Supporting Information

Fabrication of La^{3+} impregnated chitosan/β – cyclodextrin biopolymeric materials for effective utilization of chromate and fluoride adsorption in single systems

Jayaram Preethi and Sankaran Meenakshi*

Department of Chemistry, The Gandhigram Rural Institute - Deemed University

Gandhigram – 624 302, Dindigul, Tamil Nadu, India

* Corresponding author. Tel.: +91-451-2452371; Fax: +91-451-2454466

E-mail address: sankaranmeenakshi2014@gmail.com (S. Meenakshi)

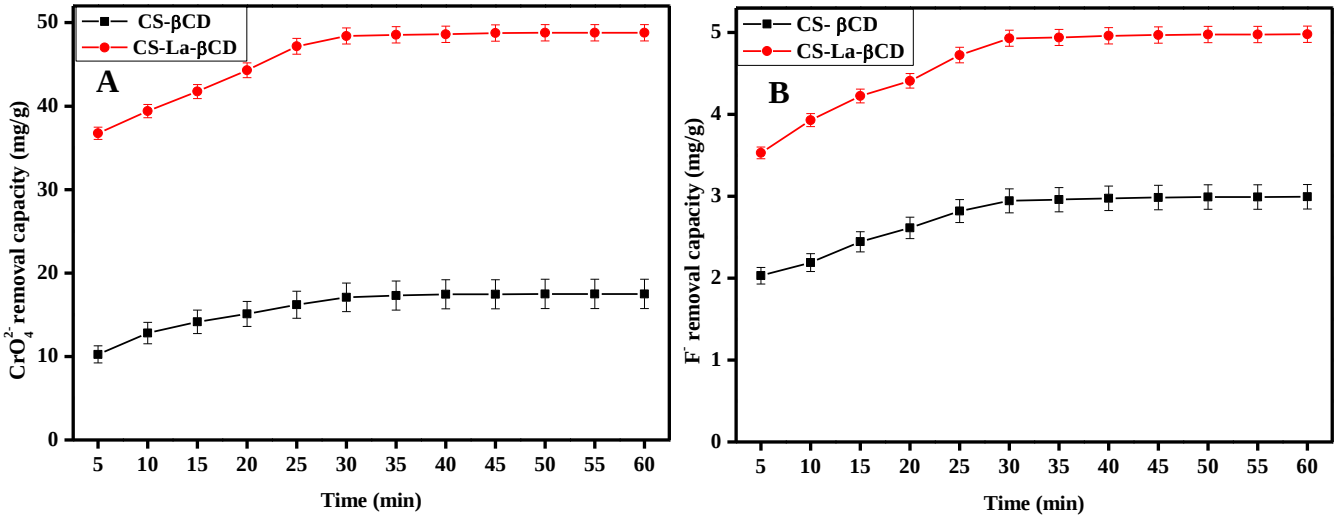

Figure S1. (A) Effect of contact time towards the removal CrO_4^{2-} of using CS-β-CD and CS-La-βCD [C_o: 100 mg/L, dosage: 0.1 g, Temperature: 303 K, pH: 4.53] (B) Effect of contact time towards the removal of F^- using CS-β-CD and CS-La-βCD [C_o: 10 mg/L, dosage: 0.1 g, Temperature: 303 K, pH: 5.42]

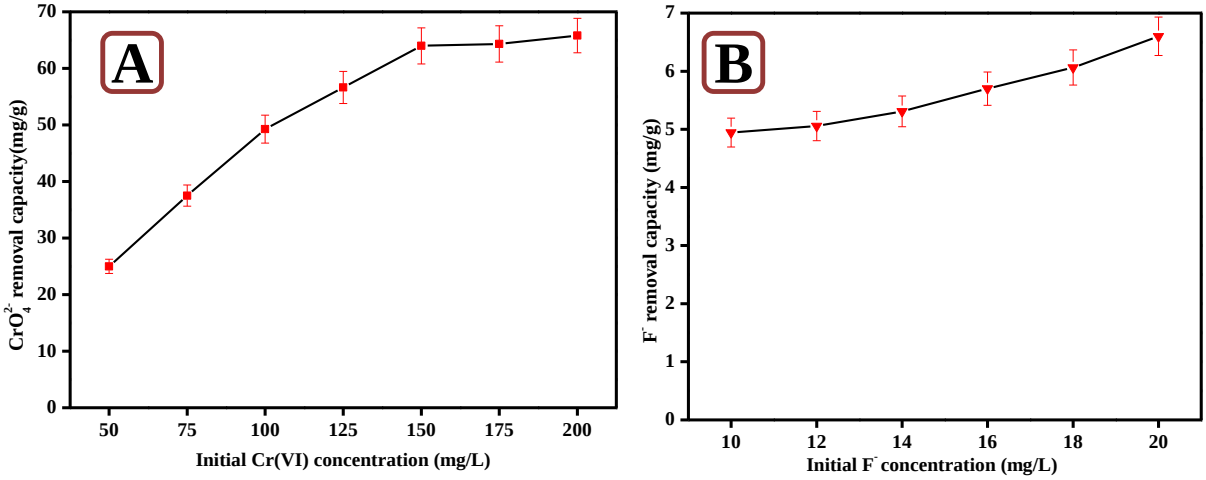

Figure S2. (A) Effect of initial concentration on the removal of CrO_4^{2-} using CS-La-βCD [dosage: 0.1 g, Time: 30 min, Temperature: 303 K, pH: 4.53]

(B) Effect of initial concentration on the removal of F^- using CS-La-βCD [dosage: 0.1 g, Time: 30 min, Temperature: 303 K, pH: 5.42]

Table S1. Isotherms and their linear forms

Isotherms		Linear form	Plot
Freundlich	$q_e = k_F C_e^{1/n}$	$\log q_e = \log k_F + \frac{1}{n} \log C_e$	log q_e vs log C_e
Langmuir	$q_e = \frac{Q^o b C_e}{1 + b C_e}$	$\frac{C_e}{q_e} = \frac{1}{Q^o b} + \frac{C_e}{Q^o}$	$\frac{C_e}{q_e}$ vs C_e
Dubinin - Radushkevich	$q_e = X_m \exp(-k_{DR} \varepsilon^2)$	$\ln q_e = \ln X_m - k_{DR} \varepsilon^2$	ln q_e vs ε^2

Table S2. Kinetic models of CS-La-βCD towards CrO_4^{2-} removal

Kinetic models	Parameters	303K					313K					323K				
		100 mg/L	**125 mg/L**	**150 mg/L**	**175 mg/L**	**200 mg/L**	**100 mg/L**	**125 mg/L**	**150 mg/L**	**175 mg/L**	**200 mg/L**	**100 mg/L**	**125 mg/L**	**150 mg/L**	**175 mg/L**	**200 mg/L**
Pseudo first order	k_{ad} (min^{-1})	0.058	0.047	0.033	0.041	0.050	0.050	0.449	0.046	0.045	0.045	0.059	0.057	0.024	0.048	0.045
	r^2	0.935	0.968	0.989	0.961	0.978	0.971	0.963	0.954	0.949	0.961	0.952	0.932	0.980	0.925	0.991
	sd	0.201	0.112	0.043	0.107	0.098	0.112	0.123	0.131	0.113	0.115	0.171	0.198	0.043	0.178	0.005
Pseudo second order	q_e (mgg^{-1})	50.226	58.173	68.213	74.074	84.104	50.865	59.809	68.681	76.511	86.730	52.384	62.267	66.313	78.616	88.496
	k ($gmg^{-1}min^{-1}$)	0.003	0.004	0.004	0.006	0.007	0.003	0.004	0.004	0.005	0.026	0.003	0.003	0.005	0.005	0.024
	h ($mgg^{-1}min^{-1}$)	8.091	19.646	19.425	34.758	47.037	8.593	13.149	19.849	30.479	38.625	8.708	13.075	24.425	27.902	41.135
	r^2	0.998	0.991	0.999	0.999	0.999	0.997	0.998	0.999	0.999	0.999	0.997	0.998	0.999	0.999	0.999
	sd	0.029	0.015	0.013	0.009	0.005	0.007	0.027	0.014	0.010	0.007	0.028	0.020	0.013	0.011	0.005
Particle diffusion	k_d	0.058	0.047	0057	0.041	0.050	0.050	0.048	0.046	0.045	0.045	0.059	0.057	0.024	0.047	0.047
	r^2	0.935	0.968	0.955	0.961	0.978	0.971	0.963	0.954	0.950	0.961	0.952	0.932	0.980	0.927	0.983
	sd	0.464	0.252	0.368	0.248	0.227	0.259	0.284	0.302	0.307	0.266	0.393	0.456	0.101	0.403	0.185
Intra particle diffusion	k_i	2.593	2.266	2.327	1.626	1.674	2.549	2.431	2.237	1.873	2.005	2.265	2.260	1.752	2.147	2.139
	r^2	0.998	0.999	0.995	0.994	0.996	0.971	0.963	0.954	0.949	0.992	0.994	0.995	0.989	0.990	0.998
	sd	0.330	0.123	0.447	0.343	0.277	0.256	0.284	0.301	0.307	0.027	0.548	0.463	0.489	0.579	0.253

Table S3. Kinetic models of CS-La-βCD towards F^- removal

Kinetic models	Parameters	303K					313K					323K				
		12 mg/L	**14 mg/L**	**16 mg/L**	**18 mg/L**	**20 mg/L**	**12 mg/L**	**14 mg/L**	**16 mg/L**	**18 mg/L**	**20 mg/L**	**12 mg/L**	**14 mg/L**	**16 mg/L**	**18 mg/L**	**20 mg/L**
Pseudo first order	k_{ad} (min^{-1})	0.747	0.056	0.049	0.047	0.028	0.100	0.071	0.057	0.053	0.042	0.143	0.089	0.066	0.061	0.059
	r^2	0.967	0.983	0.991	0.993	0.996	0.960	0.987	0.995	0.994	0.997	0.917	0.961	0.991	0.996	0.995
	sd	0.089	0.047	0.031	0.025	0.018	0.133	0.053	0.029	0.025	0.017	0.284	0.114	0.042	0.023	0.026
Pseudo second order	q_e (mgg^{-1})	9.428	9.890	10.156	12.130	12.341	10.231	10.534	10.652	11.421	12.142	10.431	10.667	10.782	11.868	12.961
	k ($gmg^{-1}min^{-1}$)	5.18E-05	1.69E-04	3.45E-04	3.38E-04	4.08 E-04	1.45E-03	1.86E-03	2.49E-03	2.62E-03	3.13E-03	1.85E-03	1.90E-03	3.46E-03	4.65E-03	2.23E-03
	h ($mgg^{-1}min^{-1}$)	0.152	0.163	0.177	0.188	0.200	0.235	0.262	0.284	0.299	0.320	0.272	0.290	0.357	0.414	0.449
	r^2	0.998	0.993	0.997	0.997	0.997	0.991	0.991	0.995	0.995	0.991	0.995	0.993	0.991	0.997	0.993
	sd	0.013	0.039	0.038	0.035	0.037	0.108	0.115	0.100	0.097	0.013	0.082	0.099	0.135	0.087	0.129
Particle diffusion	k_d	0.076	0.058	0.049	0.047	0.043	0.051	0.037	0.029	0.026	0.023	0.153	1.188	0.066	0.059	0.059
	r^2	0.966	0.982	0.990	0.990	0.996	0.958	0.985	0.995	0.995	0.997	0.905	0.961	0.990	0.997	0.996
	sd	0.212	0.117	0.069	0.058	0.041	0.322	0.134	0.058	0.055	0.038	0.755	0.267	0.096	0.050	0.061
Intra particle diffusion	k_i	1.061	1.067	1.070	1.117	1.168	1.091	1.109	1.095	1.110	1.271	1.140	1.188	1.153	1.137	1.202
	r^2	0.994	0.995	0.997	0.997	0.998	0.998	0.999	0.999	0.999	0.992	0.999	0.999	0.999	0.999	0.999
	sd	0.152	0.141	0.109	0.060	0.277	0.083	0.072	0.047	0.040	0.027	0.059	0.069	0.047	0.062	0.037