiation as directed by the XTT (100 µm) reduction after 20h UV irradiation.

S3. EDS of rGO-TiO_2

The elemental analysis of the synthesized composite (rGO-TiO_2) has been done using EDS equipped with electronic microscope. Only Ti, O and C atoms have found in the spectrum.

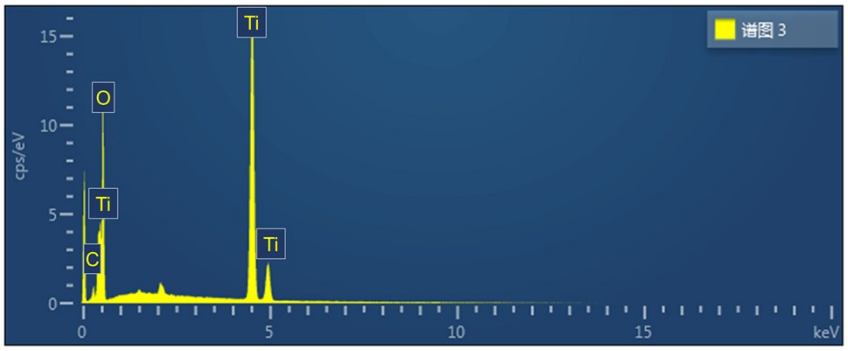

Figure S3: EDS spectrum of rGO-TiO_2

S4: Reusability and stability of as-prepared composite.

The most essential factor is the reusability and stability of the photocatalyst for the field applications. The recyclability of the rGO-TiO_2 catalyst is examined at optimal conditions

within 90 min. After five cycles of catalytic reaction, the rGO-TiO_2 NPs show significant catalytic potential (see Fig. S4). The nicotine degradation rate is varied between cycles and reduced slightly after 5 cycles. The catalytic conversion of nicotine is higher than 96% in every cycle. The high conversion after 5 cycles signifies its potential as a catalyst of toxic nicotine for sustainable development and could be a efficient catalyst owing to its great reusability performance.

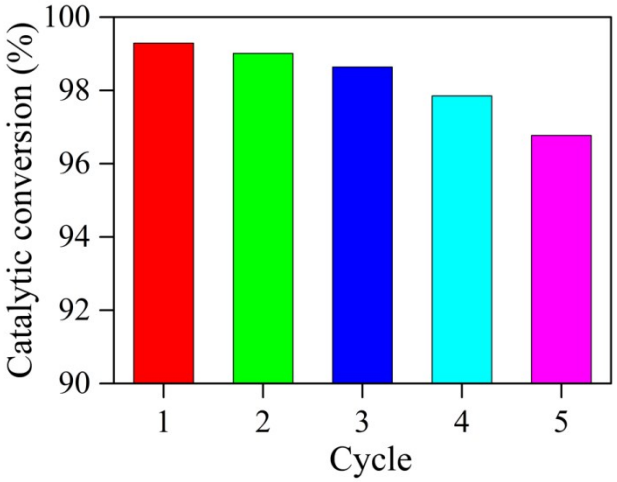

Figure S4: Catalytic conversion of Nicotine by using recycled rGO-TiO_2 for different cycle numbers.

S5: Mineralization studies

Mineralization efficiency of the system is calculated using the equation: Mineralization ratio=$(1\text{-}TOC_t)/TOC_0$) x 100% where TOC_t and TOC_0= total organic carbon concentrations in the solution at t time and initial time. TOC analysis was used to explore the extent of carbon–carbon bonds in the organic compounds, carried out at selected conditions. Figure shows the TOC removal of the system for different irradiation times. The TOC removal was 100% after 240 min.

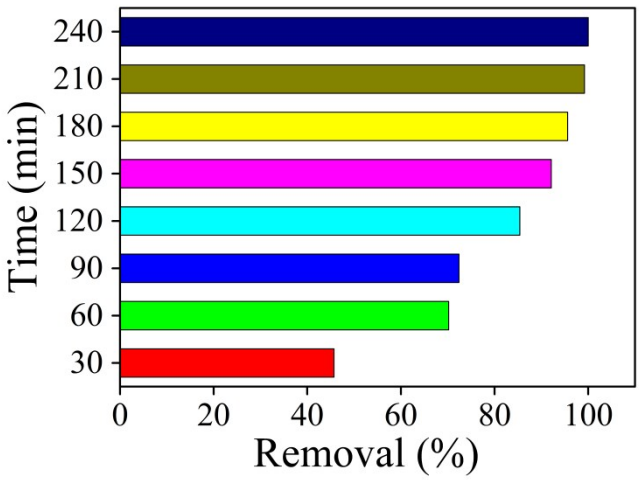

Figure S5: TOC during nicotine decontamination under UV irradiation

S6: Photoluminescence (PL) Intensity:

Photoluminescence spectroscopy (PL) was employed specially to characterize the recombination probability of rGO-TiO_2 and TiO_2 photocatalysts. Figure S5 shows the photoluminescence spectra of rGO-TiO_2 and TiO_2 composites. PL spectra are recorded on JascoFP-8300 spectrometer in the wavelength range of 420–520 nm, using an excitation wavelength of 380 nm. PL spectra in the wavelength range 420–520 nm with the emission peaks at 438 nm and 471 nm are due to the band edge free excitons. Similarly, the excitonic PL signal centered at 494 nm is directly related to defects in the photocatalysts.[1] Very importantly, it is immediately noticeable that the luminescence intensities of the rGO–TiO_2 composites are generally lower compared to pristine TiO_2, confirm the lower electron–hole recombination probability and the defective structures in the rGO-TiO_2 photocatalyst. The outcomes indicate the photogenerated electrons from TiO_2 can be transferred into carbon atoms on the rGO sheet, charge recombination is reduced, rGO–TiO_2 is more efficient for surface oxygen vacancies and defects.

[1] L. Jing, H. Fu, B. Wang, D. Wang, B. Xin, S. Li and J. Sun, Appl. Catal., B, 2005, 62, 282

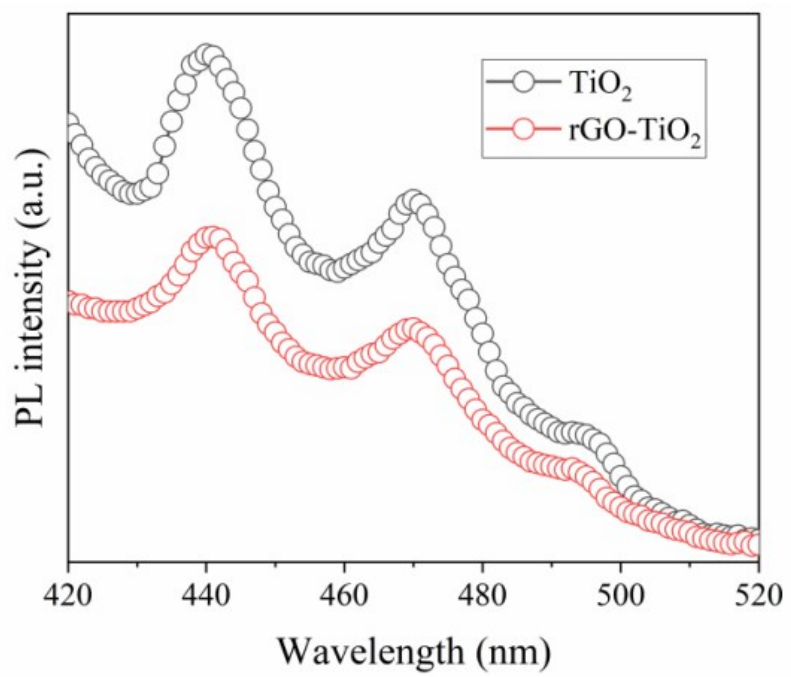

Figure S6: Photoluminescence spectra of pure TiO_2 and rGO–TiO_2