

## **Supporting Information**

### **Investigating kinetics and adsorption isotherm study for fluoride removal from aqueous solution by mesoporous Cerium-Aluminum Binary Oxide Nanomaterials**

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Table 2s. Pseudo-second order Kinetics parameters for the sorption of fluoride ions onto Ce-Al (1:3) binary oxide nanoadsorbent

Kinetic models	Dosage of Ce-Al Binary oxides nanoparticles											
	0.1 g/l				0.5 g/l				1 g/l			
Pseudo-Second Order												
Linear Fitting	Initial concentrations (mg/l)											
	10	15	25	35	10	15	25	35	10	15	25	35
q <sub>e</sub> exp (mg/g)	68.9	99.9	159	197.9	15.4	24.2	42.22	60.42	9.43	13.58	23.36	32.9
q <sub>e</sub> cal (mg/g)	69.44	104.1	163.9	204.0	15.57	24.21	42.19	60.60	9.48	13.64	23.36	33.11
K <sub>2</sub> (g/mg/hour)	0.5184	0.0485	0.0465	0.0300	4.896	1.312	1.404	3.025	5.049	5.372	1.831	1.302
R <sup>2</sup>	1	0.9995	0.9999	0.9998	0.9991	0.9999	0.9998	1	1	1	1	1
Non-linear model												
Best-fit values												
q <sub>e</sub> exp (mg/g)	68.9	99.9	159	197.9	15.4	24.2	42.22	60.42	9.43	13.58	23.36	32.9
q <sub>e</sub> cal (mg/g)	69.92	99.99	160.25	198.16	15.50	25.39	43.01	60.67	9.65	13.89	23.52	33.28
K <sub>2</sub> (g/mg/hour)	0.40167	0.02415	0.02162	0.02106	1.15667	1.108	0.29122	0.20666	2.4509	1.9565	1.8584	1.0806
Std. Error												
q <sub>e</sub> cal (mg/g)	0.32291	2.16266	4.70601	4.51167	0.45979	1.04311	0.74891	0.04547	0.04637	0.10272	0.20072	0.11796
K <sub>2</sub> (g/mg/hour)	0.05848	0.00235	0.00361	0.00475	0.71988	1.43724	4.17567	0.23375	0.31704	0.44251	3.1799	0.15208
95% Confidence Intervals												
q <sub>e</sub> cal (mg/g)	68.8964 3 to 70.9516 9	910.3383 to 124.1034	155.2744 2 to 195.2276 6	192.8047 to 231.52099	14.03688 to 16.96342	22.0786 2 to 28.7178 8	40.62265 to 45.38941	60.53242 to 60.82183	9.5089 to 9.80402	13.5638 9 to 14.2177 2	22.8907 1 to 24.1682 8	32.9114 7 to 33.6622 6
K <sub>2</sub> (g/mg/hour)	0.2155 to 0.58778	0.01668t o 0.03162	0.0101 to 0.0331	0.01193 to 0.0422	0.1343 to 3.44764	0.46594 to 5.6819	1.9976 to 15.5800	0.4627 to 2.95054	1.44199 to 3.45993	0.5482 to 3.36481	2.26143 9	0.5966 to 1.56468
Goodness of Fit												
Degrees of Freedom	3	3	3	3	3	3	3	3	3	3	3	3
R <sup>2</sup>	0.9999	0.9995	0.9988	0.9991	0.9979	0.9959	0.9993	1	0.9999	0.9999	0.9998	0.9999
Residual Sum of Squares	0.14094	2.67027	16.1114	18.6471	0.26887	1.4710	0.81987	0.00305	0.00285	0.01421	0.05874	0.01926
Sy.x	0.21675	0.94345	2.31743	2.49314	0.29937	0.7002	0.52277	0.03187	0.03081	0.06883	0.13992	0.08013
Number of points analyzed	5	5	5	5	5	5	5	5	5	5	5	5

Table 3s. Weber–Morris intraparticle diffusion kinetic parameters for the sorption of fluoride ions onto Ce-Al (1:3) binary oxide nanoadsorbent

Kinetic models	Dosage of Ce-Al Binary oxides nanoparticles											
	0.1 g/l				0.5 g/l				1 g/l			
Intra-particle diffusion	Initial concentrations (mg/l)											
	10	15	25	35	10	15	25	35	10	15	25	35
Kid (mg/g/hour <sup>0.5</sup> )	1.26	4.27	5.30	8.90	0.1679	0.2315	0.2544	0.285	0.2466	0.2897	0.3395	0.6325
C (mg/g)	10.67	18.80	25.01	27.55	13.905	24.314	42.584	59.905	8.9868	13.074	23.223	31.663
R <sup>2</sup>	0.7794	0.8712	0.8476	0.8151	0.7677	0.8278	0.9006	0.7882	0.8207	0.8481	0.9255	0.9896