Supplementary Material

Table S1: Collected datasets

Paper No.	Concentration (cell/ml)	Ionic strength (mM)	Velocity (cm/h)	L (cm)	Porous media Type	Median grain size (μm)	Saturated hydralic conductivity (cm/h)	Organic matter content (%)	k temporal removal rate (h-1)	λ spatial removal rate (cm-1)
1	1.25E+07	1	16.67	10	sand	335		0	0.17563598	0.01053605
	1.25E+07	10	16.67	10	sand	335		0	0.25142176	0.01508229
	1.25E+07	100	16.67	10	sand	335		0	0.3719803	0.02231436
2	1.60E+07	100	31.84	10	sand	363		0	2.08210187	0.06539265
3	1.00E+08	100	8.7	10	sand	440		0	1.20607609	0.13862944
	1.00E+08	100	13	10	sand	440		0	0.90109133	0.06931472
4	2.00E+08	0.0055	15.3	30	sand	1000		0	0.18	0.01176471
	2.00E+08	0.0055	15.3	30	sand	1000		0	0.216	0.01411765
	2.00E+08	0.0055	15.3	30	sand	1000		0	0.138	0.00901961
	2.00E+08	0.0055	15.3	30	sand	1000		0	0.102	0.00666667
5	1.00E+08	10	4.16	11	sand	213		0	0.6894	0.16572115
	1.00E+08	10	20.8	11	sand	213		0	1.44	0.06923077
	1.00E+08	10	208	11	sand	213		0	1.4832	0.00713077
	1.00E+08	30	4.16	11	sand	213		0	1.368	0.32884615
	1.00E+08	30	20.8	11	sand	213		0	1.602	0.07701923
	1.00E+08	30	208	11	sand	213		0	2.94	0.01413462

	1.00E+08	50	4.16	11	sand	213		0	1.74	0.41826923
	1.00E+08	50	20.8	11	sand	213		0	2.94	0.14134615
	1.00E+08	50	208	11	sand	213		0	5.04	0.02423077
6	1.20E+07	10	16.67	10	sand	509		0	0.33081771	0.01984509
	1.20E+07	10	16.67	10	sand	509		0	1.22352661	0.07339692
7	1.00E+03	10	8.03	25	Disturbed soil	320	28.5	0.68	0.07162908	0.00892574
	1.00E+03	10	16.05	25	Disturbed soil	320	28.5	0.68	0.1274055	0.00793804
	1.00E+03	10	32.10	25	Disturbed soil	320	28.5	0.68	0.17881249	0.00557048
	1.00E+03	10	8.03	25	sand	400		0	0.09234595	0.01150728
	1.00E+03	10	16.05	25	sand	400		0	0.22898531	0.014267
	1.00E+03	10	32.10	25	sand	400		0	0.6559001	0.02043302
8	1.25E+07	10	33.3	10	sand	363		0	0.35085052	0.01053605
	1.25E+07	50	33.3	10	sand	363		0	2.30818011	0.06931472
9	1.00E+08	1	74.64	20	sand	600		0	0.31118016	0.00416908
	1.00E+08	20	74.64	20	sand	600		0	0.39320544	0.00526803
	1.00E+08	100	74.64	20	sand	600		0	0.56287102	0.00754114
10	1.00E+08	0.1	36.3	17	sand	1050		0	2.07734455	0.05722712
11	1.00E+08	150	4.77	15	sand	363		0	0.16297299	0.03416625
	1.00E+08	150	4.77	15	sand	256		0	0.19011217	0.0398558
	1.00E+08	150	4.77	15	sand	128		0	0.22361681	0.04687983
	1.00E+08	150	4.77	15	sand	91		0	0.25605255	0.05367978

12	2.00E+08	10	33.3	10	sand	400	0	0.97578883	0.02930297
	2.00E+08	50	33.3	10	sand	400	0	1.57578517	0.04732088
13	1.35E+07	5	16.67	10	sand	550	0	0.47956601	0.02876821
	1.35E+07	25	16.67	10	sand	550	0	0.71811512	0.04307829
	1.35E+07	5	16.67	10	sand	550	0	0.08550592	0.00512933
	1.35E+07	25	16.67	10	sand	550	0	0.25142176	0.01508229
	1.35E+08	5	16.67	10	sand	550	0	0.3719803	0.02231436
	1.35E+08	25	16.67	10	sand	550	0	0.54761628	0.03285041
	1.35E+08	5	16.67	10	sand	550	0	1.09009542	0.06539265
	1.35E+08	25	16.67	10	sand	550	0	1.33111233	0.07985077
14	4.07E+07	17.11	108	12	sand	150	0	1.18123458	0.01093736
	4.23E+07	85.55	108	12	sand	150	0	3.17158548	0.02936653
	3.97E+07	171.1	108	12	sand	150	0	19.9476666	0.18470062
	3.81E+07	256.65	108	12	sand	150	0	31.864135	0.29503829
	4.33E+07	85.55	108	12	sand	150	0	4.77466431	0.04420985
	4.11E+07	171.1	108	12	sand	150	0	13.0335279	0.12068081
	3.91E+07	256.65	108	12	sand	150	0	16.1619074	0.14964729
	3.03E+07	256.65	108	12	sand	150	0	16.7210934	0.15482494
	4.42E+07	17.11	108	12	sand	350	0	0.09045302	0.00083753
	3.72E+07	42.775	108	12	sand	350	0	0.24634077	0.00228093
	4.14E+07	85.55	108	12	sand	350	0	0.66281886	0.00613721

4.37E+07	128.325	108	12	sand	350	0	0.47111832	0.00436221
3.81E+07	171.1	108	12	sand	350	0	1.13006901	0.0104636
2.54E+07	213.875	108	12	sand	350	0	1.11987071	0.01036917
4.62E+07	230.985	108	12	sand	350	0	3.01925463	0.02795606
3.42E+07	256.65	108	12	sand	350	0	4.3459763	0.04024052
3.62E+07	256.65	108	12	sand	350	0	4.3751971	0.04051108
4.72E+07	342.2	108	12	sand	350	0	8.405511	0.07782881
3.71E+07	85.55	108	12	sand	350	0	0.9682669	0.00896543
4.81E+07	171.1	108	12	sand	350	0	1.66612936	0.01542712
2.97E+07	256.65	108	12	sand	350	0	2.21310485	0.02049171
3.57E+07	342.2	108	12	sand	350	0	3.57747245	0.03312474
3.13E+07	342.2	108	12	sand	350	0	7.14665789	0.06617276
4.01E+07	342.2	108	12	sand	350	0	5.76499257	0.05337956
4.37E+07	17.11	108	12	sand	710	0	0.0090045	8.3375E-05
3.58E+07	171.1	108	12	sand	710	0	1.87429445	0.01735458
4.01E+07	256.65	108	12	sand	710	0	4.4634331	0.04132808
3.61E+07	342.2	108	12	sand	710	0	3.94654466	0.03654208
3.65E+07	85.55	108	12	sand	710	0	1.50512327	0.01393633
2.38E+07	171.1	108	12	sand	710	0	2.1101158	0.01953811
2.93E+07	256.65	108	12	sand	710	0	2.121501	0.01964353
4.33E+07	342.2	108	12	sand	710	0	4.3751971	0.04051108

	2.17E+07	342.2	108	12	sand	710	0	5.18628086	0.04802112
15	1.50E+07	20	16.67	10	sand	319	0	0.50194219	0.03011051
16	3.00E+08	1	2.93	12	sand	205	0	0.05448422	0.0185953
	3.00E+08	10	2.93	12	sand	205	0	0.07024237	0.02397351
	3.00E+08	100	2.93	12	sand	205	0	0.22372765	0.07635756
17	9.08E+08	0.1	71.31	17	sand	395	0	3.20314258	0.04491586
	5.62E+08	0.1	73.99	17	sand	395	0	3.45628113	0.04671018
	7.08E+08	0.1	57.58	17	sand	1030	0	3.1721728	0.05508785
	8.40E+08	0.1	57.72	17	sand	1030	0	2.96179119	0.05131023
18	5.00E+07	25	16.67	10	sand	509	0	1.09009542	0.06539265
19	1.00E+07	10	33.3	20	sand	509	0	0.47899065	0.0143841
	1.00E+07	20	33.3	20	sand	509	0	0.74306803	0.02231436
	1.00E+07	30	33.3	20	sand	509	0	1.05707232	0.03174391
20	2.50E+07	3	133	7.35	sand	275	0	1.44	0.01082707
	2.50E+07	10	133	7.35	sand	275	0	2.16	0.0162406
	2.50E+07	30	133	7.35	sand	275	0	10.8	0.08120301
	2.50E+07	50	133	7.35	sand	275	0	18	0.13533835
	2.50E+07	100	133	7.35	sand	275	0	46.8	0.3518797
	2.50E+07	300	133	7.35	sand	275	0	54	0.40601504
	2.50E+07	10	133	7.35	sand	275	0	1.512	0.01136842
	2.50E+07	30	133	7.35	sand	275	0	2.52	0.01894737

	2.50E+07	50	133	7.35	sand	275	0	7.2	0.05413534
	2.50E+07	100	133	7.35	sand	275	0	36	0.27067669
	2.50E+07	300	133	7.35	sand	275	0	54	0.40601504
21	1.70E+08	14	5.57	15	sand	710	0	0.09129242	0.01639337
	1.70E+08	14	19.16	15	sand	710	0	0.24726791	0.01290565
	1.70E+08	14	35.64	15	sand	710	0	0.52716714	0.01479296
	1.70E+08	14	4.22	15	sand	360	0	0.17191206	0.04070973
	1.70E+08	14	17.84	15	sand	360	0	0.37425062	0.02098072
	1.70E+08	14	33.79	15	sand	360	0	0.86553819	0.02561286
	1.70E+08	14	4.81	15	sand	240	0	0.76586585	0.15906445
	1.70E+08	14	17.53	15	sand	240	0	1.01104671	0.05767483
	1.70E+08	14	3.05	10	sand	150	0	1.77404966	0.5809143
	1.70E+08	14	17.95	15	sand	150	0	2.42281809	0.13499689
	1.70E+08	14	30.34	10	sand	150	0	2.29095424	0.07550226
22	1.00E+08	20	41.67	6.8	sand	280	0	0.49	0.01176
	1.00E+08	20	41.67	6.8	sand	280	0	0.54	0.01296
	1.00E+08	20	41.67	6.8	sand	280	0	0.7	0.0168
	1.00E+08	20	20.83	6.8	sand	280	0	0.29	0.01392
	1.00E+08	20	20.83	6.8	sand	280	0	0.27	0.01296
	1.00E+08	20	20.83	6.8	sand	280	0	0.29	0.01392
	1.00E+08	20	4.17	6.8	sand	280	0	0.1	0.024

	1.00E+08	20	4.17	6.8	sand	280	0	0.05	0.012
	1.00E+08	20	4.17	6.8	sand	280	0	0.04	0.0096
23	1.00E+08	5	4.17	5	sand	213	0	0.08965434	0.02151704
	1.00E+08	10	4.17	5	sand	213	0	0.25770521	0.06184925
	1.00E+08	20	4.17	5	sand	213	0	0.33124745	0.07949939
24	1.15E+06	20	12	10	sand	420	0	0.37765289	0.03147107
25	4.00E+07	165	18.6	15	sand	774	0	3.438	0.18483871
	4.00E+07	165	18.6	15	sand	774	0	3.06	0.16451613
26	1.94E+08	2	78.46	30	sand	513	0	0.1259056	0.00160468
	1.98E+08	2	24.62	30	sand	1440	0	0.03435012	0.00139547
	2.00E+08	2	24.62	30	sand	513	0	0.0464167	0.00188568
	1.88E+08	2	24.62	30	sand	181	0	0.03178735	0.00129136
27	4.00E+07	8.4	18.6	15	sand	780	0	0.05061927	0.00272147
	4.00E+07	168	18.6	15	sand	780	0	0.53417082	0.02871886
	4.00E+07	8.4	18.6	15	sand	780	0	0.02505136	0.00134685
	4.00E+07	168	18.6	15	sand	780	0	0.57292397	0.03080236
28	4.00E+07	1	18.6	15	sand	774	0	0.51523915	0.02770103
	4.00E+07	3	18.6	15	sand	774	0	0.8595025	0.04620981
	4.00E+07	10	18.6	15	sand	774	0	1.01801588	0.05473204
	4.00E+07	30	18.6	15	sand	774	0	1.0757007	0.05783337
	4.00E+07	100	18.6	15	sand	774	0	0.91012178	0.04893128

	4.00E+07	1	18.6	15	sand	774	0	0.55339601	0.02975247
	4.00E+07	3	18.6	15	sand	774	0	0.91012178	0.04893128
	4.00E+07	10	18.6	15	sand	774	0	0.936228	0.05033484
	4.00E+07	30	18.6	15	sand	774	0	1.0757007	0.05783337
	4.00E+07	100	18.6	15	sand	774	0	1.04652289	0.05626467
	4.00E+07	1	18.6	15	sand	774	0	0.276698	0.01487624
	4.00E+07	3	18.6	15	sand	774	0	0.55339601	0.02975247
	4.00E+07	10	18.6	15	sand	774	0	0.51523915	0.02770103
	4.00E+07	30	18.6	15	sand	774	0	0.59276439	0.03186905
	4.00E+07	100	18.6	15	sand	774	0	0.59276439	0.03186905
	4.00E+07	1	18.6	15	sand	774	0	0.276698	0.01487624
	4.00E+07	3	18.6	15	sand	774	0	0.63342377	0.03405504
	4.00E+07	10	18.6	15	sand	774	0	0.49659218	0.0266985
	4.00E+07	30	18.6	15	sand	774	0	0.61292744	0.03295309
	4.00E+07	100	18.6	15	sand	774	0	0.55339601	0.02975247
29	2.00E+08	5.3	10.6	30	sand	1000	0	0.366	0.0345283
30	5.00E+07	10	39.6	10	sand	205	0	2.46	0.06212121
	5.00E+07	10	39.6	10	sand	205	0	3.6	0.09090909
	5.00E+07	30	39.6	10	sand	205	0	7.26	0.18333333
	5.00E+07	30	39.6	10	sand	205	0	5.4	0.13636364
	5.00E+07	50	39.6	10	sand	205	0	17.4	0.43939394

	5.00E+07	50	39.6	10	sand	205	0	15	0.37878788
	5.00E+07	100	39.6	10	sand	205	0	54	1.36363636
	5.00E+07	100	39.6	10	sand	205	0	54.6	1.37878788
31	4.15E+08	0.0055	300.76	44	sand	1430	0	0.79655609	0.0026485
	9.25E+08	0.0055	99.03	22	sand	1430	0	1.00441722	0.01014289
	5.55E+08	0.0055	20.22	44	sand	288	0	4.97297674	0.24590405
	3.74E+08	0.0055	25.03	44	sand	288	0	4.61460166	0.18435746
	4.80E+08	0.0055	58.29	22	sand	288	0	4.63292958	0.07948636
	4.21E+08	0.0055	47.24	22	sand	288	0	9.13570404	0.19338697
32	1.00E+08	10	33.3	10	sand	300	0	7.66760836	0.23025851
	1.00E+08	1	33.3	10	sand	300	0	6.54715581	0.19661129
33	9.30E+07	1	175.8	13.6	sand	205	0	0.396	0.00225256
	8.30E+07	1	175.8	14.2	sand	205	0	0.1044	0.00059386
	1.10E+08	1	175.8	14	sand	205	0	0.612	0.00348123
	3.20E+07	1	175.8	22.5	sand	205	0	0.2916	0.0016587
	6.00E+07	3.2	175.8	3.2	sand	205	0	0.864	0.00491468
	9.10E+07	3.2	175.8	11.9	sand	205	0	0.54	0.00307167
	3.70E+07	3.2	175.8	11.9	sand	205	0	0.504	0.00286689
	5.80E+07	3.2	175.8	11.7	sand	205	0	0.648	0.00368601
	2.50E+07	10	175.8	10	sand	205	0	2.412	0.01372014
	1.00E+08	10	175.8	14.1	sand	205	0	1.836	0.01044369

	7.90E+07	10	175.8	14.2	sand	205	0	1.332	0.00757679
	8.30E+06	10	175.8	9.2	sand	205	0	1.476	0.0083959
	1.10E+07	10	175.8	9.4	sand	205	0	2.268	0.01290102
	1.00E+08	31.6	175.8	31.6	sand	205	0	8.28	0.04709898
	6.20E+06	31.6	175.8	14.5	sand	205	0	10.8	0.06143345
	1.00E+08	31.6	175.8	13.8	sand	205	0	5.04	0.02866894
	2.00E+06	31.6	175.8	13.6	sand	205	0	9.72	0.0552901
	9.10E+06	31.6	175.8	8.9	sand	205	0	8.28	0.04709898
	8.20E+06	31.6	175.8	9.1	sand	205	0	10.08	0.05733788
	1.30E+07	31.6	175.8	9.2	sand	205	0	6.48	0.03686007
	8.40E+07	100	175.8	100	sand	205	0	68.4	0.3890785
	9.80E+07	100	175.8	13.5	sand	205	0	75.6	0.43003413
	1.10E+08	100	175.8	13.7	sand	205	0	57.6	0.32764505
	1.80E+07	100	175.8	7.3	sand	205	0	68.4	0.3890785
	7.10E+06	100	175.8	7.3	sand	205	0	54	0.30716724
	1.80E+07	300	175.8	13.5	sand	205	0	111.6	0.63481229
34	2.00E+08	2	3.55	6	sand	463	0	1.57339552	0.44321001
	2.00E+08	20	3.55	6	sand	463	0	2.07471342	0.58442632
	2.00E+08	100	3.55	6	sand	463	0	2.4848255	0.69995085
	2.00E+08	2	10.56	6	sand	463	0	1.21993904	0.11552453
	2.00E+08	20	10.56	6	sand	463	0	1.84768694	0.17497035

	2.00E+08	100	10.56	6	sand	463	0	2.66486481	0.25235462
	2.00E+08	2	21.3	6	sand	463	0	1.02127136	0.04794701
	2.00E+08	20	21.3	6	sand	463	0	2.05835566	0.09663642
	2.00E+08	100	21.3	6	sand	463	0	1.31727607	0.06184395
35	5.00E+07	30	90	10	sand	205	0	2.00829196	0.02231436
	5.00E+07	50	90	10	sand	205	0	7.59573063	0.08439701
	5.00E+07	100	90	10	sand	205	0	35.208207	0.3912023
	5.00E+07	30	90	10	sand	205	0	5.38053301	0.0597837
	5.00E+07	50	90	10	sand	205	0	12.4766493	0.13862944
	5.00E+07	100	90	10	sand	205	0	41.4465317	0.46051702
36	3.86E+07	0.2	195.48	5	sand	196	0	3.25988738	0.01667632
	4.67E+07	0.2	167.04	2	sand	196	0	8.79971027	0.05268026
	4.61E+07	0.2	194.76	1	sand	196	0	24.8968274	0.12783337
	1.78E+08	0.2	194.76	1	sand	196	0	20.520014	0.10536052
	1.20E+09	0.2	194.76	1	sand	196	0	9.98988201	0.05129329
	4.74E+07	0.2	190.44	1	sand	196	0	17.9605258	0.09431068
	4.32E+07	0.2	187.2	5	sand	83	0	6.52779081	0.03487068
	4.54E+07	0.2	184.32	2	sand	83	0	11.7811235	0.06391669
	6.45E+07	0.2	163.44	1	sand	83	0	6.67194678	0.04082199
	1.39E+08	0.2	184.32	1	sand	83	0	13.3762301	0.07257069
	5.90E+08	0.2	182.16	1	sand	83	0	5.54844924	0.03045921

4.69E+07	0.2	179.28	1	sand	83	0	5.46072672	0.03045921
4.22E+07	0.2	174.24	5	sand	49	0	11.9351023	0.06849806
4.63E+07	0.2	174.24	2	sand	49	0	21.6459536	0.12423068
4.34E+07	0.2	154.44	1	sand	49	0	36.4049572	0.23572233
4.83E+07	0.2	117.36	5	sand	49	0	9.40000944	0.08009551
4.46E+07	0.2	77.04	5	sand	49	0	6.63750317	0.08615658
1.00E+05	0.2	149.4	5	sand	49	0	12.4156015	0.08310309
1.00E+04	0.2	154.44	5	sand	49	0	17.9094337	0.1159637
1.00E+03	0.2	149.4	5	sand	49	0	15.2634696	0.10216512
1.22E+08	0.2	181.8	1	sand	49	0	27.4196014	0.15082289
3.67E+09	0.2	164.16	1	sand	49	0	19.1301913	0.11653382
1.77E+07	0.2	164.16	0.25	sand	49	0	54.7516997	0.33352644
4.27E+07	0.2	165.96	1	sand	49	0	28.9356881	0.17435339
4.41E+07	0.2	166.32	5	sand	42	0	27.3090971	0.16419611
3.76E+07	0.2	171	2	sand	42	0	24.5968172	0.14384104
3.77E+07	0.2	156.6	1	sand	42	0	49.2837026	0.31471074
4.95E+07	0.2	112.32	5	sand	42	0	12.2367513	0.10894544
4.89E+07	0.2	68.4	5	sand	42	0	10.6229138	0.15530576
1.30E+05	0.2	132.12	5	sand	42	0	30.9473391	0.2342366
1.00E+03	0.2	132.12	5	sand	42	0	24.2120663	0.18325815
1.56E+08	0.2	171	1	sand	42	0	36.0332964	0.21072103

	9.01E+08	0.2	172.08	1	sand	42	0	32.0635938	0.18632958
	4.80E+07	0.2	161.28	0.25	sand	42	0	97.2988626	0.60329156
	4.38E+07	0.2	166.32	1	sand	42	0	61.7153115	0.37106368
37	1.00E+08	5	18.6	20	sand	120	0	0.76351191	0.04104903
	1.00E+08	20	20.4	20	sand	120	0	2.16266881	0.10601318
	1.00E+08	100	22.2	20	sand	120	0	4.34234554	0.19560115
	1.00E+08	20	618	20	sand	710	0	0.62426366	0.00101014
	1.00E+08	100	618	20	sand	710	0	2.57649172	0.00416908
38	1.00E+08	3	15	23	sand	260	0	1.1183468	0.07455645
	1.00E+08	3	15	23	sand	260	0	0.93072806	0.06204854
39	6.91E+07	0.0055	156	10	sand	300	0	30.6713606	0.19661129
	7.18E+07	0.0055	156	15	sand	300	0	26.2675779	0.16838191
	6.71E+07	0.0055	156	20	sand	300	0	20.7422283	0.132963
	6.87E+07	0.0055	156	25	sand	300	0	17.5556829	0.11253643
	7.44E+07	0.0055	156	30	sand	300	0	15.5778078	0.09985774
	7.19E+07	0.0055	156	10	sand	600	0	24.3461049	0.15606477
	7.26E+07	0.0055	156	15	sand	600	0	21.2182966	0.13601472
	7.29E+07	0.0055	156	20	sand	600	0	17.2167443	0.11036375
	7.30E+07	0.0055	156	25	sand	600	0	15.0255806	0.09631782
	6.75E+07	0.0055	156	30	sand	600	0	13.133789	0.08419095
	7.28E+07	0.0055	156	10	sand	1000	0	21.626192	0.13862944

	7.27E+07	0.0055	156	15	sand	1000	0	19.7300478	0.12647467
	6.95E+07	0.0055	156	20	sand	1000	0	17.9601637	0.11512925
	7.15E+07	0.0055	156	25	sand	1000	0	15.7605467	0.10102915
	7.52E+07	0.0055	156	30	sand	1000	0	14.6297357	0.09378036
40	1.00E+09	10	110	37	sand	356	0	1.12796082	0.01025419
	1.00E+09	10	110	57	sand	356	0	0.86256103	0.00784146
	1.00E+09	10	110	77	sand	356	0	1.04979395	0.00954358
	1.00E+09	10	110	107	sand	356	0	0.90205233	0.00820048
	1.00E+09	10	110	147	sand	356	0	0.78962977	0.00717845
41	1.00E+08	10	292	600	sand	356	0	0.30202599	0.00103434
	1.00E+08	10	292	1215	sand	356	0	0.26272891	0.00089976
	1.00E+08	10	292	1900	sand	356	0	0.20791075	0.00071202
	1.00E+08	10	292	2565	sand	356	0	0.20493594	0.00070184
42	1.31E+08	10	2.76	25.4	sand	532	0	0.02910816	0.01054643
	1.57E+08	10	2.81	25.4	sand	532	0	0.01837061	0.00653758
43	3.00E+07	10	54	15	sand	387	0	3.69186159	0.06836781
	3.00E+07	100	54	15	sand	387	0	2.63110972	0.04872425
44	4.00E+07	1	50.4	15	sand	254	0	0.69499157	0.01378952
	4.00E+07	5	50.4	15	sand	254	0	1.0149002	0.02013691
	4.00E+07	20	50.4	15	sand	254	0	2.93322812	0.05819897
	4.00E+07	50	50.4	15	sand	254	0	7.91609208	0.15706532

45	9.08E+08	0.1	71.3142857	17	sand	360	0	3.58434618	0.05026126
	5.62E+08	0.1	73.9941691	17	sand	360	0	4.7850084	0.06466737
	6.29E+08	0.1	74.3023256	17	sand	360	0	3.73452885	0.05026126
	7.08E+08	0.1	57.5838926	17	sand	900	0	3.47939834	0.06042312
	8.40E+08	0.1	57.7232143	17	sand	900	0	3.39688208	0.05884776
46	1.00E+07	10	139.8	10	sand	607	0	0.57390755	0.0041052
	1.00E+07	10	139.8	10	sand	310	0	1.12052842	0.00801522
	1.00E+07	10	21	10	sand	607	0	0.20837461	0.0099226
	1.00E+07	10	21	10	sand	310	0	0.37978606	0.01808505
	1.00E+07	32	139.8	10	sand	607	0	1.39936018	0.01000973
	1.00E+07	32	139.8	10	sand	310	0	4.00465552	0.0286456
	1.00E+07	32	21	10	sand	607	0	0.50283	0.02394429
	1.00E+07	32	21	10	sand	310	0	1.69407045	0.08067002
47	1.00E+08	10	2.38	10	sand	300	0	0.31845995	0.1338067
	1.00E+08	10	2.38	10	sand	300	0	0.37110545	0.15592666
48	1.30E+08	1.5	108.3	15	sand	327	0	1.43281578	0.01323006
49	3.00E+08	1	252	30	sand	1500	0.82	1.74011385	0.00690521
	3.00E+08	5	252	30	sand	1500	0.82	3.61039909	0.01432698
	3.00E+08	10	252	30	sand	1500	0.82	4.46010069	0.01769881
	3.00E+08	50	252	30	sand	1500	0.82	6.09601761	0.02419055
	3.00E+08	100	252	30	sand	1500	0.82	7.35262584	0.02917709

	3.00E+08	1	252	30	sand	1500		0.9	2.47335535	0.0098149
	3.00E+08	50	252	30	sand	1500		0.9	9.05986673	0.03595185
	3.00E+08	1	252	30	sand	1500		0.05	2.48277146	0.00985227
	3.00E+08	50	252	30	sand	1500		0.05	3.66931527	0.01456077
50	2.00E+08	10	6	5	Intact soil		0.674	3.71	1.25978655	0.20996442
	2.00E+08	10	6	5	Intact soil		0.713	3.05	0.65367261	0.10894544
	2.00E+08	10	6	5	Intact soil		1.017	2.55	0.23814113	0.03969019
	2.00E+08	10	6	5	Intact soil		0.857	2.11	0.0120604	0.00201007
	2.00E+08	10	6	5	Disturbed soil		0.674	3.84	2.27654398	0.379424
	2.00E+08	10	6	5	Disturbed soil		0.713	3.35	0.95820924	0.15970154
	2.00E+08	10	6	5	Disturbed soil		1.017	2.86	0.37765289	0.06294215
	2.00E+08	10	6	5	Disturbed soil		0.857	2.47	0.22359549	0.03726592
51	2.00E+08	10	12	5	Intact soil		0.674	3.71	0.72265222	0.06022102
	2.00E+08	10	12	5	Intact soil		0.713	3.05	0.47628225	0.03969019
	2.00E+08	10	12	5	Intact soil		1.017	2.55	0.33422896	0.02785241
	2.00E+08	10	12	5	Intact soil		0.857	2.11	0.02412081	0.00201007
	2.00E+08	10	12	5	Disturbed soil		0.674	3.84	2.5195731	0.20996442
	2.00E+08	10	12	5	Disturbed soil		0.857	2.47	0.02412081	0.00201007
52	2.00E+08	0.0055	15.3	30	Disturbed soil		2.51	0.06	1.284	0.08392157
	2.00E+08	0.0055	15.3	30	Disturbed soil		2.51	0.06	1.392	0.09098039
53	3.50E+08	4.6	9.5	15	Intact soil		3.96	0.84	0.04596144	0.00483805

	3.50E+08	4.6	9.5	30	Intact soil	3.96	0.84	0.09534995	0.01003684
	3.50E+08	4.6	9.5	45	Intact soil	3.96	0.84	0.11499796	0.01210505
	3.50E+08	4.6	15.33	15	Intact soil	9.66	0.97	0.10767845	0.00702403
	3.50E+08	4.6	15.33	30	Intact soil	9.66	0.97	0.14700554	0.0095894
	3.50E+08	4.6	15.33	45	Intact soil	9.66	0.97	0.13138235	0.00857028
54	3.50E+08	1.1	2.495	15	Disturbed soil	0.95309	0.53	0.13609527	0.0545472
	3.50E+08	1.1	2.495	30	Disturbed soil	0.95309	0.53	0.08328695	0.03338154
	3.50E+08	1.1	2.495	45	Disturbed soil	0.95309	0.55	0.09138156	0.03662588
	3.50E+08	1.1	7.083	15	Intact soil	3.32901	0.53	0.10420466	0.01471194
	3.50E+08	1.1	7.083	30	Intact soil	3.32901	0.53	0.31255211	0.04412708
	3.50E+08	1.1	7.083	45	Intact soil	3.32901	0.55	0.22875674	0.03229659
	3.50E+08	1.1	4.593	15	Disturbed soil	1.488132	0.42	0.34801161	0.07577
	3.50E+08	1.1	4.593	30	Disturbed soil	1.488132	0.44	0.19022741	0.04141681
	3.50E+08	1.1	4.593	45	Disturbed soil	1.488132	0.5	0.15721499	0.03422926
	3.50E+08	1.1	6.15	15	Intact soil	2.29395	0.42	0.29124048	0.04735618
	3.50E+08	1.1	6.15	30	Intact soil	2.29395	0.44	0.30561399	0.04969333
	3.50E+08	1.1	6.15	45	Intact soil	2.29395	0.5	0.274466	0.04462862
55	4.88E+04	0.5	34	25	Intact soil	17.22	0.35	1.6286	0.0479
	6.54E+04	0.5	37	25	Intact soil	17.22	0.56	4.2513	0.1149
	7.32E+04	0.5	38	25	Intact soil	17.22	0.58	3.1882	0.0839
	5.54E+04	0.5	39	25	Intact soil	17.22	0.26	4.0287	0.1033

56	3.00E+03	1.1	0.722	20	Intact soil		0.26	0.48	0.016606	0.023
	3.00E+03	0.75	0.743	40	Intact soil		0.26	0.36	0.0392304	0.0528
57	1.00E+08	0.4	87	18.2	Disturbed soil		55.8	0.55	5.52202691	0.06347157
58	1.20E+06	7.5	5.29166667	50	Disturbed soil	180		0.6	0.11548533	0.021824
	1.20E+06	7.5	10.5833333	50	Disturbed soil	180		0.6	0.215392	0.020352
	1.20E+06	5.7	11.7083333	50	Disturbed soil	500	4.17	2.7	0.2761106	0.0235824
	1.20E+06	5.7	32.375	50	Disturbed soil	500	4.17	2.7	0.56877954	0.01756848
59	5.20E+08	30	5.96	10	Intact soil		0.84	1.45	0.55209928	0.09263411
	5.20E+08	30	4.73	10	Intact soil		1.01	1.56	0.53161894	0.11239301
60	3.50E+08	4.6	2.52	15	Disturbed soil		0.95309	0.97	0.09740951	0.03865457
	3.50E+08	4.6	2.52	30	Disturbed soil		0.95309	0.97	0.07909512	0.03138695
	3.50E+08	4.6	2.52	45	Disturbed soil		0.95309	0.97	0.06932096	0.02750832
	3.50E+08	4.6	15.42	15	Intact soil		9.66	0.97	0.06360792	0.00412503
	3.50E+08	4.6	15.42	30	Intact soil		9.66	0.97	0.14786859	0.0095894
	3.50E+08	4.6	15.42	45	Intact soil		9.66	0.97	0.12222061	0.00792611
	3.50E+08	4.6	4.68	15	Disturbed soil		1.488132	0.84	0.18090337	0.03865457
	3.50E+08	4.6	4.68	30	Disturbed soil		1.488132	0.84	0.10813096	0.02310491
	3.50E+08	4.6	4.68	45	Disturbed soil		1.488132	0.84	0.09022006	0.01927779
	3.50E+08	4.6	11.34	15	Intact soil		3.96	0.84	0.03877773	0.00341955
	3.50E+08	4.6	11.34	30	Intact soil		3.96	0.84	0.10373713	0.00914789
	3.50E+08	4.6	11.34	45	Intact soil		3.96	0.84	0.12872806	0.01135168

61	4.60E+05	20	0.09416667	20	Intact soil	0.07541667	3.535	0.0134061	0.14236561
	4.60E+05	20	0.34791667	20	Intact soil	0.27833333	3.285	0.01944498	0.05588976
	4.60E+05	20	0.38666667	20	Intact soil	0.30916667	2.99	0.01340085	0.03465736

Table S2: (a) The performance of candidate models in predicting first-order attachment coefficient (one example and averaged values from 5-fold cross validation).

Model ID	RMSE	MAE
GBM_5_AutoML_5_20230329_213518	6.876519	47.28651
XGBoost_2_AutoML_5_20230329_213518	7.20765	51.95022
GBM_grid_1_AutoML_5_20230329_213518_model_2	7.316178	53.52646
XGBoost_grid_1_AutoML_5_20230329_213518_model_3	7.476035	55.8911
XGBoost_grid_1_AutoML_5_20230329_213518_model_2	7.52997	56.70045
XGBoost_grid_1_AutoML_5_20230329_213518_model_1	7.598393	57.73557
XGBoost_3_AutoML_5_20230329_213518	7.751489	60.08558
GBM_4_AutoML_5_20230329_213518	7.849978	61.62216
XRT_1_AutoML_5_20230329_213518	7.931582	62.90999
DeepLearning_grid_2_AutoML_5_20230329_213518_model_1	7.978416	63.65512
GBM_3_AutoML_5_20230329_213518	8.228532	67.70874
GBM_2_AutoML_5_20230329_213518	8.36859	70.03329
XGBoost_1_AutoML_5_20230329_213518	8.42557	70.99022
DRF_1_AutoML_5_20230329_213518	8.724111	76.11012
DeepLearning_grid_3_AutoML_5_20230329_213518_model_1	9.753101	95.12297
GBM_grid_1_AutoML_5_20230329_213518_model_1	9.774047	95.53199
DeepLearning_grid_1_AutoML_5_20230329_213518_model_1	10.34111	106.9385
GBM_1_AutoML_5_20230329_213518	11.9224	142.1435
DeepLearning_1_AutoML_5_20230329_213518	12.66608	160.4296
GLM_1_AutoML_5_20230329_213518	12.89371	166.2478
GBM	6.842156	46.94377
XGBoost	6.802661	46.47265
DeepLearning	8.781804	77.99138
DRF	8.347773	69.77396
XRT	8.130502	66.23638
GLM	12.97116	168.6133

Table S2: (b) The performance of candidate models in predicting spatial removal rate (one example and averaged values from 5-fold cross validation).

Model ID	RMSE	MAE
GBM_5_AutoML_3_20230331_225732	0.066207	0.004383
XGBoost_3_AutoML_3_20230331_225732	0.06785	0.004604
XGBoost_grid_1_AutoML_3_20230331_225732_model_2	0.073635	0.005422
XGBoost_grid_1_AutoML_3_20230331_225732_model_3	0.074827	0.005599
XGBoost_2_AutoML_3_20230331_225732	0.076888	0.005912
DRF_1_AutoML_3_20230331_225732	0.08459	0.007156
GBM_grid_1_AutoML_3_20230331_225732_model_2	0.085605	0.007328
GBM_2_AutoML_3_20230331_225732	0.087612	0.007676
GBM_3_AutoML_3_20230331_225732	0.088714	0.00787
GBM_4_AutoML_3_20230331_225732	0.090402	0.008172
XGBoost_1_AutoML_3_20230331_225732	0.092268	0.008513
XRT_1_AutoML_3_20230331_225732	0.101373	0.010276
GBM_grid_1_AutoML_3_20230331_225732_model_1	0.113753	0.01294
XGBoost_grid_1_AutoML_3_20230331_225732_model_1	0.115458	0.01333
DeepLearning_grid_2_AutoML_3_20230331_225732_model_1	0.126975	0.016123
DeepLearning_grid_1_AutoML_3_20230331_225732_model_1	0.131267	0.017231
DeepLearning_grid_3_AutoML_3_20230331_225732_model_1	0.142589	0.020332
GBM_1_AutoML_3_20230331_225732	0.146386	0.021429
GLM_1_AutoML_3_20230331_225732	0.147182	0.021663
DeepLearning_1_AutoML_3_20230331_225732	0.149172	0.022252
GBM	0.067772	0.005586
XGBoost	0.067376	0.005509
DeepLearning	0.098221	0.011626
DRF	0.080607	0.007842
XRT	0.083007	0.008277
GLM	0.116385	0.016353

Code in R used for training H2O AutoML.

```r
# Start H2O AutoML
library(h2o)
h2o.init()
# Import training datasets and testing datasets
train <- h2o.importFile("G:/Chen Fengxian 2022.4.27/ML/EcoliML/AML/FAC-train.csv")
test <- h2o.importFile("G:/Chen Fengxian 2022.4.27/ML/EcoliML/AML/FAC-test.csv")
# Name the input variables and target variables
y <- "AC"
x <- setdiff(names(train), y)
print(x)
print(y)
# Define the porous medium type as categorical variable
train["PM"] <- as.factor(train["PM"])
test["PM"] <- as.factor(test["PM"])
# Model training
aml <- h2o.automl(x = x, y = y,
                  training_frame = train,
                  max_models = 20,
                  seed = 1)
# Print the leaderboard according to the model performance
lb <- aml@leaderboard
print(lb, n = nrow(lb))
#Print the predicted results
pred <- h2o.predict(aml@leader, test)
print(pred, n = nrow(pred))
#Print the variable importance of the best model
varimp <- h2o.varimp(aml)
print (varimp)
#Get the best model based on its ID
```

```
gbm5 <- h2o.getModel ("GBM_5_AutoML_1_20221215_164033")
#Plot the SHAP summary plot of the best tree-based model
shap_summary_plot <- h2o.shap_summary_plot (gbm5, test)
print(shap_summary_plot)
```

Reference

1. Wang, S., Zhang, M., He, L., Li, M., Zhang, X., Liu, F. and Tong, M., 2022. Bacterial Capture and Inactivation in Sand Filtration Systems With Addition of Zero-valent Iron As Permeable Layer Under Both Slow and Fast Filtration Conditions. *Journal of Hazardous Materials*, p.129122.
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