**Supplementary File**

**S.1 Comparative study**

A comparative study of removal of TNP using pristine rGO, α-Fe2O3, α-Fe2O3/rGO and physical mixture of α-Fe2O3 and rGO was carried out using 25 mg of absorbent per 100 mL of 21.5 mg.L-1 TNP solutions at pH 6 for 4 hours.

**S.2 Effect of pH: Adsorption Isotherms**

*Temkin model*

This model relates the heat of adsorption of molecules in a layer with indirect adsorbent/adsorbate interactions.[47] The model is represented as follows (eq. S1)

(S1)

where, AT and bT are equilibrium binding and Temkin isotherm constants, respectively. qe and Ce are variables as discussed in the preceding section. T is the temperature and R is the gas constant. The constants extracted from Figure S5 are shown in Table S1. The adsorption energy, bT being positive signifies that the adsorption is exothermic at pH 2 and 6.

*Dubinin-Radushkevich (D-R) isotherm*

The porous nature of adsorbent and the energy involved in adsorption phenomena are examined by D-R isotherm.[48] The isotherm is represented by equation (S2). The behavior of adsorption is depicted by mean adsorption energy (E, kJ.mol-1) as represented by the equation below.[20]

(S2)

(S3)

whereis D-R isotherm constant. ε is defined by equation (S4) as

(S4)

where R is the universal gas constant.[20] qe and qm, are variables as described in previous sections. The linear plots of ln qe vs 2 at pH 2 and 6 are shown in Figure S6a and S6b, respectively and qm, , E and R2 values are tabulated in Table S1. The energy values at pH 2 and 6 are 0.85 and 8.84 kJ.mol-1, respectively, which indicates physisorption.[47]

*Redlich-Peterson (R-P) isotherm*

The nature of adsorption being homogeneous or heterogeneous can also be ascertained through R-P isotherm model.[49] The linearised R-P isotherm is represented as follows.

(S5)

where bR-P, α and qmon are constants.[20] Ce and qe, are variables as discussed in preceding sections. The adsorption is considered homogeneous when α → 1 and heterogeneous when α → 0.The values of α lie in the range 0.82-0.75 (tending to 1) for adsorption at pH 2 (Figure S6c) which shows that adsorption of TNP followed Langmuir monolayer adsorption. However, an opposite trend was observed at pH 6 (Figure S6d), where the optimum α values were ranging from 0.01 to 0.05 (tending to 0) which indicated that the adsorption followed Freundlich multilayer adsorption.

**Figure Captions**

**Figure S1.** Calibration Curve for determination of concentration of TNP at pH2

**Figure S2.** XRD pattern of α-Fe2O3

**Figure S3.** FESEM image of α-Fe2O3

**Figure S4.** Comparative plot of qe against time (a) rGO (b) α-Fe2O3 /rGO, (c) bare α-Fe2O3 (d) Physically mixed rGO & α-Fe2O3 and

**Figure S5.** Effect of pH: Temkin adsorption isotherm for TNP sorption on α-Fe2O3/rGO at 30oC at pH 2 and 6

**Figure S6.** Effect of pH: Dubinin-Radushkevich adsorption isotherm at (a) pH 2 and (b) pH 6; Redlich-Peterson adsorption isotherm at (c) pH 2 and (d) pH 6 for sorption of TNP on α-Fe2O3/rGO at 30 oC

**Figure S7.** Time dependent UV-Visible Spectra depicting TNP removal using α-Fe2O3 /rGO

**Figure S8.** Reusability of α-Fe2O3 /rGO

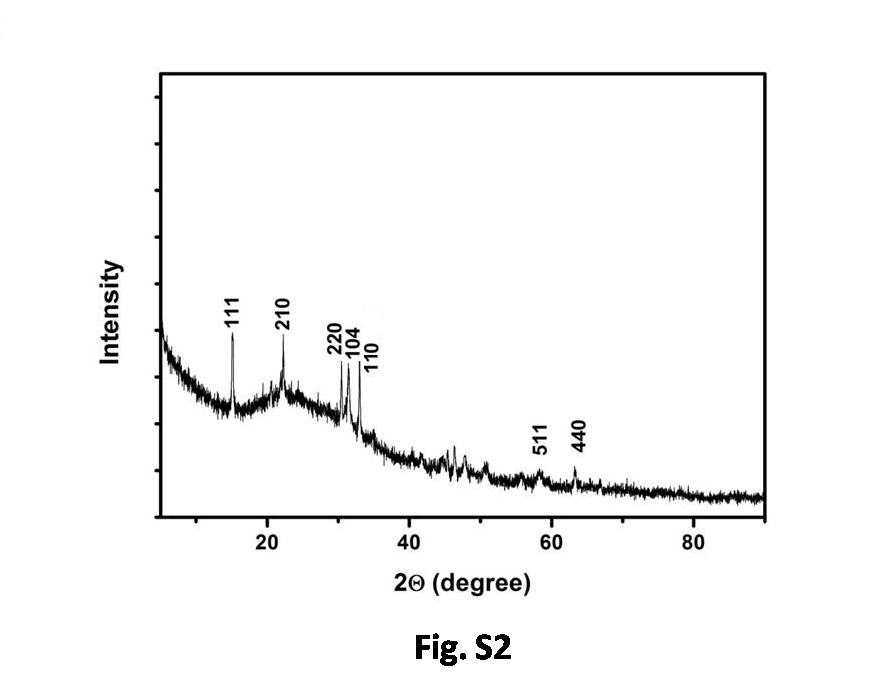
**Figure S9.** Isoelectric titration plot of -Fe2O3/rGO



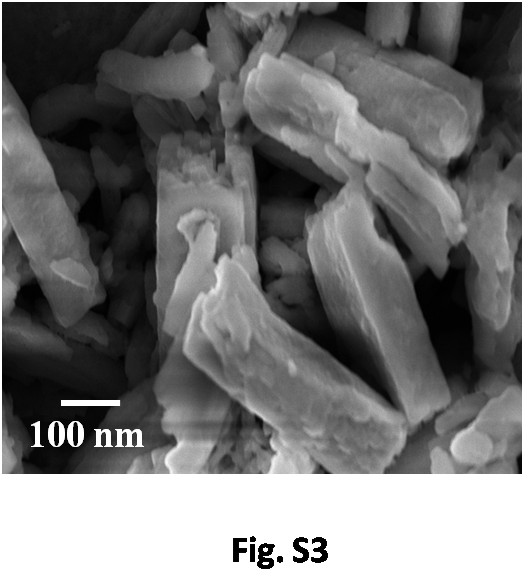
Slope = 0.058

R2 ­= 0.9993

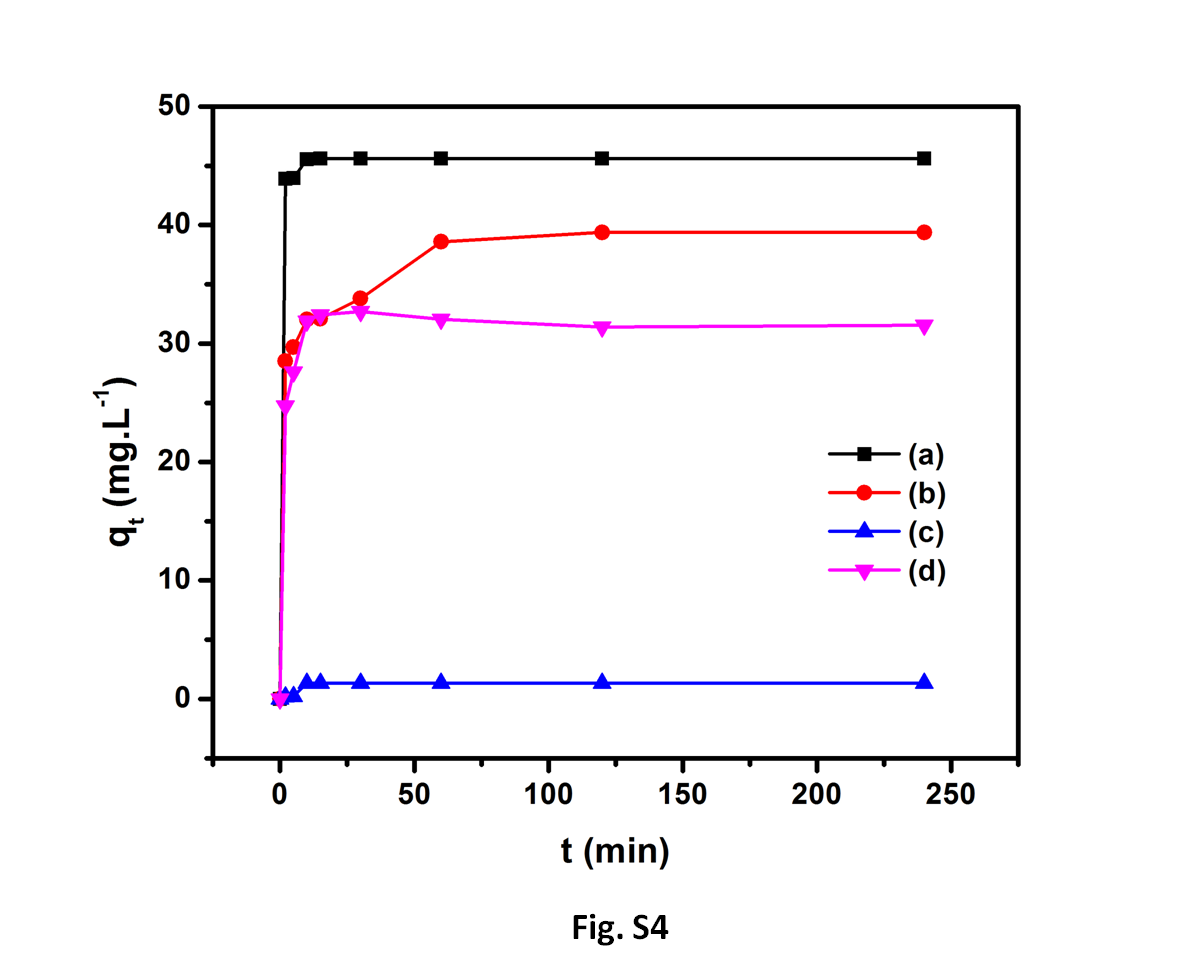
**Figure S1**



**Figure S2**



**Figure S3**



**Figure S4**



**Figure S5**



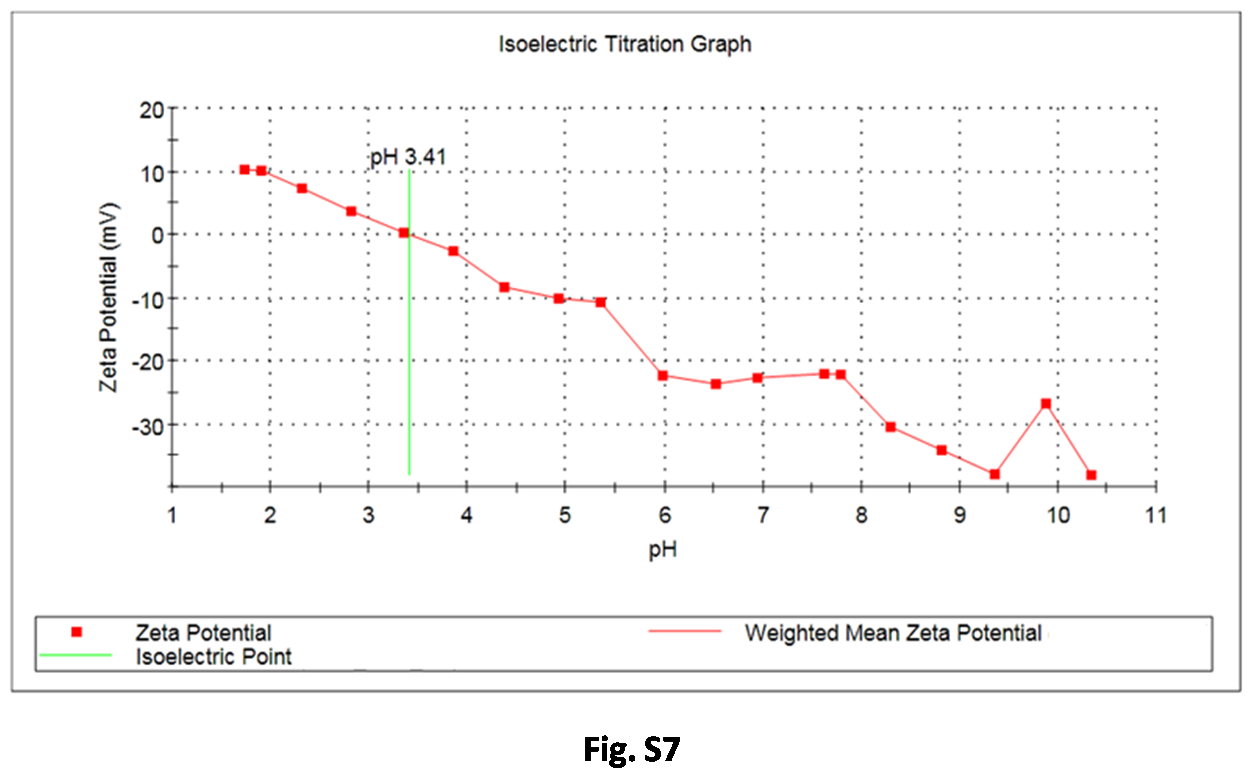
**Figure S6**



**Figure S7**



**Figure S8**



**Figure S9**

**Table Caption**

**Table S1.** Langmuir, Freundlich, Temkin, Dubinin-Radushkevich, and Redlich-Peterson isotherm model constants and correlation coefficients for sorption of TNP on -Fe2O3/rGO at 30 oC

**Table S1**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Langmuir Isotherm** | | | | |
|  | *pH 2* | | *pH 6* | |
| qmax (mg.g-1) | 48.31 | | 18.38 | |
| KL(L.mg-1) | 0.4849 | | 2.8313 | |
| R2 | 0.9842 | | 0.9951 | |
|  | Conc.  (mg.L-1)  ( *pH 2)* | RL | Conc.  (mg.L-1)  ( *pH 6)* | RL |
|  | 8.3 | 0.1990 | 8.3 | 0.0408 |
| 19.9 | 0.0941 | 19.9 | 0.0174 |
| 34.3 | 0.0567 | 27.05 | 0.0129 |
| 63.4 | 0.0315 | 32.15 | 0.0109 |
| **Freundlich Isotherm** | | | | |
|  | *pH 2* | | *pH 6* | |
| KF  (mg 1-1/n.L1/n.g-1) | 37.63 | | 13.32 | |
| n | 28.86 | | 8.54 | |
| R2 | 0.6601 | | 0.9969 | |
| **Temkin Isotherm** | | | | |
|  | *pH 2* | | *pH 6* | |
| AT (L.g-1) | 2.19×1012 | | 3.49×103 | |
| bT (kJ.mol-1) | 1.87 | | 1.73 | |
| R2 | 0.5820 | | 0.9831 | |
| **Dubinin-Radushkevich Isotherm** | | | | |
|  | *pH 2* | | *pH 6* | |
| β (mol2.J-2) | 6.89×10-7 | | 6.95×10-9 | |
| qm (mg.g-1) | 40.08 | | 17.07 | |
| E (kJ.mol-1) | 0.85 | | 8.84 | |
| R2 | 0.9893 | | 0.9486 | |
| **Redlich-Peterson Isotherm** | | | | |
|  | *pH 2* | | *pH 6* | |
| qmon (mg.g-1) | 22.98 | | 4.85 | |
| bRP (L.mg-1) | 6.3985 | | 0.2604 | |
| α | 0.82 | | 0.01 | |
| R2 | 0.9978 | | 0.9995 | |