Electronic Supplementary Material (ESI) for RSC Advances.

Platinum supported reduced graphene catalyst to enhance the hydrogenation of nitro compound activity

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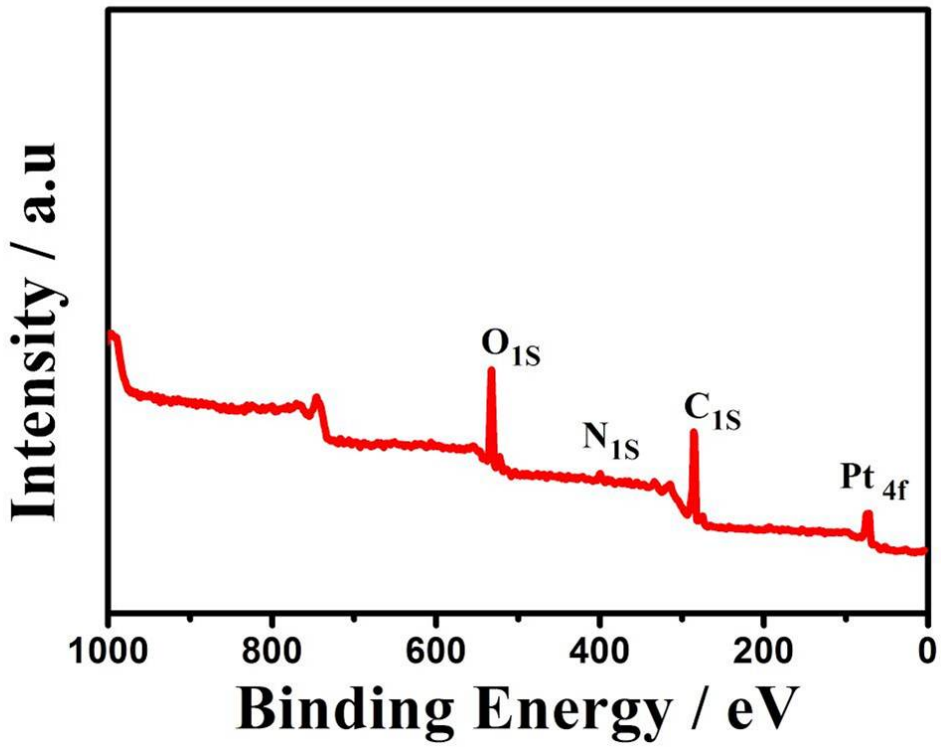

Figure S-1: XPS spectra of full scale servey pattern of Pt/RG-N catalyst.

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When, the concentration of $NaBH_4$ is 10 and 20 mM while keeping the catalyst amount 12.5 µg, the reduction process took 11 and 9 min with rate constant value 25×10^{-2} and 29×10^{-2} min^{-1}, respectively as shown in Fig. S-2. This indicates concentration of $NaBH_4$ also effect the reduction of nitro compound.

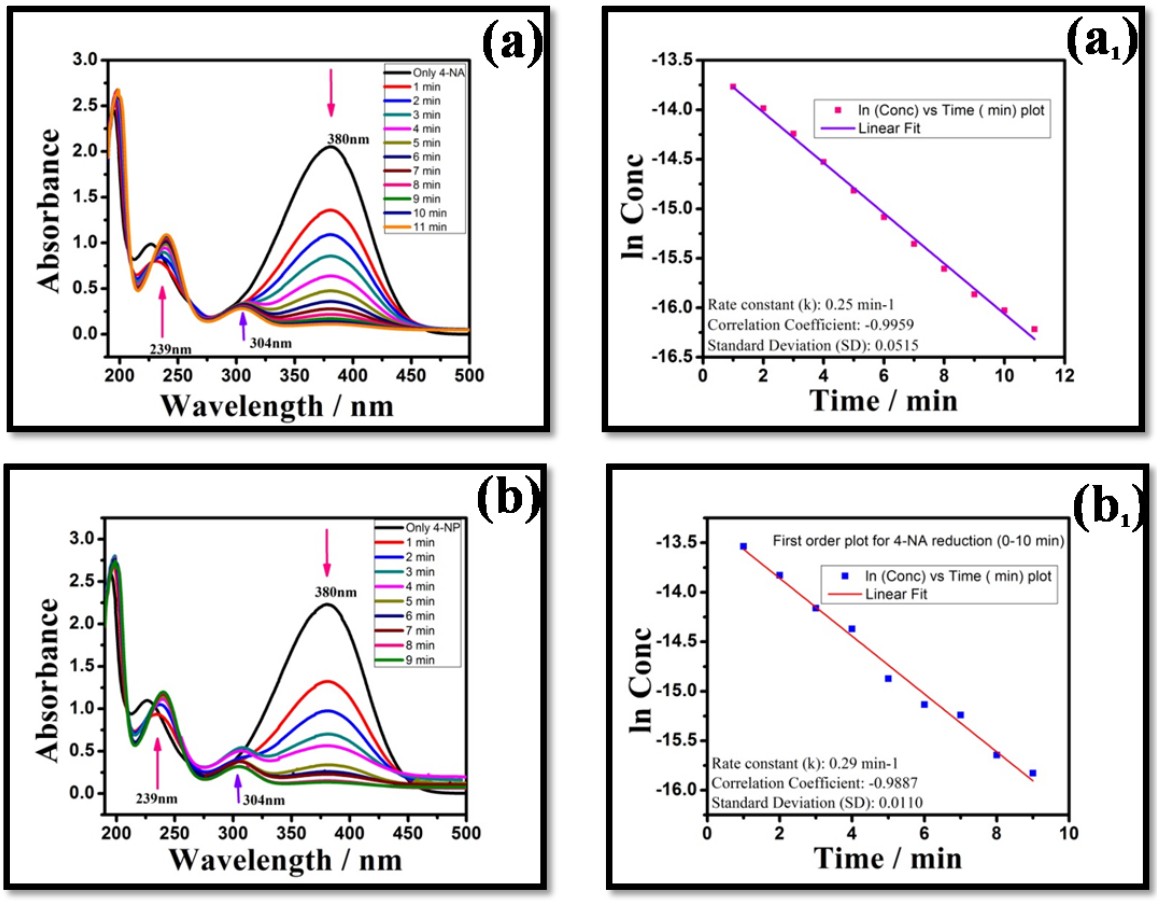

Figure S-2: UV – Vis spectra for the successive reduction of 4- NA to p- PDA by $NaBH_4$ in the presence of Pt/RG (12.5 µg) where $NaBH_4$ concentration (a) 10 mM, (b) 20 mM, and (a_1, b_1) corresponding plot of ln Conc vs. time (min).

It can be seen that the reduction of 4NA in presence of $NaBH_4$ solution alone is sluggish and about 5 to 6 % reduction took place even after 30 min of reaction as seen from UV-Vis spectrum (Fig. S-3). Earlier reports on reduction of organic nitro compound in the presence of $NaBH_4$ suggest more than 430 min without any catalyst. This signifies that the expected catalytic reaction does not take place in the absence of any catalyst, probably due to the

presence of some kinetic barrier which prevents the required electron transfer for the catalytic reaction to take place. Therefore, catalyst is always essential to enhance the catalytic reaction. In this regard Ag, Au, and Ag-Au (I) nano particles are already explained in the literature to catalyze the reduction reaction. However, literature says, these solutions take 150, 120 and 100 min, respectively to completely reduce the nitro compound. This indicates, only metal nano particles has poor catalytic performance for the reduction of nitro compounds possibly due to the aggregation of these metal nano particles in the solution. In addition, noble metal nano particle based catalysts often suffer from poisoning by the reaction product during the catalytic reaction. Carbon based noble metal decorated supports as catalysts are recently found more attention due to the electronic perturbation that is induced in the metallic component such as (Pt NPs). Reduced graphene being high conductive material, when decorated with Pt NPs enhances the Pt/RG interaction, and electron transfer between Pt NPs and the two dimensional sheet of the large Sp^2 hybridized carbon, which may affect the chemical nature of the 4-NA adsorbed onto the Pt surface and there by enhances the catalytic performance of the Pt NPs

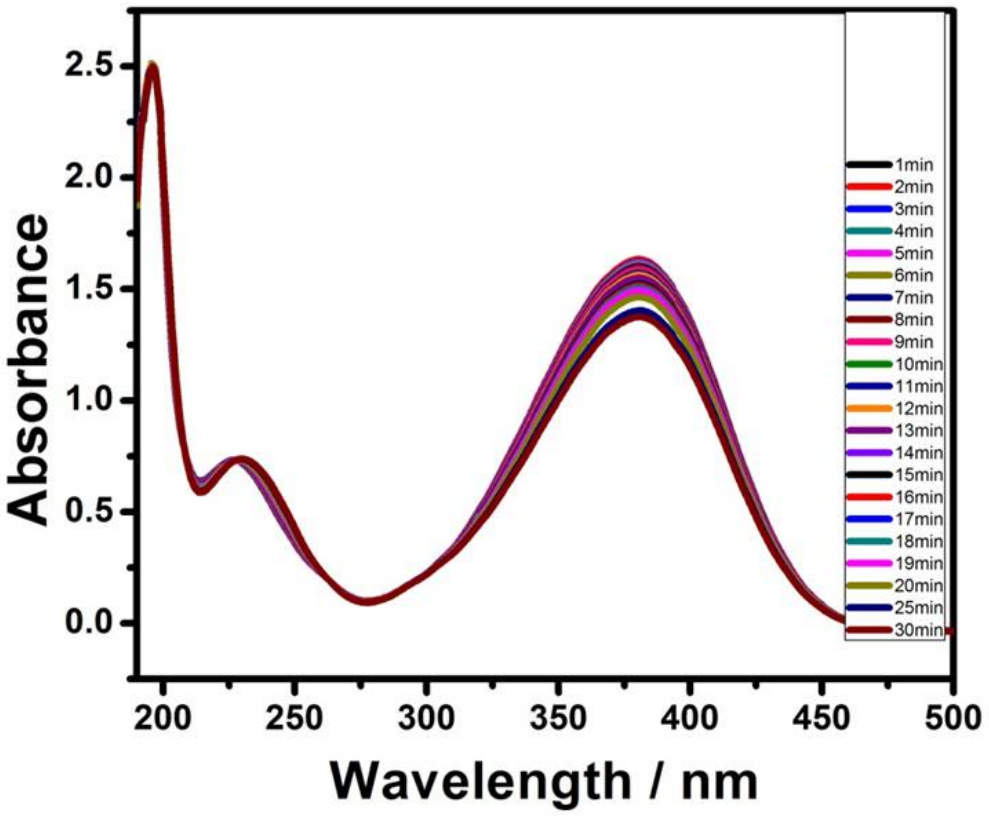

Figure S-3: UV – Vis spectra for the successive reduction of 4- NA to p- PDA by $NaBH_4$ without using Pt/RG catalyst.

Figure S-4 shows the catalytic activity of N-doped graphene for the reduction of 4-NA to p-PDA in the same experimental condition. Results showed N-doped graphene catalytic activity is rather slow and about 20% reduction after 2hr.

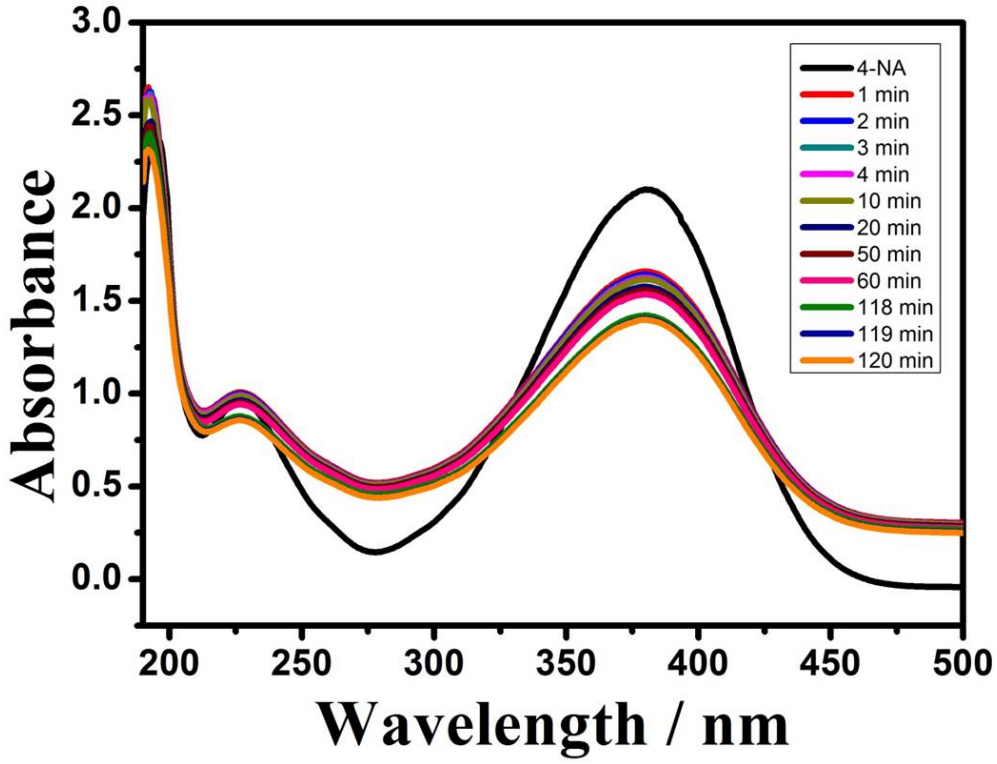

Figure S-4: UV – Vis spectra for the successive reduction of 4- NA to p- PDA by $NaBH_4$ concentration 25 mM in the presence of N-doped graphene .

Figure S-5 shows the comparative study of home made Pt/C and Pt/RG-N catalyst for same concentration of Pt where home made Pt/C shows slightly longer duration for complete reduction of 4-NA compared to Pt/RG-N.

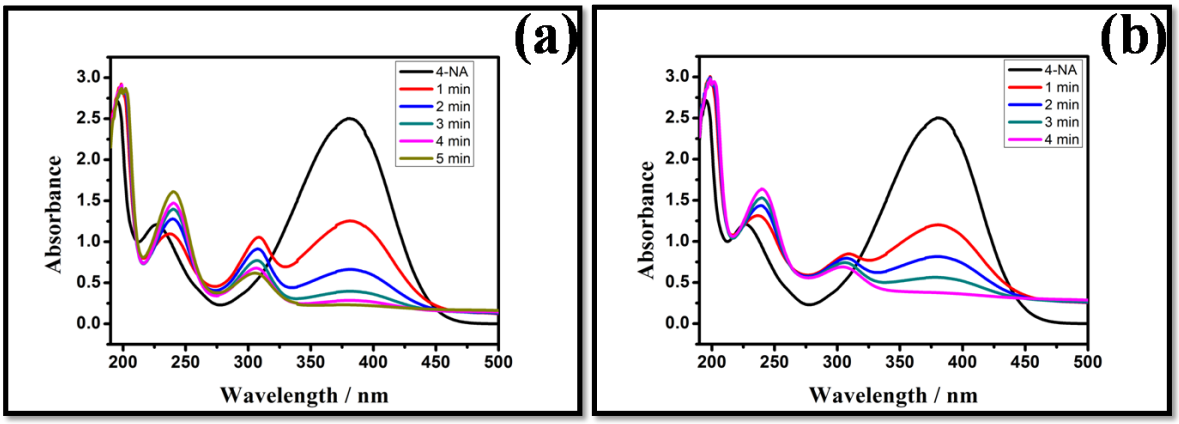

Figure S-5: UV – Vis spectra for the successive reduction of 4- NA to p- PDA by $NaBH_4$ concentration 25 mM in the presence of (a) Pt/C (37.5 µg) (b) Pt/RG-N (37.5 µg) .