Electronic Supplementary Material (ESI) for Environmental Science: Water Research & Technology.

Supplementary Materials

Quenching H_2O_2 residuals after UV/H_2O_2 oxidation using GAC in drinking water treatment

Yifeng Huang[1], Zhijie Nie[1], Chengjin Wang[1], Yi Li[1], Mindy Xu[1], Ron Hofmann[1,*]

[1]*Department of Civil Engineering, University of Toronto, Toronto, Ontario, Canada, M5S 1A4*

[*]*Corresponding author: ron.hofmann@utoronto.ca, 416 946-7508*

Table S1. Regression statistics (Fig. 5) of the H_2O_2 breakthrough from pilot- and bench-scale column tests (Degree of freedom = 28)

Compound	95% confidence interval		R^2	Lin's coefficient
	Slope	Intercept		
H_2O_2	0.851 (0.752, 0.950)	0.025 (0.002, 0.048)	0.917	0.9506

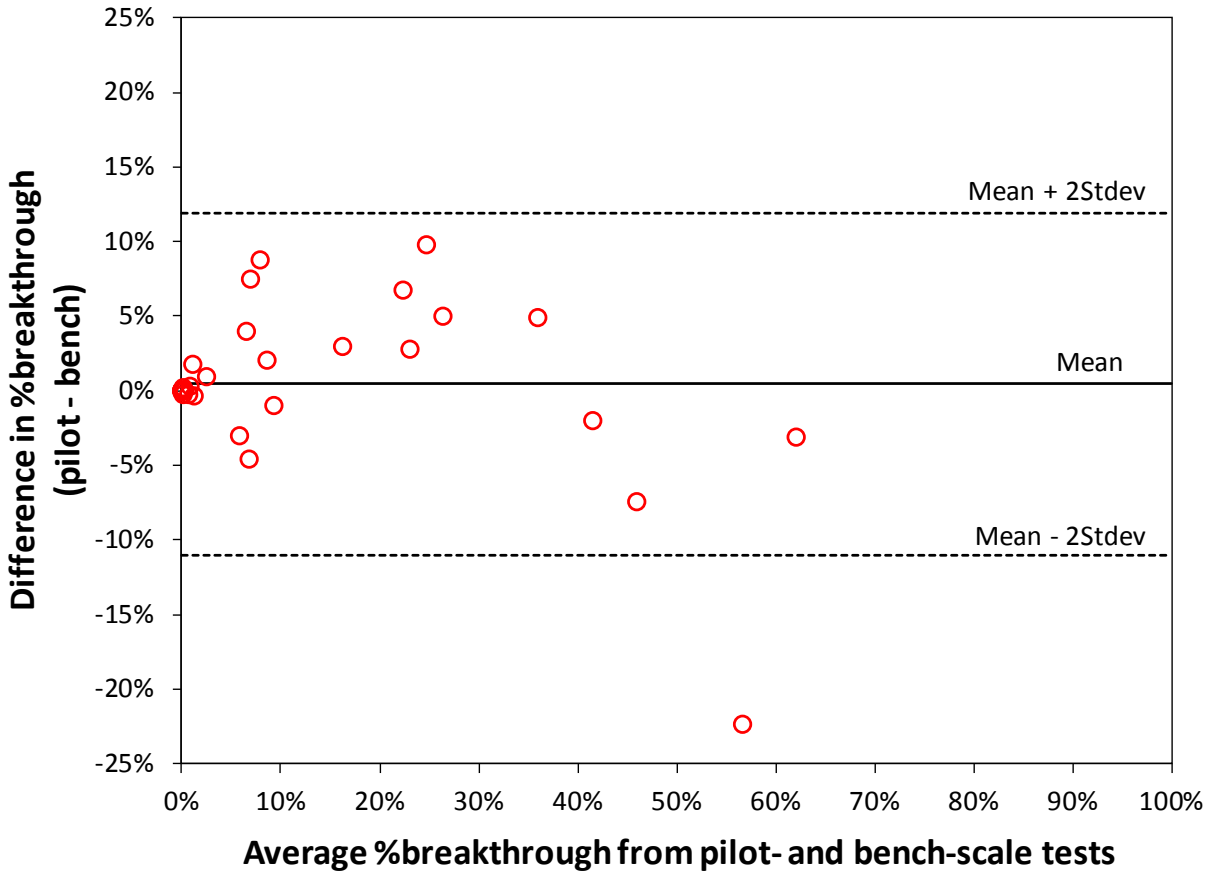

Figure S1. Differences in H_2O_2 breakthrough between pilot- and bench-scale tests plotted against the average breakthrough results from the two tests. All data is related to Fig. 5.

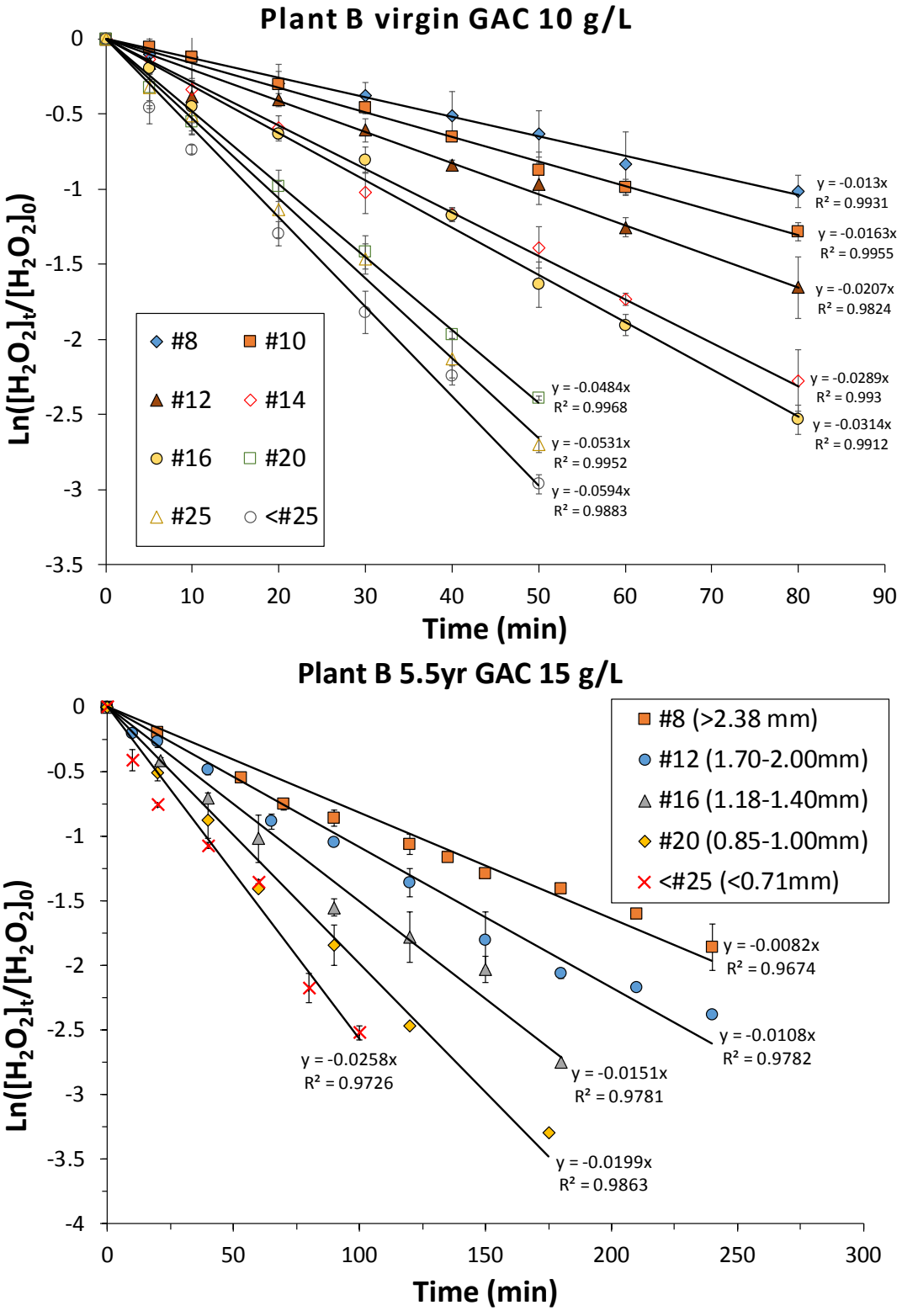

Figure S2. Change of H_2O_2 concentration for plant B GAC with different particle size. Batch experiments were conducted in the Milli-Q water. $[H_2O_2]_0$ = 50 mg/L.

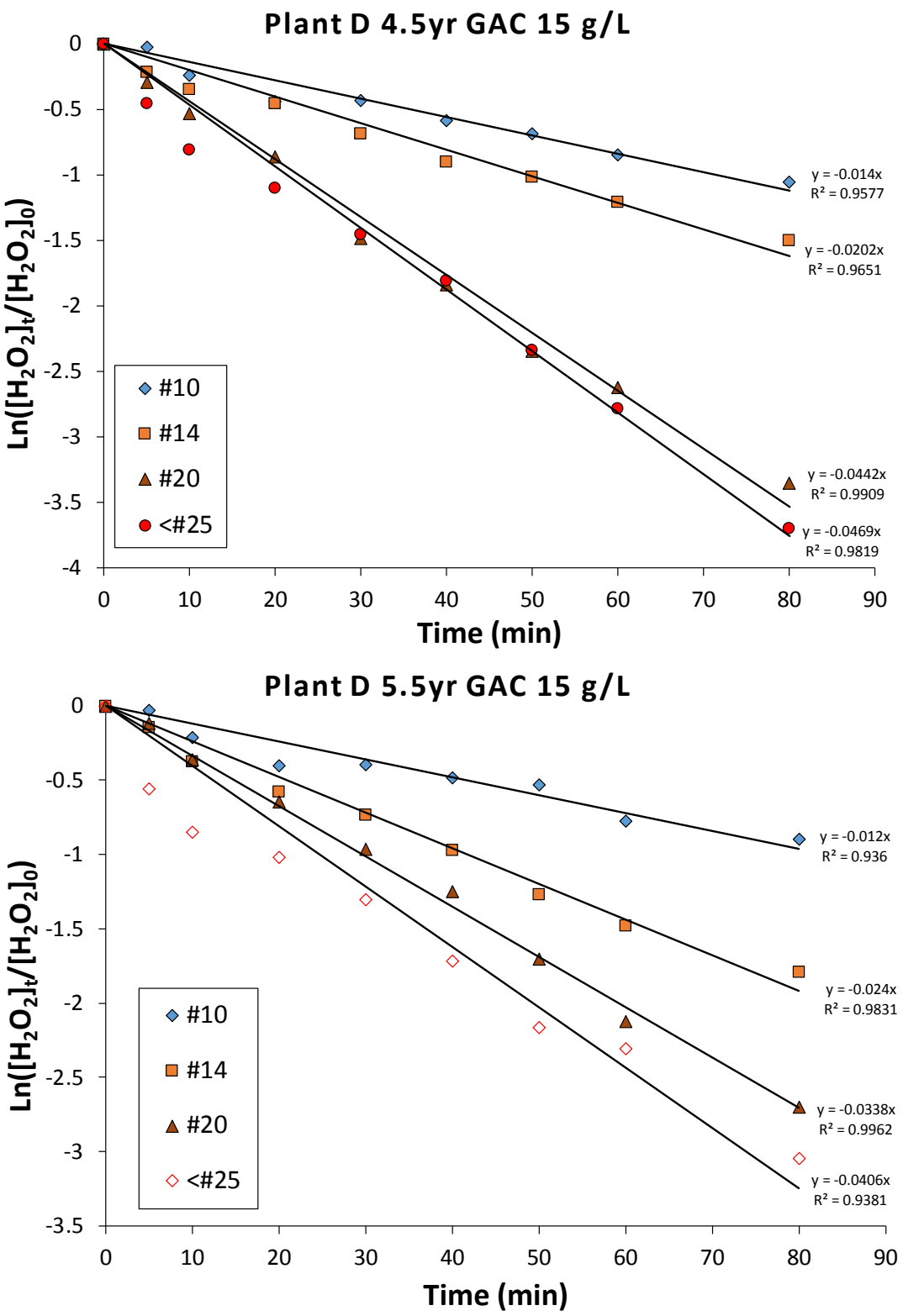

Figure S3. Change of H_2O_2 concentration for Plant D GAC with different particle size. Batch experiments were conducted in the Milli-Q water. $[H_2O_2]_0$ = 50 mg/L.

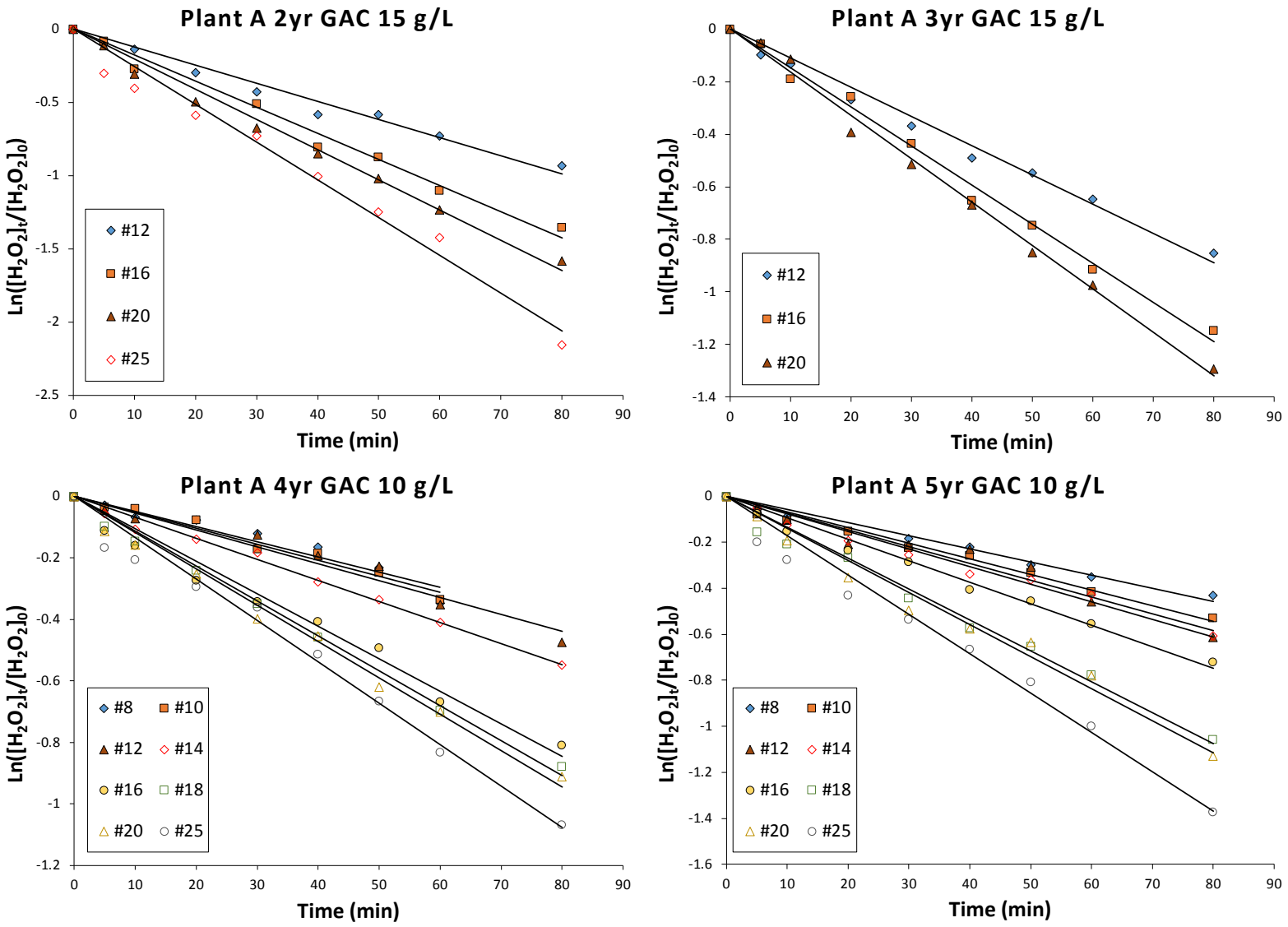

Figure S4. Change of H_2O_2 concentration for plant A GAC with different particle size. Batch experiments were conducted in the Milli-Q water. $[H_2O_2]_0$ = 50 mg/L.

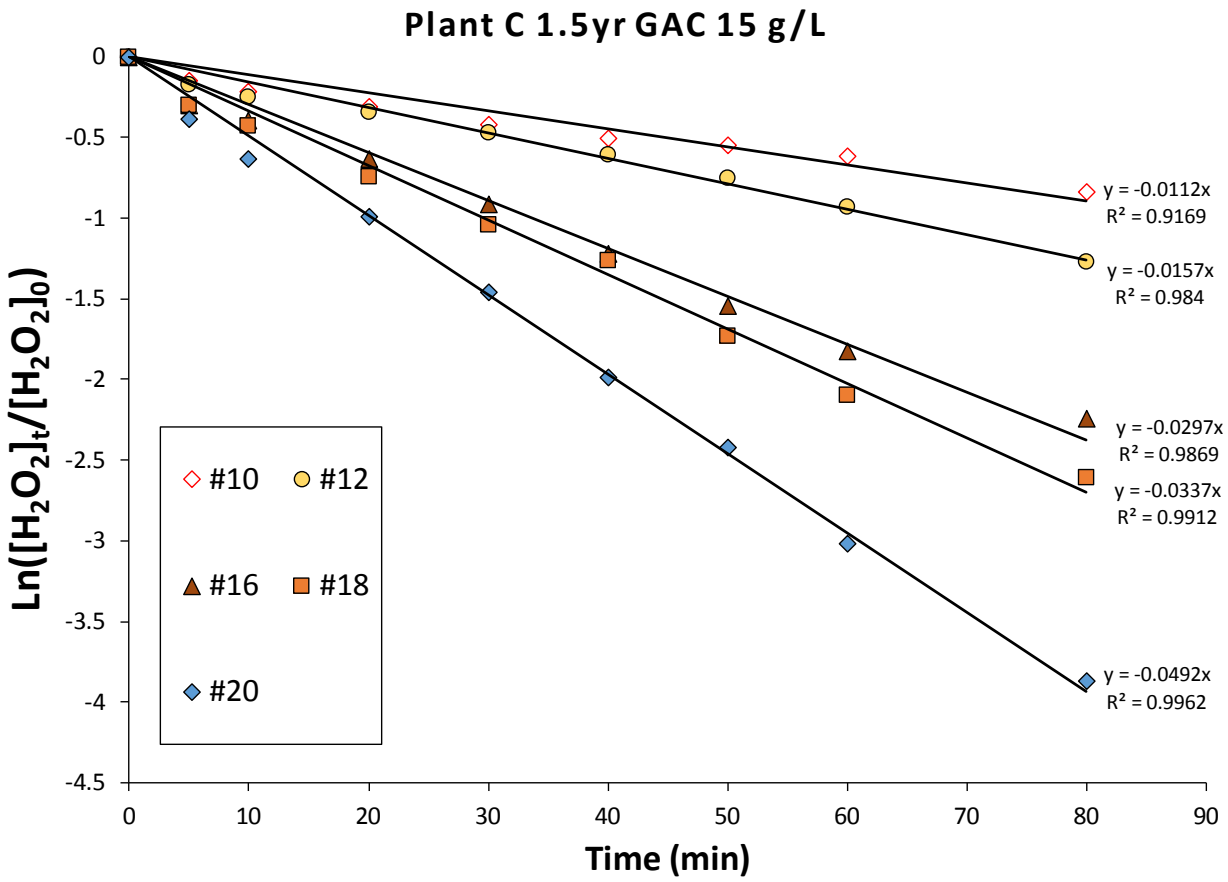

Figure S5. Change of H_2O_2 concentration for Plant C GAC with different particle size. Batch experiments were conducted in the Milli-Q water. $[H_2O_2]_0$ = 50 mg/L.

GAC particle size distribution

GAC samples from 4 water treatment plants were air-dried and sieved to obtain different GAC particle size for kinetic tests. Figure S6 shows the particle size distribution of GAC from Plant B at different filter bed depth. Due to the regular backwash, the GAC in the filter is stratified with large particles distributed on the bottom while small ones close to the top. To minimize the stratification effect, the total collected GAC throughout the depth was sieved for the batch kinetic tests.

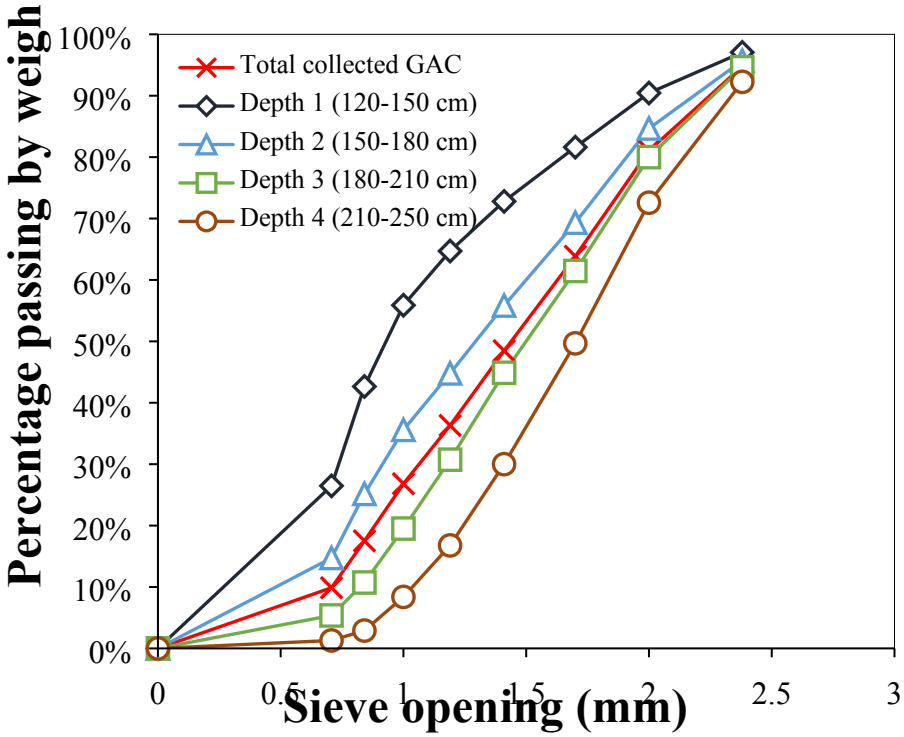

Figure S6. An example of particle size distribution of air-dried GAC at Plant B.

Table S2. GAC particle size for each sieve level using the USA Standard Sieve Test.

Sieve level	Range of diameter (mm)	Sieve level	Range of diameter (mm)
#8	> 2.38	#18	1.00 - 1.18
#10	2.00 - 2.38	#20	0.85 - 1.00
#12	1.70 - 2.00	#25	0.71 - 0.85
#14	1.40 - 1.70	<#25	< 0.71
#16	1.18 - 1.40		

Calculation of the total spherical surface area of GAC

To simplify the calculation, we assume that each GAC particle is a sphere. Then, the total spherical surface area of certain amount of GAC can be calculated as follows:

$$A = \frac{m}{\rho \times \frac{4}{3}\pi r^3} \times 4\pi r^2 = \frac{3m}{\rho r}$$

where A is the total spherical surface area (m^2), m is the total mass of the GAC (kg), ρ is density of the GAC (kg/m^3), and r is the equivalent radius of the GAC particle (m). Since the particle size obtained in each sieved level is in between a range (Table S2), an averaged radius is used for estimation.

Table S3. Linear regression results of the plots of $k_{H_2O_2}$ vs. $[GAC]_s$ (Fig. 6).

Water treatment plant	**GAC age (yr)**	**k_s (L·m^{-2}·h^{-1})**	**R^2**
Plant A	2	7.151	0.8902
	3	6.1735	0.4804
	4	6.0226	0.9024
	5	6.8562	0.9652
Plant B	5.5	6.6073	0.9683
	virgin	23.509	0.9761
Plant C	1	13.182	0.9235
Plant D	4.5	12.16	0.9323
	5.5	10.362	0.9167