Electronic Supplementary Material (ESI) for RSC Advances.

1. Synthesis of ionic liquids

Synthesis of anionic tetraalkylguanidinium-based ionic liquids

In this work, 20.0 mmol acids in 40 mL ethanol was added into a flask which contains 2.3 g TMG (20.0 mmol) and 100 mL ethanol and stirring for 2 h under 25℃. The resulting mixture was evaporated under reduced pressure. The crude oily residue was dissolved in 100 mL ethanol, treated with active carbon, filtered, and evaporated under vacuum for 24h.

Synthesis of cationic hexaalkylguanidinium-based ionic liquids

A mixture of 20 mmol TMG, 44 mmol haloalkanes, tetrabutylammonium bromide (2% molar fraction) and 60 mmol potassium carbonate were refluxed in 50 mL acetonitrile under 60℃ for 6h. Filtered and 80 mL H_2O was added into the solution. The residue was treated with 5 mL NaOH (30%). The reaction mixture was extracted with 80 mL petroleum ether to remove unreacted 1-bromobutane and pentaalkylguanidine. The petroleum ether phase was back extracted with 30 mL H_2O and 20 mL saturated aqueous NaBr solution was added to the combined aqueous phase. Finally, the IL was extracted from aqueous phase by using 50 mL CH_2Cl_2 and subjected to reduced pressure distillation.

2. Synthesis of guanidinium ILs modified magnetic chitosan graphene oxide nanocomposites (GIL-MCGO)

GIL-MCGO was prepared by guanidinium ionic liquids and magnetic chitosan graphene oxide nanocomposites.

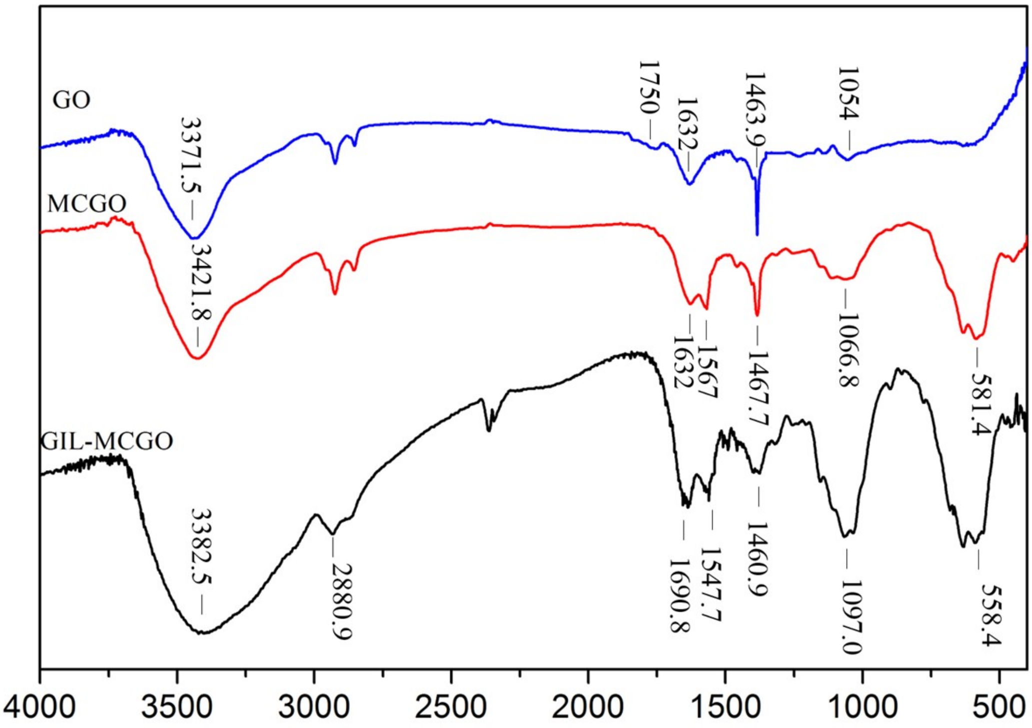
First, MCGO was prepared by 2g chitosan was dissolved in 100 mL acetic acid solution, and 0.75g iron (Ⅲ) oxide were added to the chitosan-acetic acid mixture and ultrasonic dispersed for 20 min. 8 mL of 1-butanol ,4 mL of span ™80 and 100 mL of paraffin were separately added and mechanical agitation at room temperature. After sufficiently dispersing uniformly, 3 mL of glutaraldehyde was added dropwise at 55℃ and mechanical agitation for 3.5 h. Particles were separated by magnetic separation and washed with petroleum ether and ethanol respectively and vacuum freeze dryer to obtain magnetic chitosan (MC).

Second, 50 mg of GO was dispersed in 100 mL double distilled water for 3 hours, and 0.288 g N-hydroxysuccinimide (NHS) and 0. 478 g 1-ethyl-3-(3-dimethylaminopropyl) carbodiimide hydrochloride (EDC) were added to the GO dispersion and mechanical agitation continuously for 2 h at room temperature, the pH was adjusted to 7 with 2% (w/v) NaOH solution. Then, 1.5 g of MC were added in the activated GO solution and were dispersed in 100 mL of double distilled water, and ultrasonic dispersion for 20 min, the mixed solutions was mechanical agitation at

60℃ for 3 h. The precipitate was washed sequentially with 2% (w/v) NaOH solution and deionized water until the pH was about 7.0. The resulting product was collected by an external magnetic field and dried under vacuum freeze dryer to obtain MCGO.

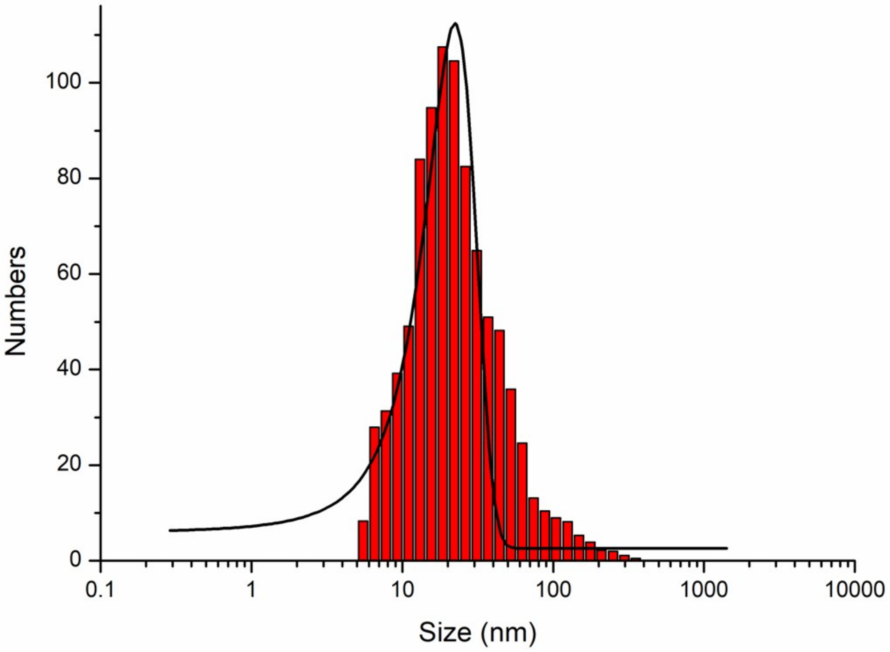
Finally, 1.0 g of the guanidinium ionic liquid (GIL) was dissolved in 15 mL of methanol and ultrasonically added to a beaker containing 1.0 g of MCGO, ultrasound 20min then stop 15 minutes until accumulated for 2 h. The obtained product was washed with absolute ethanol and dried at room temperature to give a product of GIL-MCGO.

2. FT-IR spectra of GIL-MCGO

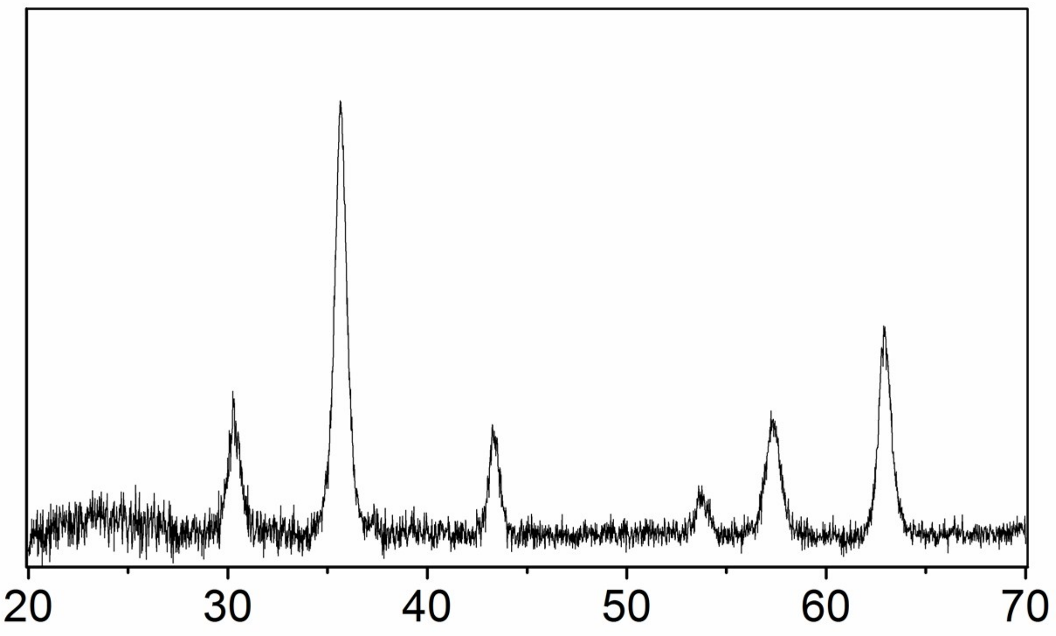


The peaks of GO at 1054.1 cm^{-1}, 1463.9 cm^{-1}, 1632 cm^{-1} correspond to C-O-C stretching vibrations, C–OH stretching, C–C stretching mode of the sp^{2} carbon skeletal network, respectively. Peaks located at 1750 cm^{-1} and 3371.5 cm^{-1} correspond to C–O stretching vibrations of the –COOH groups and O–H stretching vibration, respectively. In the spectrum of MCGO, the peaks at 1632 cm^{-1},1567 cm^{-1},1467.7 cm^{-1} correspond to C-O stretching vibrations of –NHCO, N–H bending of NH_2, and C–H bending vibration. Peaks at 581.4 cm^{-1} is the characteristic peak of Fe_3O_4. In the spectrum of GIL-MCGO, the peak located at 3382.5 cm^{-1} corresponds to -OH stretching vibration. 2880.9 cm^{-1} is the stretching vibration of C-H. 1690.8 cm^{-1} is the C=O stretching vibration of -COOH groups. 1541.7 cm^{-1} is the N-H bending vibration of $-NH_2$. 1460.9 cm^{-1} correspond to C-H bending vibration. 1097.0 cm^{-1} correspond to C-O stretching vibration. 558.4cm^{-1} is the characteristic peak of Fe_3O_4.

3. The size distribution of the nanocomposites



4. XRD pattern of GIL-MCGO nanocomposites



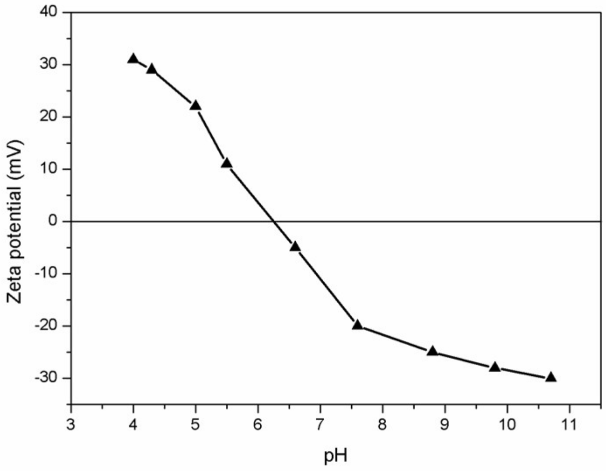
In the 2θ range of 20°-70°, the six characteristic X-ray diffraction peaks for Fe_3O_4 (2θ= 30.1°, 35.5°, 43.3°, 53.4°, 57.0°, and 62.6°), marked by their indices (2 2 0), (311), (4 0 0), (4 2 2), (511) and (4 4 0) are observed. The XRD patterns revealed that the synthesized process did not change the crystalline phase of Fe_3O_4.

5. Buffer system used in the research on effect of pH value on extraction efficiency (Fig. 4a)

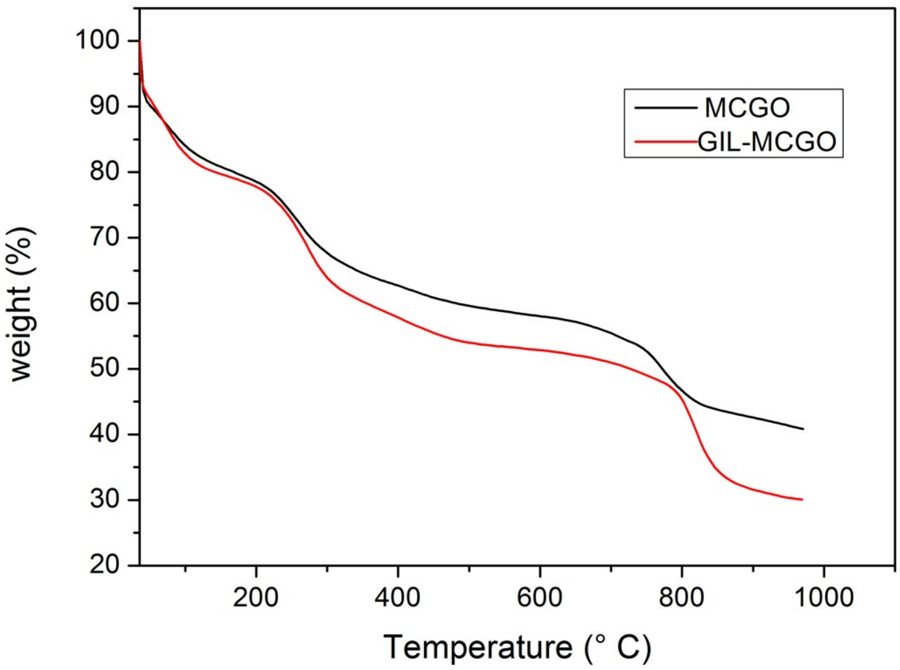
Britton-Robinson buffer solution: it consists of a mixture of 0.04 M H_3BO_3, 0.04 M H_3PO_4 and 0.04 M CH_3COOH that has been titrated to the desired pH with 0.2 M NaOH. The detailed information is in the table below:

	Mixture (0.04 mol L^{-1})	NaOH (0.2 mol L^{-1})
PH=2	100mL	5 mL
PH=4	100mL	23 mL
PH=6	100mL	41 mL
PH=8	100mL	60 mL
PH=10	100mL	79 mL
PH=12	100mL	97 mL

6. The Zeta potential of GIL-MCGO nanocomposites



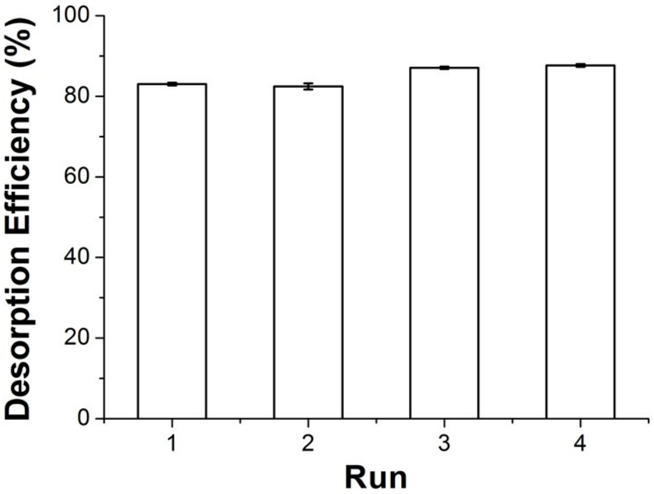
7. The curves for MCGO and GIL-MCGO



The curves for MCGO and GIL-MCGO at heating rate of 10°C per min in nitrogen.

Thermogravimetric analysis (TGA) measurements were performed under the atmosphere of N_2. The weight loss of MCGO was 59wt%, while the weight loss of GIL-MCGO was 70wt%. Therefore, the yield of GIL on the surface of MCGO is estimated to be 11wt%.

8. The desorption efficiency of DNA for different cycle



0.04 mol L^{-1} BR buffer (pH=10) was selected as stripping reagent, the concentration of DNA was measured at 260 nm using a NanoDrop 2000 spectrophotometer from Thermo Scientific.