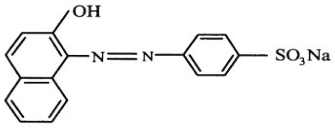
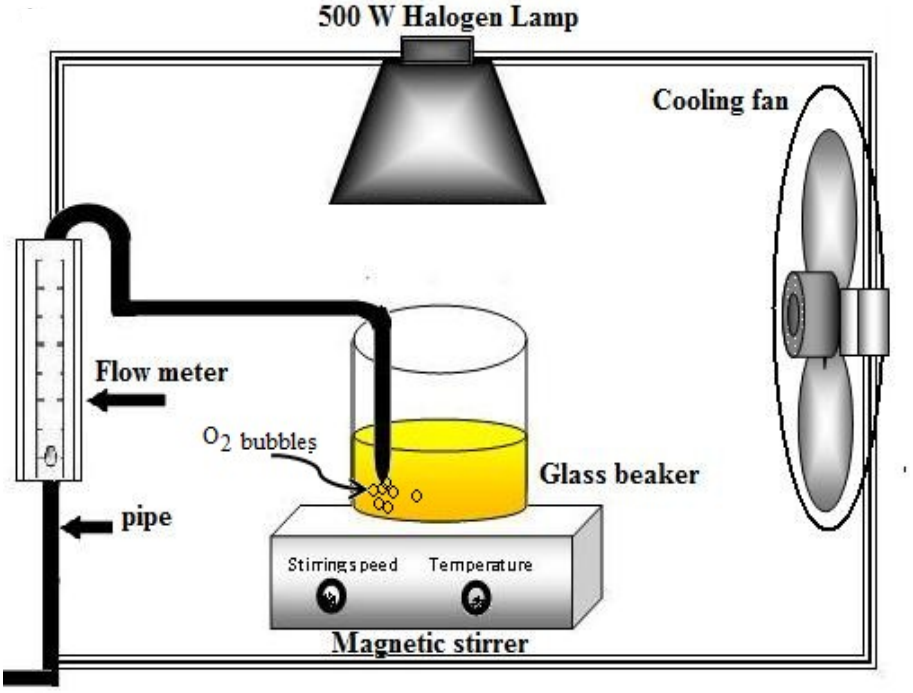
Supplementary materials

S 1 Orange II specifications

Commercial name	Orange II sodium salt
Synonym	Acid Orange 7
Classification	Azo
Molecular Formula	$C_{16}H_{11}N_2O_4SNa$
Molecular Weight	350.3 g mol^{-1}
Physical form	Dark orange-brown powder
λ max	483-487nm
CAS Number	633-96-5
Color Index Number	15510
EC Number	211-199-0
MDL number	MFCD00011657
CA Index name	4-(2-Hydroxy-1-naphthylazo), Benzene sulfonic acid, monosodium salt
pH range	7.4 – 8.6, 10.2- 11.4
Solubility	very soluble in water (130 mg·mL^{-1}), slightly soluble in ethanol (4 mg·mL^{-1})
Chemical structure	



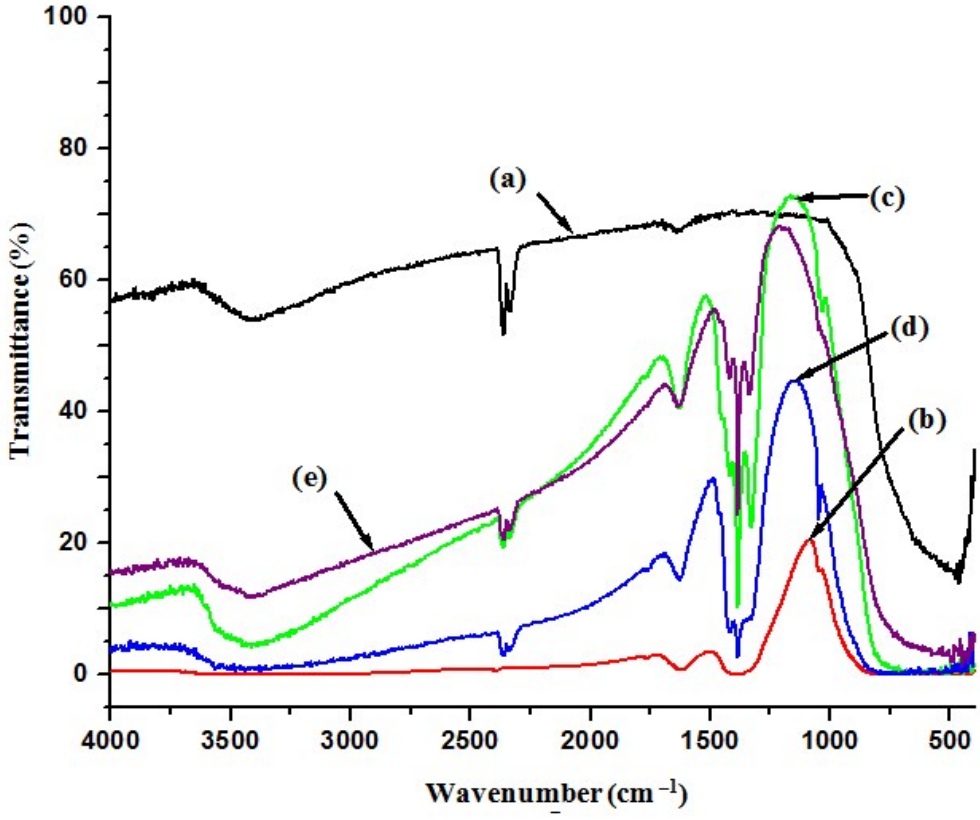
S 2 Experimental setup

S 3 Comparison of related process occurring during TGA

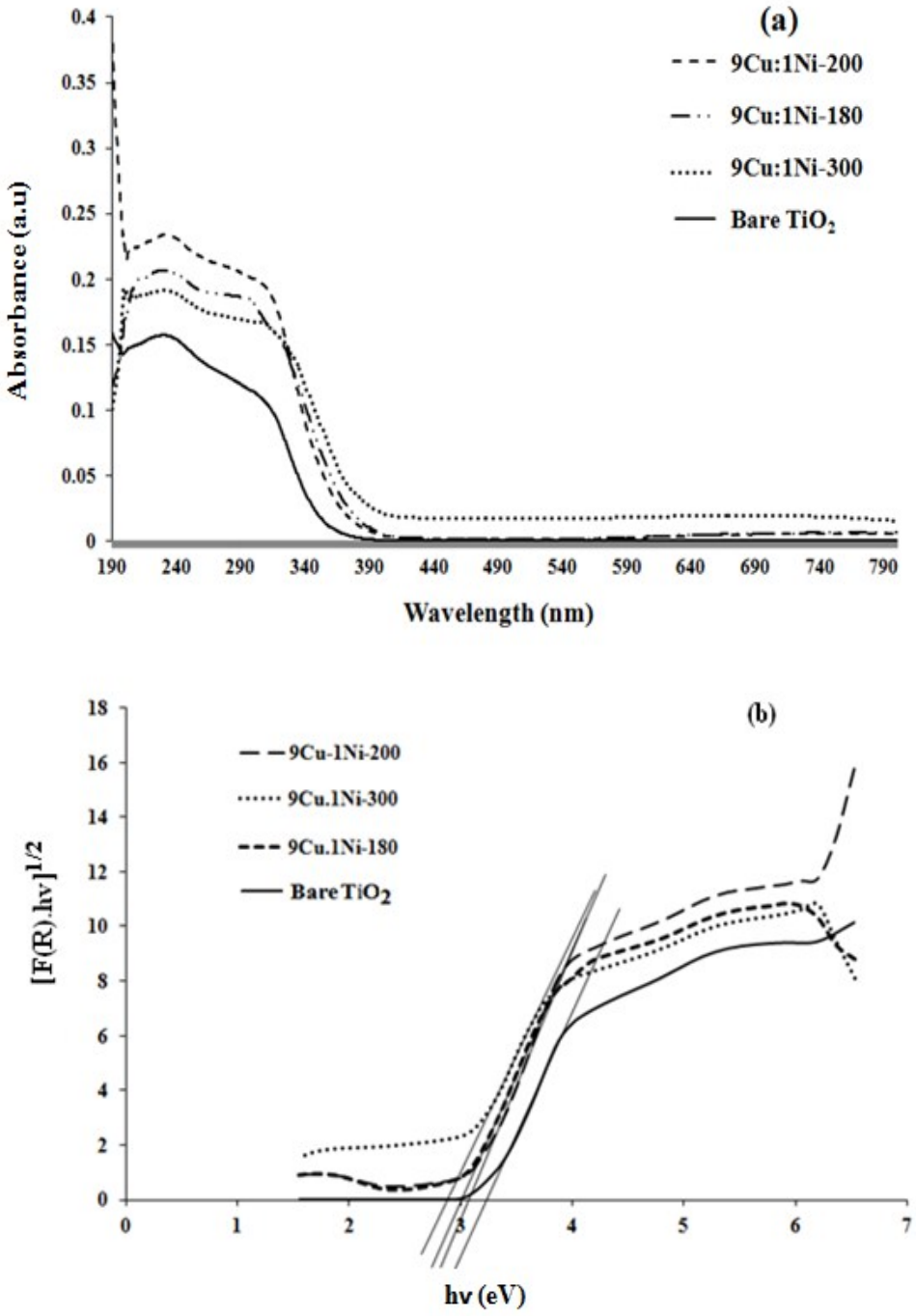
Steps	Temp. range(°C)	Total drop in mass (%)	Related process occurring
1	30–150	26.45	Evaporation of adsorbed water
2	150–400		Decomposition of $Cu(NO_3)_2$& $Ni(NO_3)_2$ to metal oxide

S 4 Assignment of absorption peaks observed in FTIR spectra of bare TiO_2 and Cu:Ni/TiO_2 photocatalysts

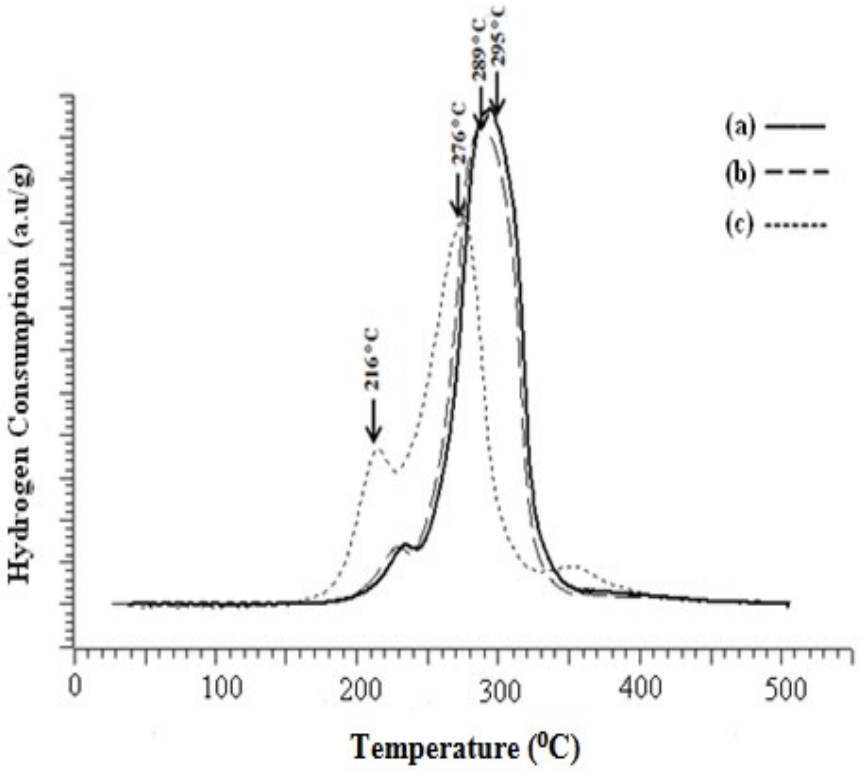
Peaks(cm^{-1})	Possible assignment	Related process occurring
1600, 3400	H–O–H bending O–H stretching of hydroxyl group	Physically adsorbed moisture
1384	NO_3^- anion	Presence of nitrate



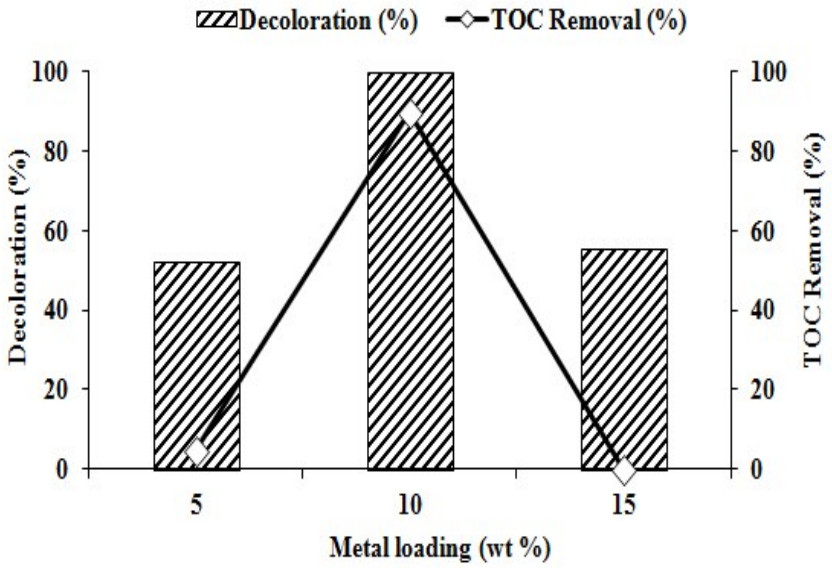
S 5 FTIR spectra of (a) bare TiO_2; 9Cu:1Ni/TiO_2 photocatalysts: (b) raw and calcined at (c) 180°C, (d) 200°C and (e) 300°C



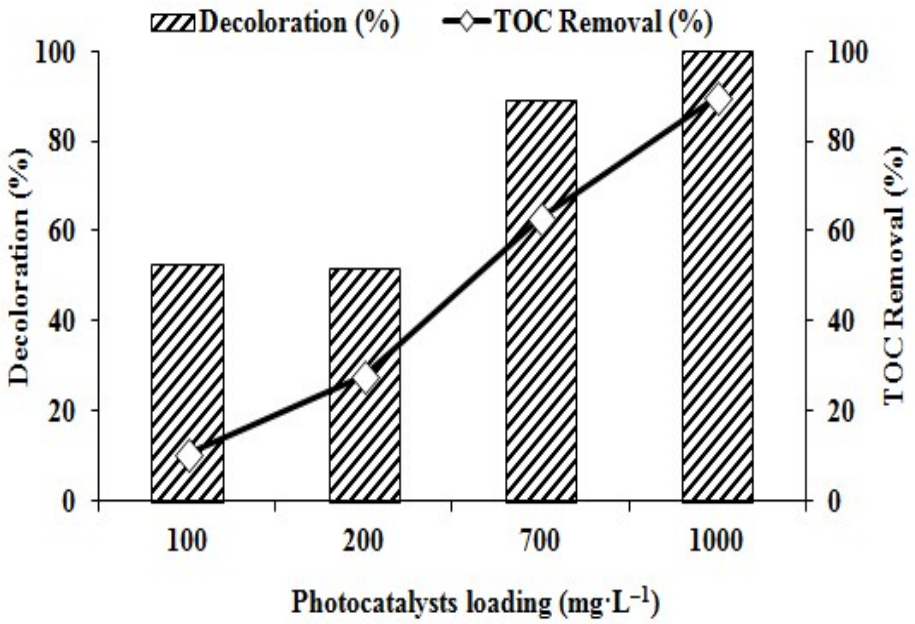
S 6 (a) Absorption spectra and **(b)** Plot of transformed Kubelka-Munk functions $[F(R).hv]^{1/2}$ vs hv for WI photocatalysts with different calcination temperature



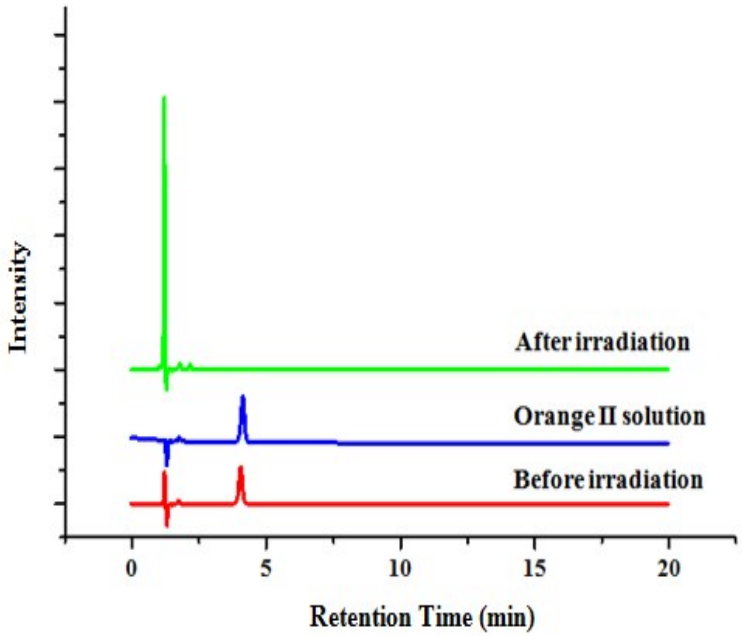
S 7 The TPR profiles of WI-9Cu:1Ni photocatalysts calcined at different temperatures (a) 9Cu:1Ni-200, (b) 9Cu:1Ni-180 and (c) 9Cu:1Ni-300



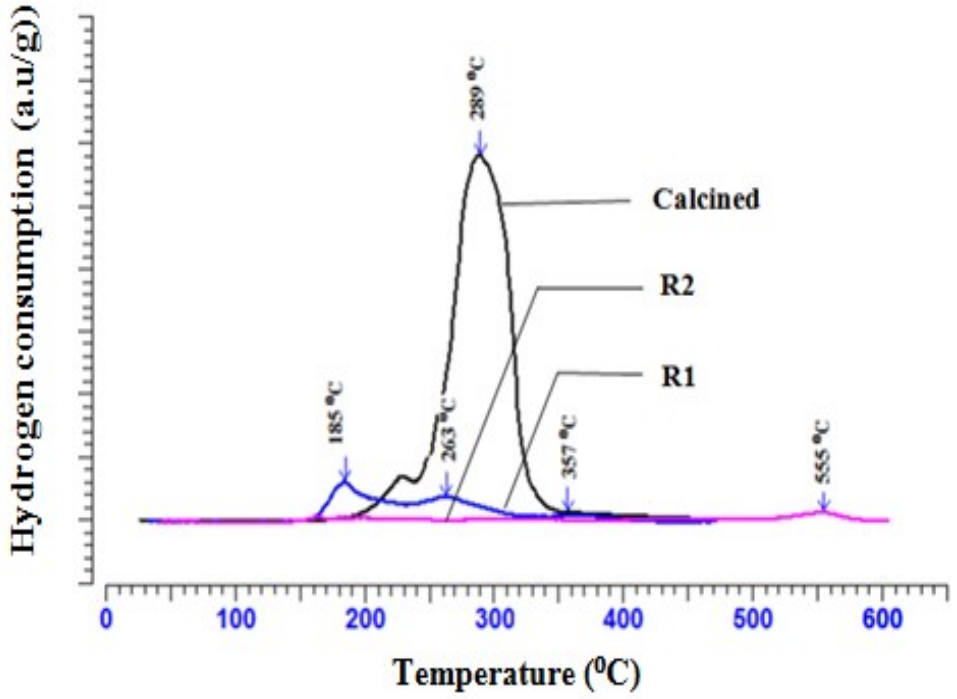
S 8 Effect of metal loading on Orange II decoloration



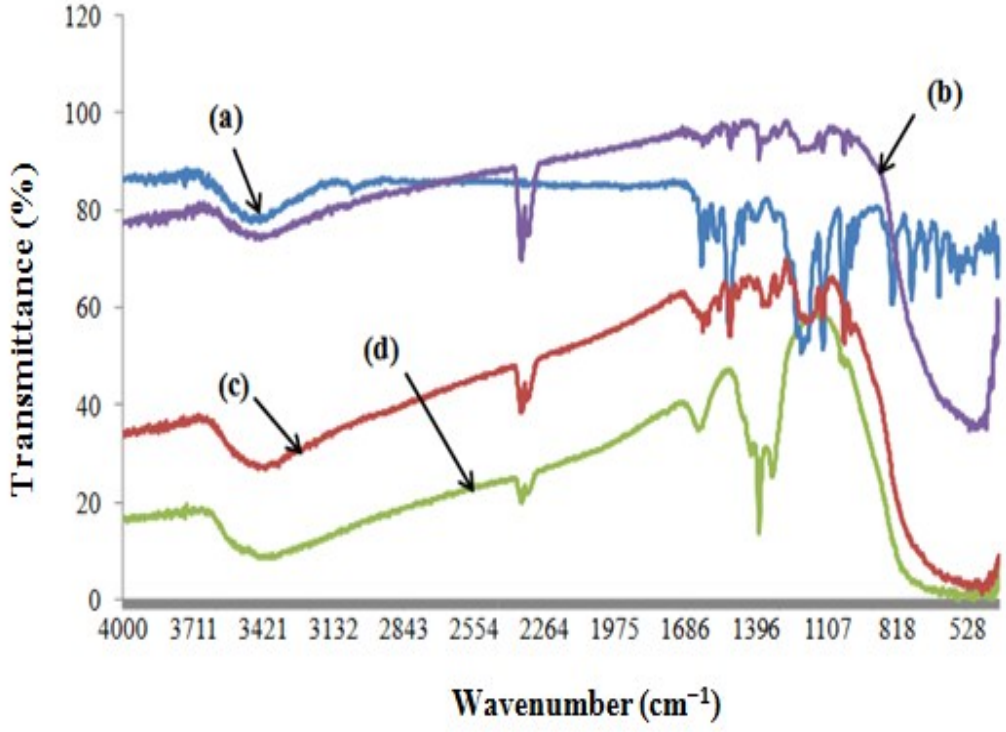
S 9 Effect of photocatalysts loading on Orange II decoloration at pH 6.8



S 10 Chromatogram for Orange II and WI photocatalysts samples before and after reaction(1 h reaction duration)



S 11 TPR profile of fresh and recycled photocatalyst



S 12 FTIR spectra of (a) Orange II and 9Cu:1Ni-200 after reaction: (b) washed, (c) unwashed and (d) 9Cu-1Ni-200 before reaction