Supporting Information:

A biomass carbon mass coated with modified TiO_2 nanotubes/graphene for photocatalysis

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Fig. S1 The TEM image of the aggregation of nanotubes in composite.

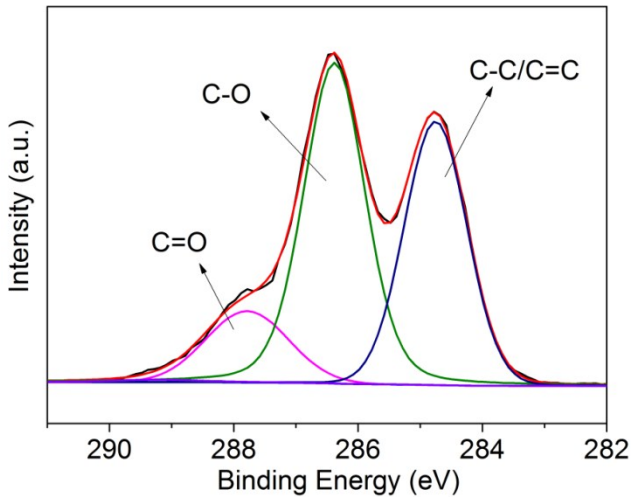

Fig. S2 The C 1s high resolution XPS spectra of GO.

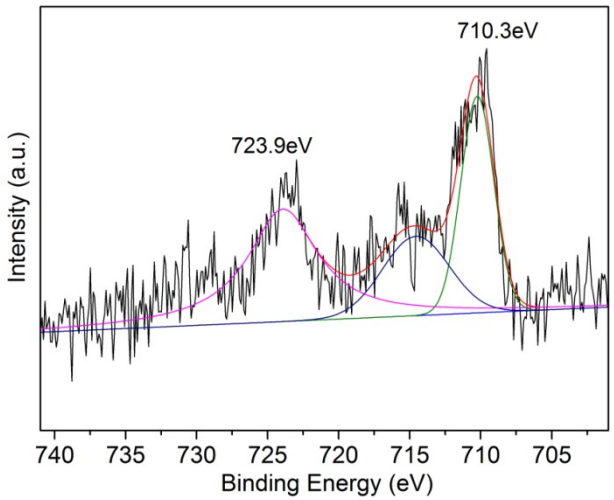

Fig. S3 The Fe 2p high resolution XPS spectra of Fe_2O_3.

Table S1

Different Fe/N-TNTs/NG composites for the degradation of methylene blue at same condition.

Parameters	1	2	3	4	5	6	7	8	9	10
Fe/TNTs (%)	0	0	0	0	1	1	2.8	3.4	3.8	4
N/TNTs	0	0.5	3	10	0	3	4.2	3.4	6	4
C/C_0	0.211	0.392	0.701	0.509	0.409	0.811	0.918	0.941	0.886	0.956

11	12	13	14	15	16	17	18	19	20
4.6	5	5	5	5	5	7	10	10	10
4	6	0	0.5	3	10	3	0	3	10
0.933	0.852	0.523	0.795	0.889	0.645	0.693	0.181	0.452	0.204

Note: Fe/TNTs (10^2·g/g) is the mass ratio of $Fe(NO_3)_3·9H_2O$ and TNTs; N/TNTs (g/g) is the mass ratio of urea and TNTs; C is the concentration of methylene blue and C_0 is the initial concentration of methylene blue. .

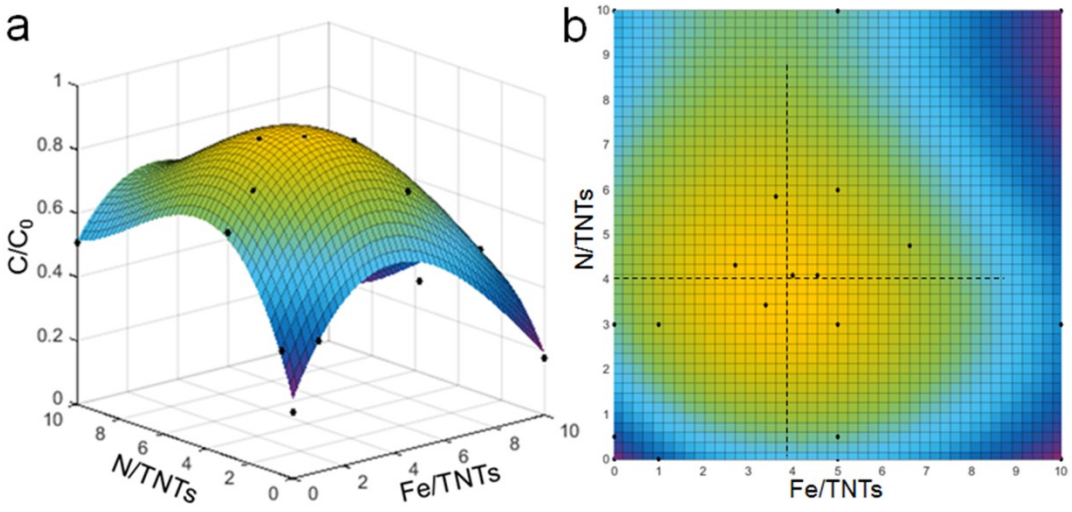

Fig. S4 (a) 3D fitting curved surface for the effect of sample N/TNTs and Fe/TNTs on degradation of methylene blueand (b) the planform of the 3D fitting curved surface.

Considering the different photocatalytic performance of Fe/N-TNTs/NG composites with

different contents of Fe and N elements, it was necessary to study the photocatalytic activities of Fe/N-TNTs/NG composites with different additions of urea and $Fe(NO_3)_3 \cdot 9H_2O$. As shown in Fig. S4a, Twenty different groups of Fe/N-TNTs/NG samples displayed their different photocatalytic degradation efficiencies within 100 min under the same condition and the data was analyzed by a polynomial fitting. As a result, a 3D fitting curved surface formed and demonstrated the effect of different N/TNTs and Fe/TNTs on methylene blue degradation. Fig. S4b shows the planform of the 3D fitting curved surface, it is easy to find that the center of luminous yellow area was near the coordinate (4, 4). That means the sample of Fe/N-TNTs/NG at the ratios of N/TNTs (4:1) and Fe/TNTs (4:1) present the best photocatalytic performance.

Table S2
The bonding energy of each element on TNTs/GO, N-TNTs/NG and Fe/N-TNTs/NG.

Element	Chemical bonds	Bonding Energy (eV)		
		TNTs/GO	N-TNTs/NG	Fe/N-TNTs/NG
O1s	C-O	530.38	530.49	530.53
	O-Ti-N	—	531.42	531.39
	O-Ti	532.61	532.59	532.67
C1s	C=C	284.75	284.74	284.74
	C=N/C-O	286.62	285.35	285.33
	C-N/C=O	287.33	287.72	286.74
	Ti-O-C	289.24	289.19	289.20
Ti 2p	Ti 2p1/2	464.81	464.79	464.71
	Ti 2p3/2	459.15	459.11	458.94
N1s	Pyridinic N	—	398.55	398.52
	Pyrrolic N/O-Ti-N		400.06	400.02
	Quaternary N		401.59	401.64
Fe 2p	Fe 2p3/2	—	—	711.50
	Fe 2p1/2			724.80

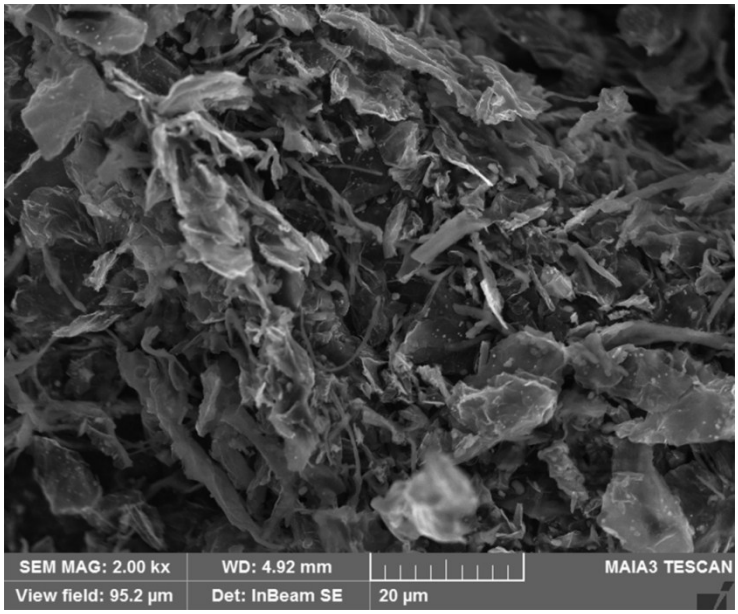

Fig. S5 SEM image of FH~Fe/N-TNTs/NG after the fourth cycle.