

Supplementary Information

Enhancing Uptake Capability of Green Carbon Black Recycled from Scrap Tires for Water Purification

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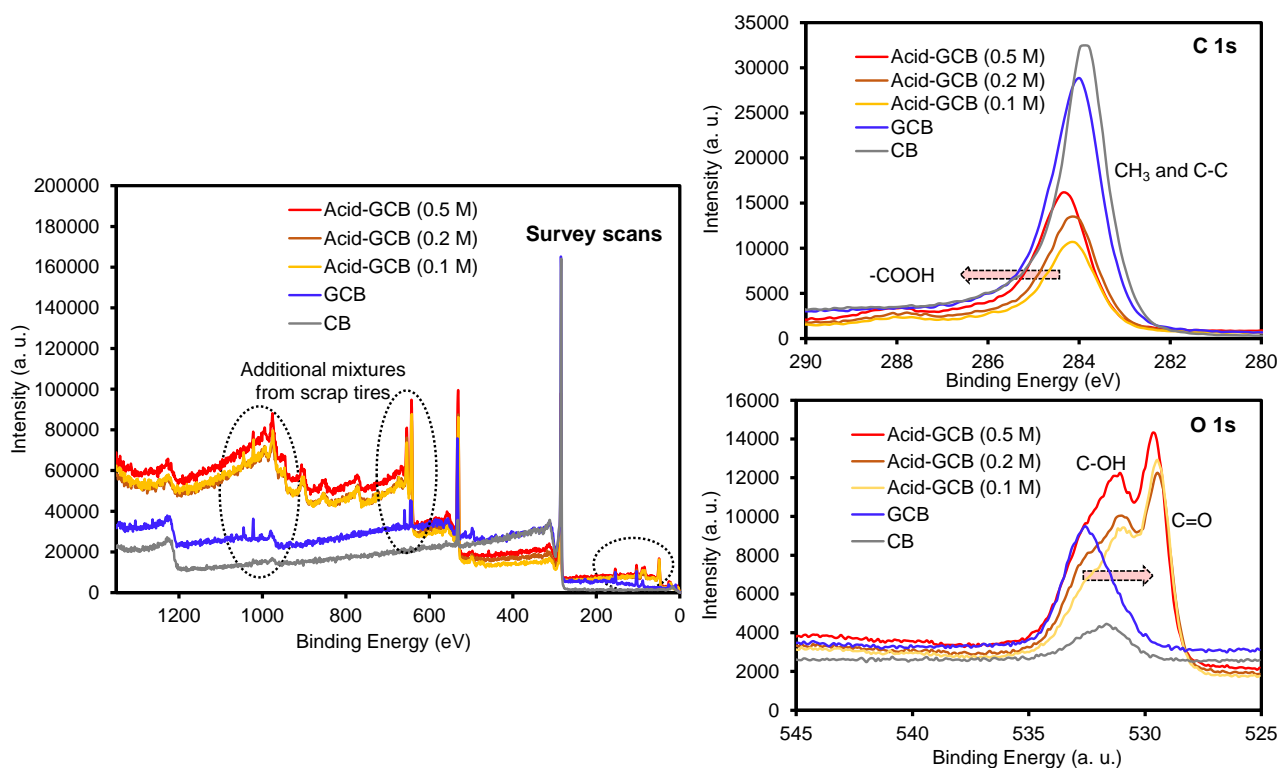


Figure S1. XPS survey and detail scans of CB, GCB, and acid-treated GCB (0.1 M, 0.2 M, and 0.5 M acetic acid).

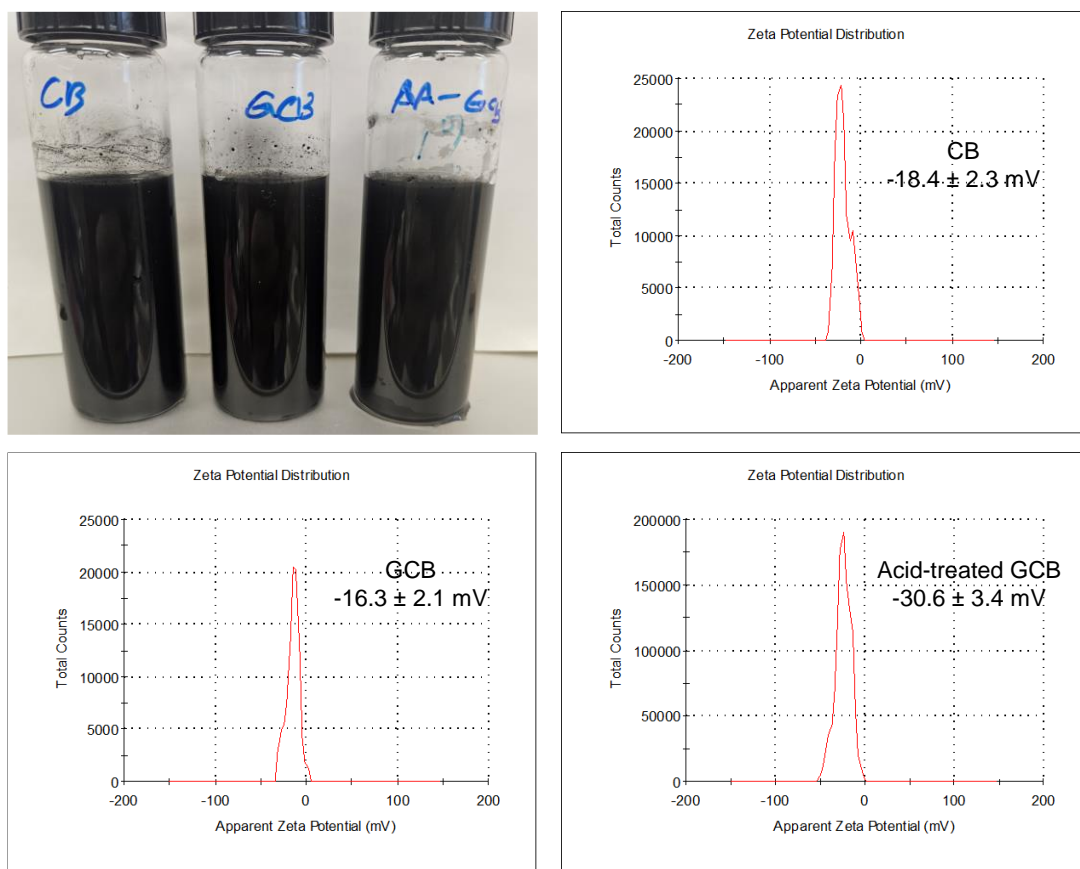


Figure S2. Digital photo and zeta potential of CB, GCB, and acid-treated GCB (20 mg) in 30 mL water.

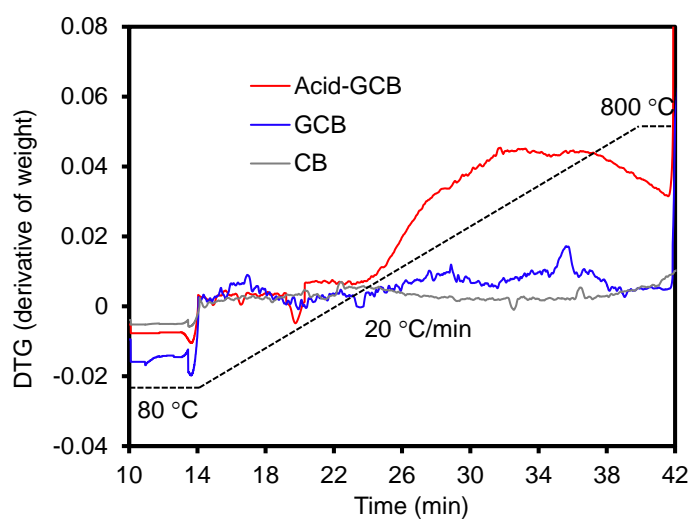


Figure S3. Derivative TGA curves of CB, GCB, and acid-treated GCB as a function of time.

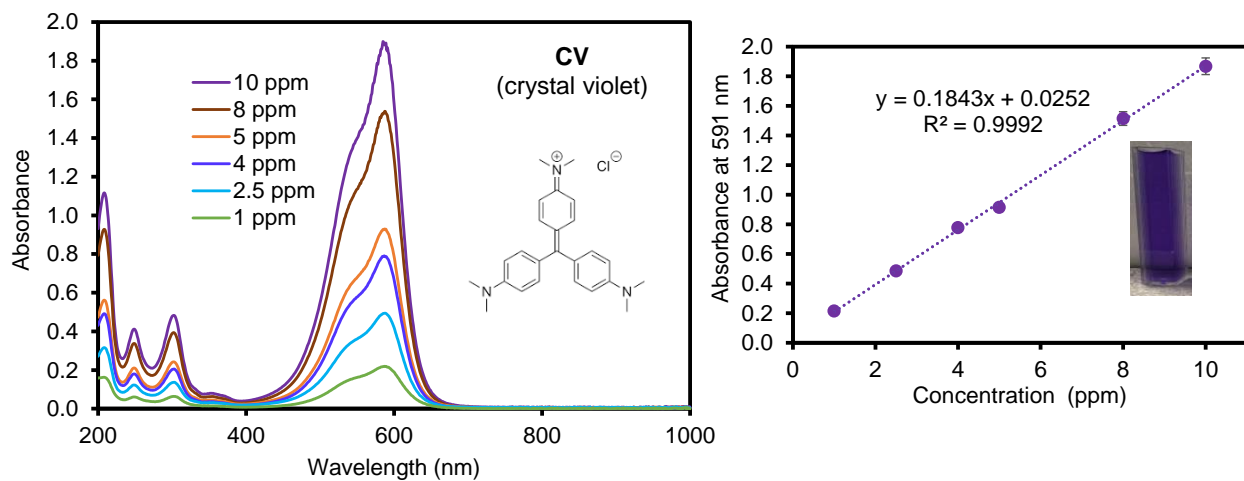


Figure S4. UV-Vis spectra of CV as a function of concentration and the corresponding calibration curve.

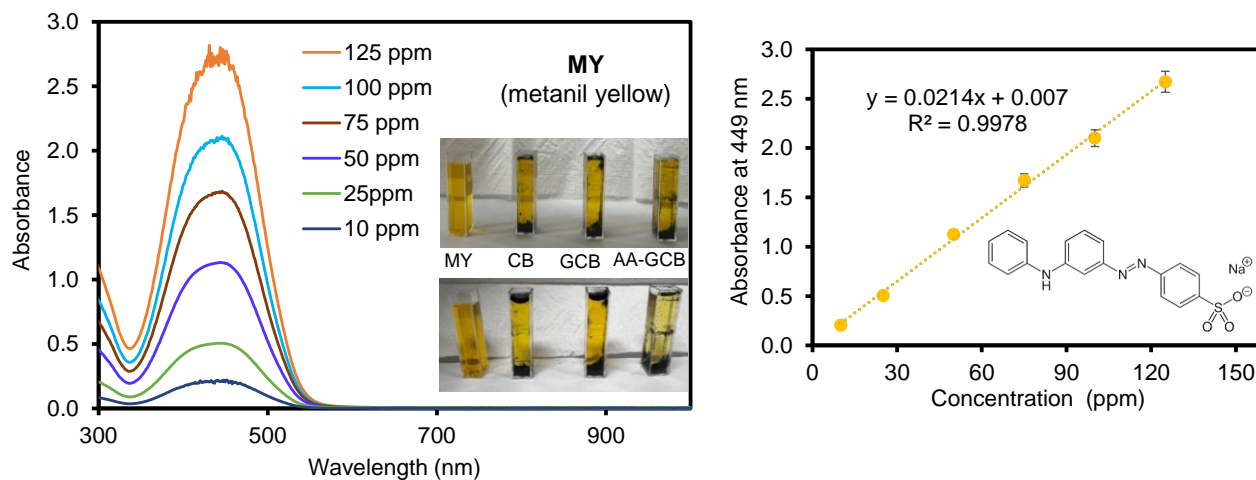


Figure S5. UV-Vis spectra of MY as a function of concentration and the corresponding calibration curves (digital photos show the dye solutions before and after treatment with CB-based adsorbents overnight).

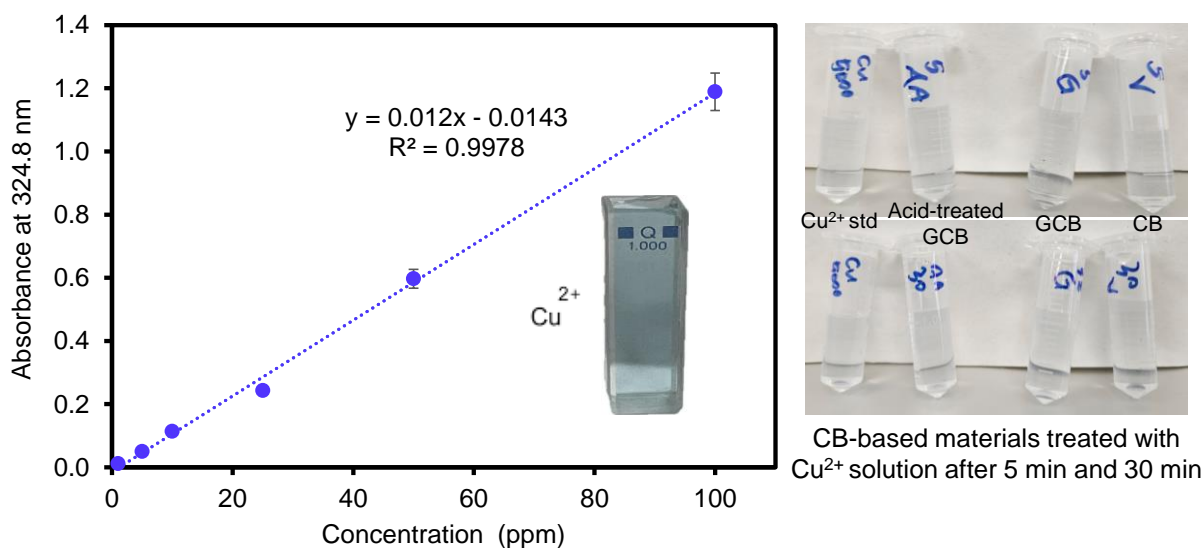


Figure S6. Calibration curve of Cu²⁺ ions obtained by atomic absorption spectroscopy (AAS) and the representative Cu²⁺ solution after the treatment with CB-based adsorbents.

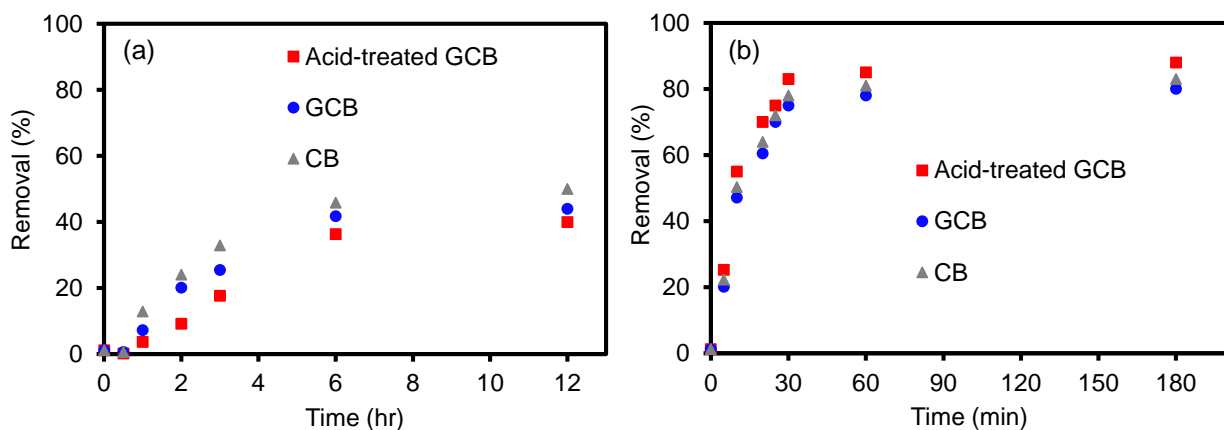


Figure S7. Removal (%) of MY (a) and Cu²⁺ (b) using CB, GCB, and acid-treated GCB (0.03 g) as a function of time.

Table S1. Specific surface area (S_{BET}), pore volume, and pore size analysis of CB, GCB, and acetic acid-treated GCB via N_2 gas adsorption-desorption isotherms.

CB		Volume/Area summary
		<u>Surface Area Data</u>
MultiPoint BET.....		5.297e+01 m ² /g
BJH method cumulative adsorption surface area.....		4.636e+01 m ² /g
BJH method cumulative desorption surface area.....		7.065e+01 m ² /g
t-method external surface area.....		5.297e+01 m ² /g
DFT cumulative surface area.....		5.018e+01 m ² /g
		<u>Pore Volume Data</u>
Total pore volume for pores with Diameter less than 234.66 nm at P/Po = 0.991766.....		4.412e-01 cc/g
BJH method cumulative adsorption pore volume.....		4.373e-01 cc/g
BJH method cumulative desorption pore volume.....		4.374e-01 cc/g
DFT method cumulative pore volume.....		1.536e-01 cc/g
		<u>Pore Size Data</u>
Average pore Diameter.....		3.331e+01 nm
BJH method adsorption pore Diameter (Mode Dv(d)).....		3.410e+00 nm
BJH method desorption pore Diameter (Mode Dv(d)).....		3.051e+00 nm
DFT pore Diameter (Mode).....		2.600e+00 nm

GCB		Volume/Area summary
		<u>Surface Area Data</u>
MultiPoint BET.....		8.664e+01 m ² /g
BJH method cumulative adsorption surface area.....		6.280e+01 m ² /g
BJH method cumulative desorption surface area.....		8.590e+01 m ² /g
t-method external surface area.....		8.664e+01 m ² /g
DFT cumulative surface area.....		7.156e+01 m ² /g
		<u>Pore Volume Data</u>
Total pore volume for pores with Diameter less than 292.08 nm at P/Po = 0.993400.....		5.611e-01 cc/g
BJH method cumulative adsorption pore volume.....		5.464e-01 cc/g
BJH method cumulative desorption pore volume.....		5.427e-01 cc/g
DFT method cumulative pore volume.....		2.728e-01 cc/g
		<u>Pore Size Data</u>
Average pore Diameter.....		2.591e+01 nm
BJH method adsorption pore Diameter (Mode Dv(d)).....		3.408e+00 nm
BJH method desorption pore Diameter (Mode Dv(d)).....		3.055e+00 nm
DFT pore Diameter (Mode).....		3.324e+01 nm

0.1 M Acid-GCB

Volume/Area summary

Surface Area Data

MultiPoint BET.....	1.182e+02 m ² /g
BJH method cumulative adsorption surface area.....	9.602e+01 m ² /g
BJH method cumulative desorption surface area.....	1.231e+02 m ² /g
t-method external surface area.....	1.182e+02 m ² /g
DFT cumulative surface area.....	1.016e+02 m ² /g

Pore Volume Data

Total pore volume for pores with Diameter less than 317.46 nm at P/Po = 0.993932.....	5.599e-01 cc/g
BJH method cumulative adsorption pore volume.....	5.442e-01 cc/g
BJH method cumulative desorption pore volume.....	5.469e-01 cc/g
DFT method cumulative pore volume.....	3.593e-01 cc/g

Pore Size Data

Average pore Diameter.....	1.895e+01 nm
BJH method adsorption pore Diameter (Mode Dv(d)).....	3.409e+00 nm
BJH method desorption pore Diameter (Mode Dv(d)).....	3.053e+00 nm
DFT pore Diameter (Mode).....	2.000e+00 nm

0.2 M Acid-GCB

Volume/Area summary

Surface Area Data

MultiPoint BET.....	1.021e+02 m ² /g
BJH method cumulative adsorption surface area.....	9.624e+01 m ² /g
BJH method cumulative desorption surface area.....	1.146e+02 m ² /g
t-method external surface area.....	1.021e+02 m ² /g
DFT cumulative surface area.....	9.104e+01 m ² /g

Pore Volume Data

Total pore volume for pores with Diameter less than 308.81 nm at P/Po = 0.993761.....	5.340e-01 cc/g
BJH method cumulative adsorption pore volume.....	5.290e-01 cc/g
BJH method cumulative desorption pore volume.....	5.214e-01 cc/g
DFT method cumulative pore volume.....	3.465e-01 cc/g

Pore Size Data

Average pore Diameter.....	2.092e+01 nm
BJH method adsorption pore Diameter (Mode Dv(d)).....	3.824e+00 nm
BJH method desorption pore Diameter (Mode Dv(d)).....	3.410e+00 nm
DFT pore Diameter (Mode).....	2.600e+00 nm

0.5 M Acid-GCB

Volume/Area summary

Surface Area Data

MultiPoint BET.....	1.195e+02 m ² /g
BJH method cumulative adsorption surface area.....	1.120e+02 m ² /g
BJH method cumulative desorption surface area.....	1.357e+02 m ² /g
t-method external surface area.....	1.195e+02 m ² /g
DFT cumulative surface area.....	1.039e+02 m ² /g

Pore Volume Data

Total pore volume for pores with Diameter less than 307.01 nm at P/Po = 0.993724.....	6.127e-01 cc/g
BJH method cumulative adsorption pore volume.....	6.108e-01 cc/g
BJH method cumulative desorption pore volume.....	6.023e-01 cc/g
DFT method cumulative pore volume.....	4.185e-01 cc/g

Pore Size Data

Average pore Diameter.....	2.051e+01 nm
BJH method adsorption pore Diameter (Mode Dv(d)).....	3.415e+00 nm
BJH method desorption pore Diameter (Mode Dv(d)).....	3.408e+00 nm
DFT pore Diameter (Mode).....	2.838e+00 nm

Table S2. Langmuir and Freundlich isotherm parameters for the removal of CV using CB, GCB, and acid-treated GCB (0.5 M).

	Parameters	CB	GCB	Acid-treated GCB
Langmuir	q_{\max} (mg/g)	181.8	161.3	312.5
	K_L (L/mg)	21.3	23.8	30.9
	R_L	5.9×10^{-3}	4.2×10^{-3}	4.0×10^{-4}
	R^2	0.971	0.983	0.989
Freundlich	K_f	12.08	10.31	14.56
	$1/n$	0.6531	0.640	0.677
	R^2	0.958	0.980	0.983