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for

An *in situ* Approach for Synthesis of Gum Ghatti-*g*-Interpenetrating Terpolymer Network Hydrogel for High-performance Adsorption Mechanism Evaluation of Cd(II), Pb(II), Bi(III) and Sb(III)

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Adsorption isotherm models

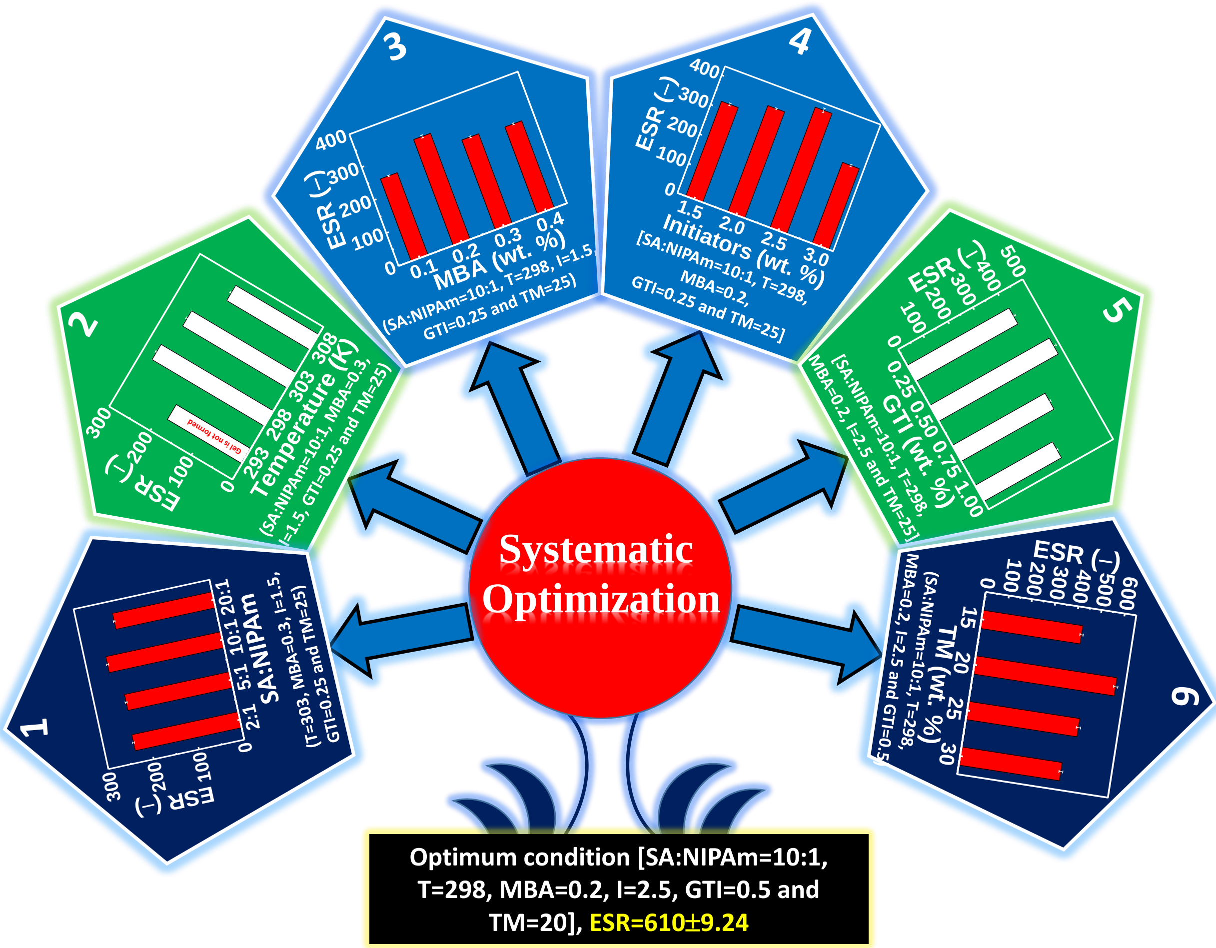
Adsorption isotherm data were fitted to the following isotherm models

$$q_e = q_{\max}\frac{k_L C_e}{1+k_L C_e} \tag{S1}$$

$$q_e = k_F C_e^{1/n} \tag{S2}$$

$$q_e = q_{BET}\frac{k_1 C_e}{(1-k_2 C_e)(1-k_2 C_e + k_1 C_e)} \tag{S3}$$

Here, k_L, k_F, k_1 and k_2 are the corresponding isotherm constants and q_{max}, n and q_{BET} are the corresponding isotherm parameters.



Scheme S1. Systematic optimization

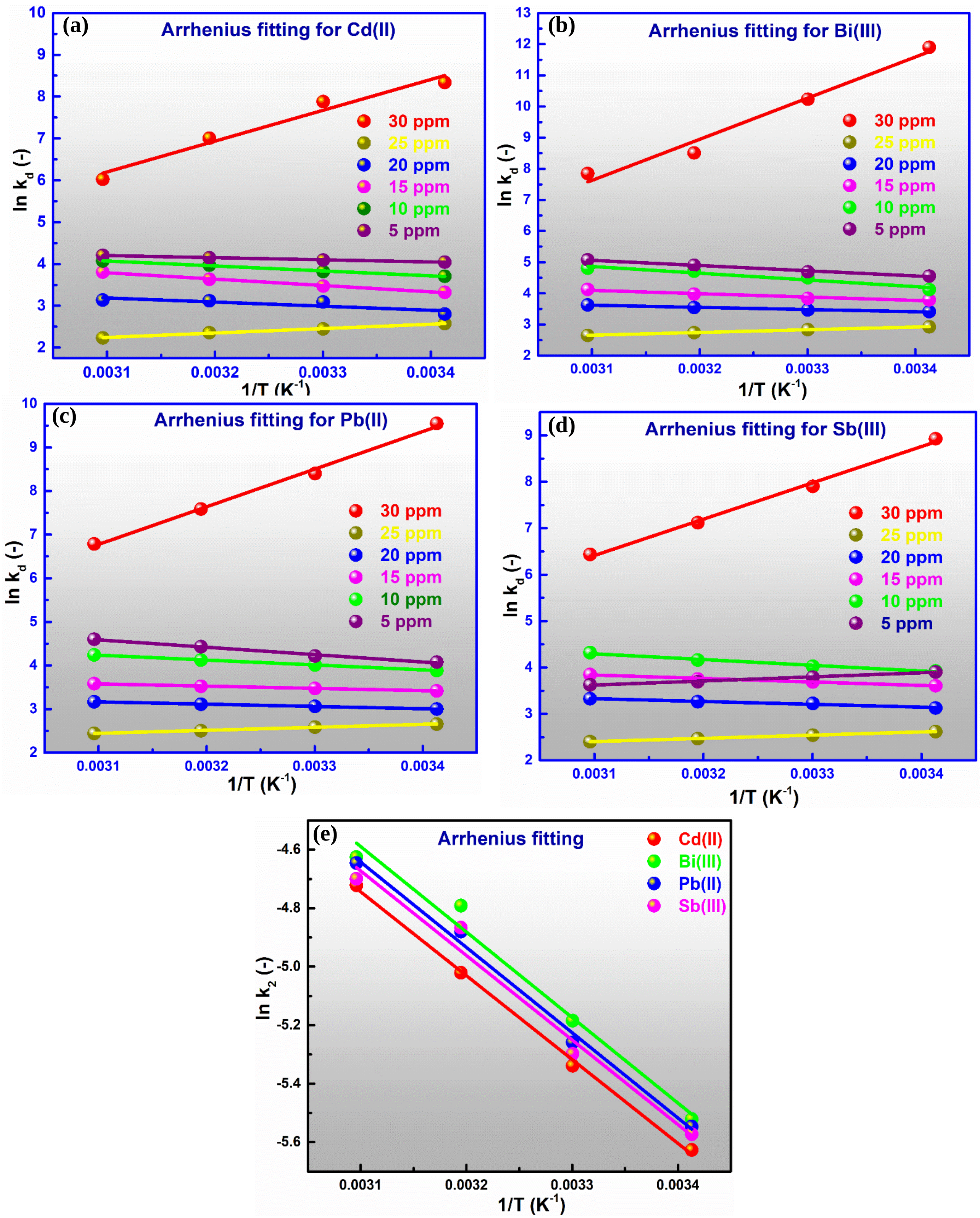


Fig. S1 ln k_d vs 1/T plots for (a) Cd(II), (b) Bi(III), (c) Pb(II) and (d) Sb(III) and ln k_2 vs 1/T plots for Cd(II)/Bi(III)/Pb(II)/Sb(III)

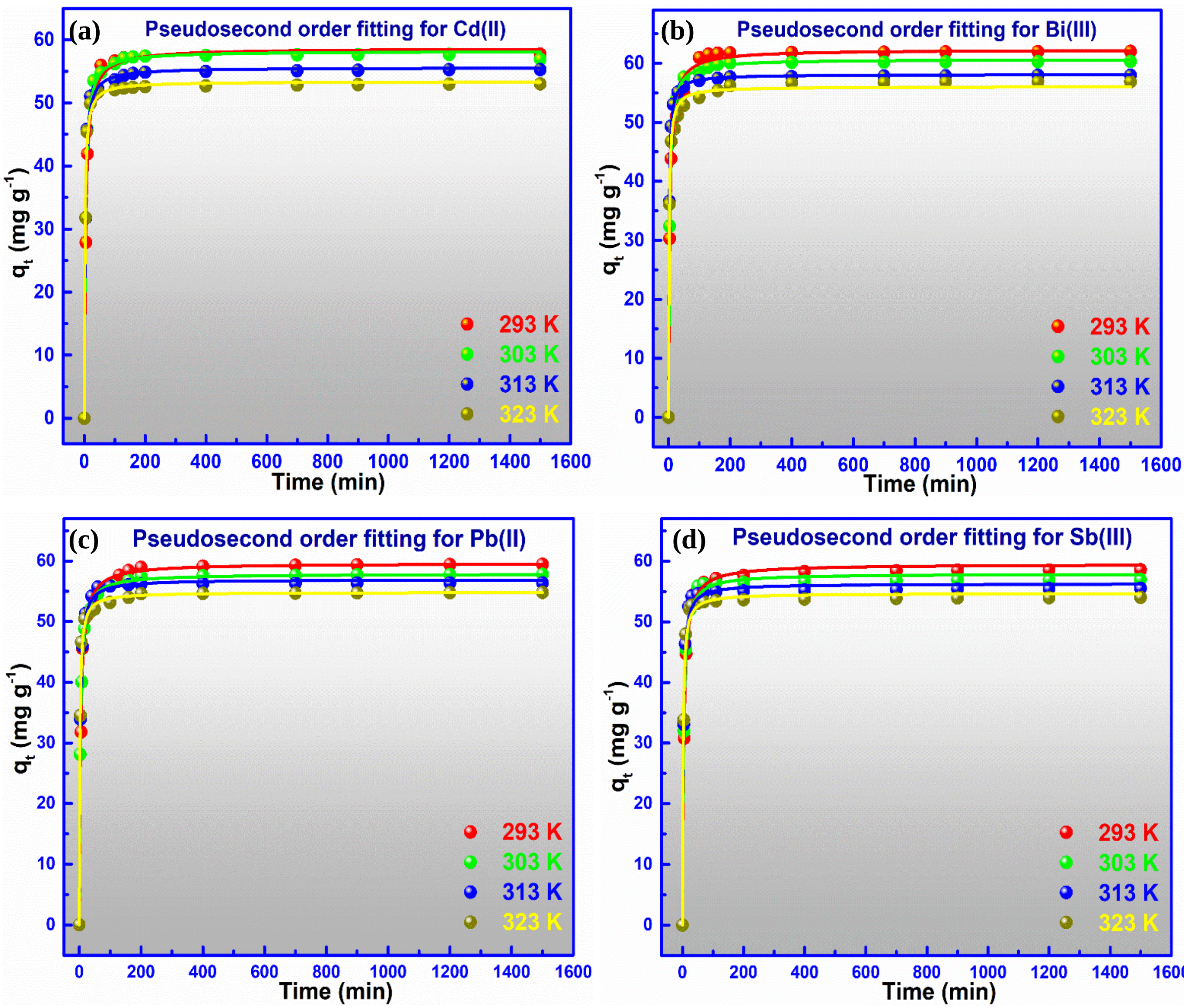


Fig. S2 Pseudosecond order kinetics plots for (a) Cd(II), (b) Bi(III), (c) Pb(II) and (d) Sb(III) at different temperatures, $pH_i = 7$ and adsorbent dose = 0.02 g L^{-1}

Table S1 Comparison of the results obtained from literature

M(II)	Name of the adsorbents	AC (mg g^{-1})/pH$_i$/C_0 (mg L^{-1}) /temperature (K)	Ref.
Cd(II)	RGO[a]-Fe(O)/Fe_3O_4	1.91/7.0/2–6/298	S1
	Dithiocarbamated-sporopollenin	7.09/7.0/15/293	S2
	Dead T. viride	10.95/6.0/26/320	S3
	BiOBr microsphere	11.70/7.0/29/298	S4
	Polyaniline grafted chitosan	12.87/6.0/20–40/303	S5
	GO[b]	14.90/5.6/–/–	S6
	Garden grass	17.60/4.0/50/303	S7
	Functionalized graphene (GNS^{C8P})	30.05/6.2/–/–	S8
	GGAAAMAPA[c]	40.55/7.0/5–25/303	S9
	Si-DTC[d]	43.47/7.0/100/298	S10
	Novel magnetic nanocomposite hydrogel (m-CVP)	53.20/5.5/20/298	S11
	GO-TiO_2	72.80/5.6/–/–	S6
	Functionalized graphene (GNS^{PF6})	73.42/6.2/–/–	S8
	Dithiocarbamate-anchored polymer/organosmectite composites	82.20/7.0/50/293	S12
	Graphene oxide–Al13	89.74/6.0/10/298	S13
	MGO[e]	91.29/6.0/200/298	S14
	Biomass of nonliving, dried brown marine algae *Sargassum natans*, *Fucus vesiculosus*, and *Ascophyllum nodosum*	100.00/3.5/100/–	S15
	Polyvinyl alcohol-chelating sponge	125.11/5.5/560/293	S16
	CS-co-MMB-co-PAA[f]	135.51/4.5–5.5/300/–	S17
	GO[b]	167.50/6.0/–/333	S18
	AC-Fe_3O_4-NPs modified with DBABT[g]	185.22/6.0/5/–	S19
	Mesoporous MCM-41	210.96/7.0/250/298	S20
	ANMP derived from PCBs[h]	230.06/3.5/450/293	S21
	GTINIAMSA[i]	**1477.83/7.0/500–800/293–323**	**TS^**
Pb(II)	Bare Malachite Nanoparticle	7.20/5.0–6.0/10–100/–	S22
	Kaolinite	11.50/5.7/10–50/303	S23
	Jordanian kaolinite	13.32/5.0/50–400/295	S24
	Montmorillonite	31.10/5.7/10–50/303	S23
	Lemon peel	37.87/5.0/100–300/301	S25
	GGAAAMAPA[c]	41.98/7.0/5–25/303	S9
	IPNS[j]	54.86/7.0/5–30/303	S26
	APAN[k]	60.60/4.0/40–1000/303	S27
	GTINIAMSA[i]	**1568.81/7.0/500–800/293–323**	**TS^**
Bi(III)	Coconut shell activated carbon	54.35/–/250/299	S28
	Collagen fiber-immobilized bayberry tannin	72.72/–/–/303	S29
	Activated carbon powder	87.00/5.0/1/–	S30
	D2EHPA[l]	490.70/3.6/100–250/–	S31
	GTINIAMSA[i]	**1582.38/7.0/500–800/293–323**	**TS^**
Sb(III)	Carbon nanotubes	0.33/7.0/4/298	S32

Blast-furnace-slag geopolymer	0.34/4.0–10.0/2/293	S33
Bentonite	0.37/6.0/0–4/298	S34
WAP[m]	1.16/2.8/10/298	S35
Polysiphonia lanosa	1.74/2.8/10/298	S35
QFGO[n]	2.88–6.09/–/20–60/298	S36
Hydrochar from swine solids	3.98/4.5/0–100/323	S37
Cyanobacteria Microcystis biomass	4.88/4.0/10/298	S38
Sargassum muticum	5.50/5.0/10/296	S39
Imprinted polymer	6.70/3.5–9.5/300/298	S40
Graphene	7.50/11.0/1–10/303	S41
Bonded silica gel	7.90/5.0–9.0/70/–	S42
Ferric hydroxide	18.50/7.0/–/–	S43
Activated carbon	24.00/–/–/–	S44
Sb(III)-imprinted sorbent	27.70/6.0/100/–	S45
Sb(III)-imprinted silica gel	32.40/3.5–6.5/100–600/298	S46
Diatomite	35.20/6.0/1000–20000/293	S47
Natural perlite	54.40/4.0/10/293	S48
Akaganeite	60.80/7.0/–/–	S49
Modified perlite	76.50/4.0/10/293	S48
Lichen (*Physcia tribacia*)	81.10/3.0/4000/293	S50
Synthetic manganite	95.00/3.0/–/–	S51
Mercapto-functionalized hybrid sorbent	108.80/3.0–8.0/100–800/298	S52
HFO[o]	113.96/4.0/–/–	S53
Fe-Mn binary oxide	120.53/5.0/–/–	S43
Orange waste	125.90/3.0/15/303	S54
K_2FeO_4	129.93/4.0/1–10/–	S55
PAG[p] sorbent	158.20/6.0/40/313	S56
Fe-Mn binary oxide	197.80/3.0/24–244/293	S57
GTINIAMSA[i]	**1518.09/7.0/500–800/293–323**	**TS^**

[a]Reduced graphene oxide, [b]graphene oxide, [c]guar gum-g-(acrylic acid-co-acrylamide-co-3-acrylamido propanoic acid), [d]silica-supported dithiocarbamate adsorbent, [e]Magnetic graphene oxide, [f]a chitosan-based hydrogel, [g]activated carbon magnetized with Fe_3O_4 nanoparticles modified with2-((2, 4-Dichloro-benzylidene)-amino)-benzenethiol, [h]activated non-metallic Powder derived from printed circuit boards,[i]gumghatti-g-N-isopropylacrylamide-co-2-acrylamido-co-sodiumpropanoate, [j]interpenetrating network superadsorbent, [k]aminated polyacrylonitrile, [l]di(2-ethylhexyl)phosphoric acid on the Amberlite XAD-1180, [m]ascophyllum product, [n]a composite of quartz sand coated with Fe_3O_4 and graphene oxide, [o]hydrous ferric oxide, [p]polyamide-graphene and ^this study.

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