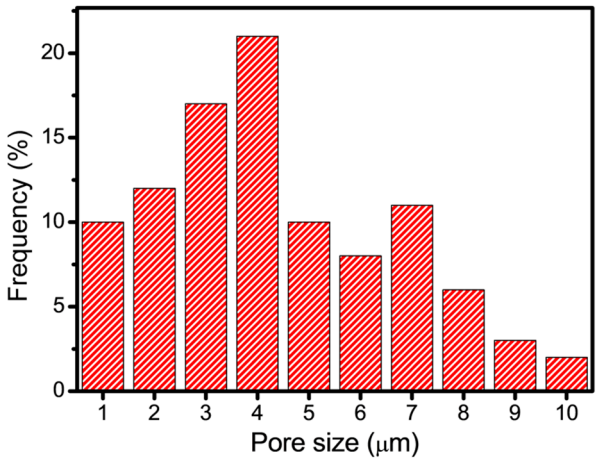


Figure S1. Pore size measurements of κ-CG/CL hydrogel.

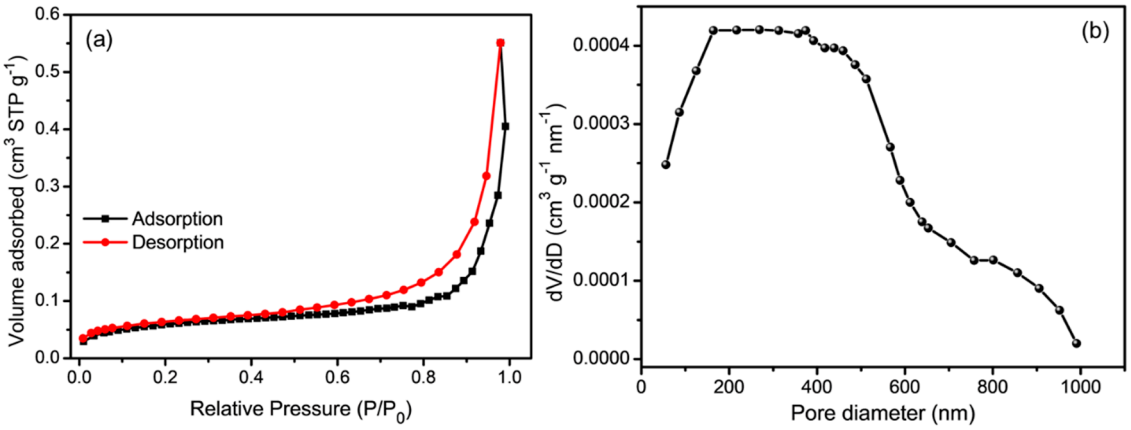


Figure S2. (a) BET analysis and (b) pore size distribution of the κ-CG/CL hydrogel.

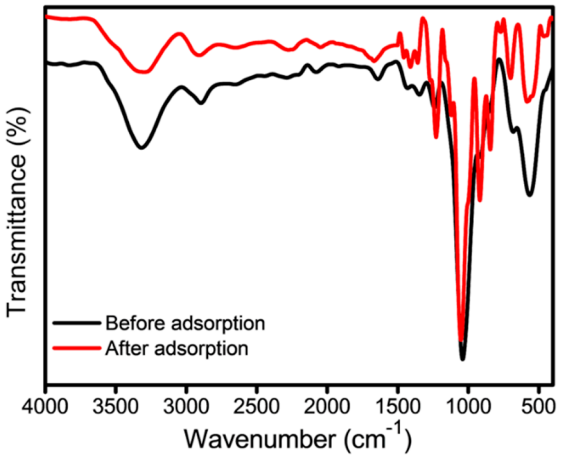
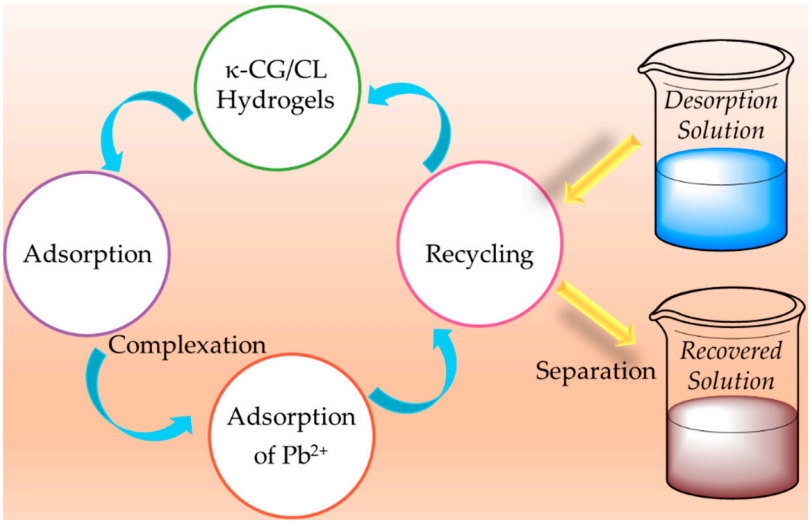


Figure S3. FTIR spectra of κ-CG/CL hydrogel before and after Pb^{2+} ions adsorption.



Scheme S1. An overview of the reusability studies for Pb^{2+} ions removal from κ-CG/CL hydrogel.

Calibration of Atomic Absorption Spectrometry (AAS)

Under optimal conditions, 0.5 absorbance units should be produced by a Pb^{2+} ions concentration of 600 mgL^{-1} at the wavelength listed in the characteristic concentration check value. It is possible to determine if instrumental parameters are optimized and if the instrument is performing according to specifications by performing a characteristic concentration check. In this study, AAS calibration was carried out using an external calibration curve. Stock solutions were created from solutions with known concentrations of the sample element, which was used for preparing the external calibration curve. The stock solution was made with high-purity metal salts dissolved in high-purity acids. A diluted stock standard was used for working standards.

Table S1. Adsorption kinetics model parameters for Pb^{2+} ions removal by κ-CG/CL hydrogel.

Models	Parameters	Values
Pseudo-first order	Q_t (mg/g)	467.3±23.3
	k_1 (min^{-1})	0.0018
	R^2	0.9863
Pseudo-second-order	Q_t(mg/g)	438.2±21.8
	k_2 (g (mg min)$^{-1}$)	0.16 x 10^{-3}
	R^2	0.9959
Elovich	Q_t(mg/g)	421.3±19.3
	α (mg/(g min))	0.0223
	β (mg/g)	6.6271
	R^2	0.9873
Intra-particle diffusion	$k_{d,1}$(g (mg $min^{-0.5}$)$^{-1}$)	0.125
	C_1	192.3±9.6
	R^2	0.9738
	$k_{d,2}$(g (mg $min^{-0.5}$)$^{-1}$)	0.0416
	C_2	462.7±23.1
	R^2	0.9841
	$k_{d,3}$(g (mg $min^{-0.5}$)$^{-1}$)	0.0277
	C_3	484.3±24.2
	R^2	0.9878

Table S2. Adsorption isotherm model parameters for Pb^{2+} ions removal by κ-CG/CL hydrogel.

Models	Parameters	Temperature		
		298	308	318
Langmuir	Q_m (mg/g)	454±18.1	418±21.9	373±11.4
	K_L (mg/L)	0.0031	0.0016	0.0016
	R^2	0.8860	0.9067	0.8996
	R_L	2.37 x 10^{-4}	2.69 x 10^{-4}	2.62 x 10^{-4}
Freundlich	Q_m (mg/g)	486±28.5	440±23.3	388±48.7
	C_e (mg/L)	0.0029	0.0018	0.0062
	R^2	0.9038	0.9267	0.9684
	K_F (mg/g)/ (mg/L)^n	1.2134	0.7951	2.1294

Table S3. Comparison of maximum Pb^{2+} ions adsorption capacity of other reported adsorbents.

Adsorbents	Q_m (mg/g)	References
CS/PVA/CCNFs	171.0	[1]
SA-DMSA	116.4	[2]
SDS-AZS	21.0	[3]
CEL-MT-CBM	39.0	[4]
CA-PCL	70.5	[5]
Fe_3O_4-CS/EDTA	220.0	[6]
SC-ALG	179.1	[7]
ACSSB-ZnO	55.5	[8]
NCS-SA-MC	114.4	[9]
SA-PAM-GO	240.6	[10]
κ-CG/CL	486.0	This work

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