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Supplementary Information

Conversion of recovered carbon black from waste tire to activated carbon via chemical/microwave methods for efficient removal of heavy metal ions from wastewater

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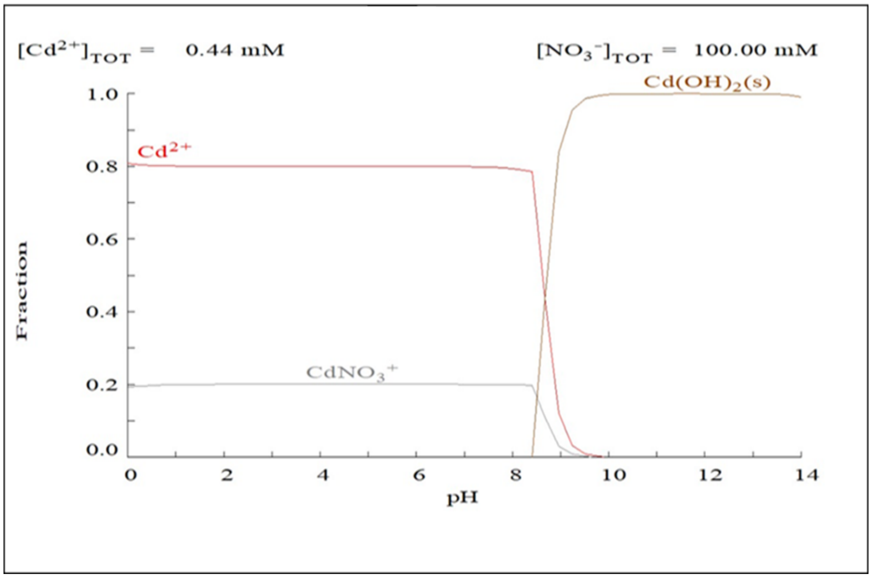

Figure S1: Expected aqueous speciation of Cd(II) concentration (50 mg L^{-1}) as a function of pH in 0.1 M HNO_3 using Medusa/Hydra program.

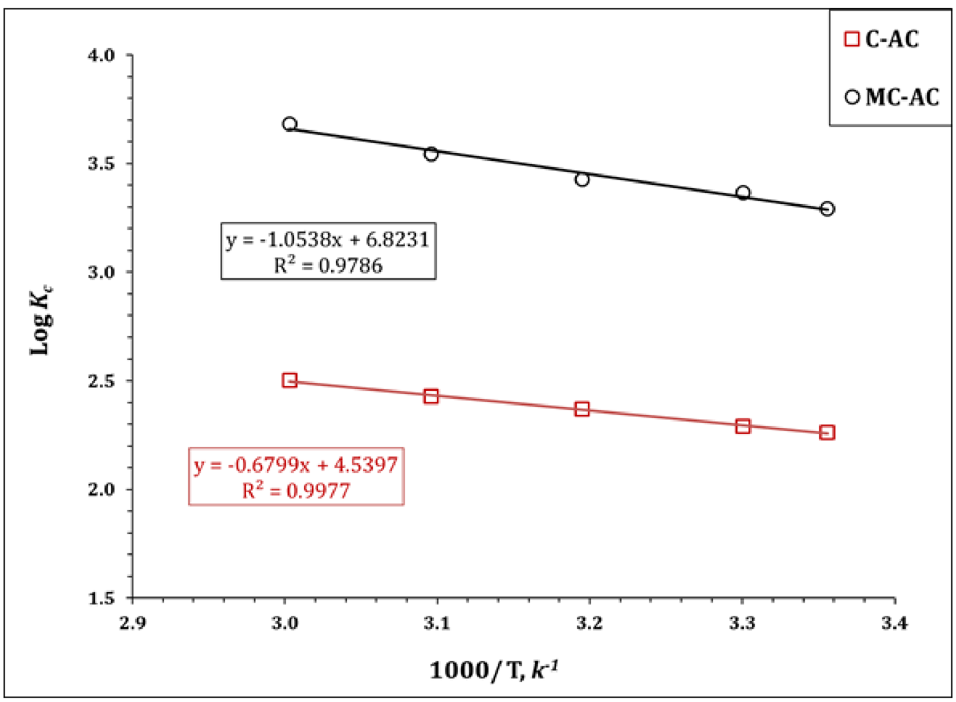

Figure S2: *Van't Hoff plot for Cd(II) sorption onto C-AC and MC-AC sorbents*.

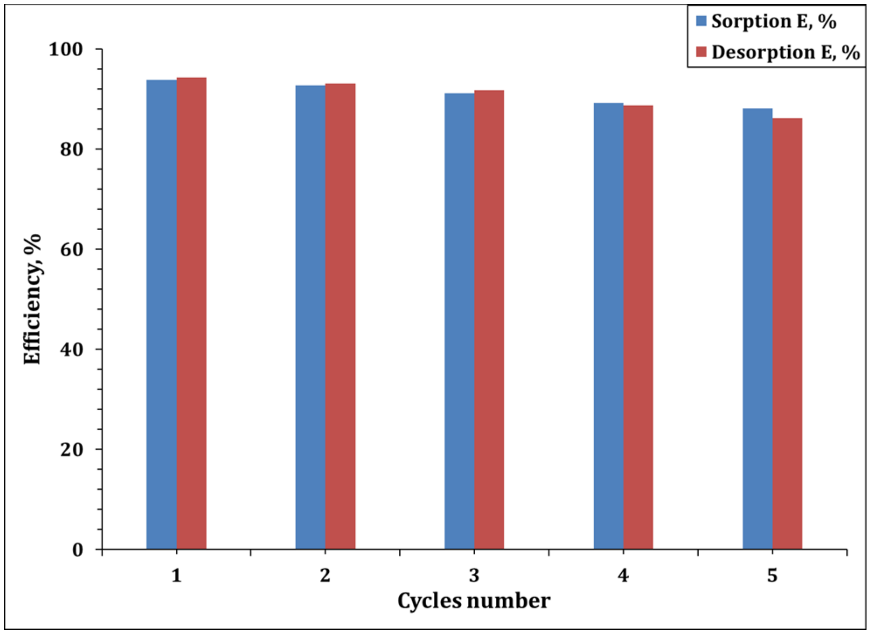

Figure S3: *Recycling investigation for Cd(II) uptake using MC-AC sorbent.*

Table S1: *Kinetics, isotherm, and thermodynamics equations for Cd(II) ions adsorption of* ***[1-5]***

Kinetics	Equations
Pseudo-first-order	$Log\ (q_e - q_t) = Log\ q_e - \frac{K_1}{2.303} t$
Pseudo-second-order	$\left(\frac{t}{q_t}\right) = \frac{1}{K_2 q_e^2} + \frac{1}{q_e} t$
Intra-particle diffusion model (IPD)	$q_t = K_{id} t^{0.5} + C_i$
Isotherms	**Equations**
Langmuir model	$C_e/q_e = (1 \mid K_L q_{max}) + \left[C_e/q_m\right]$
Freundlich model	$\ln q_e = \ln K_F + \left[\frac{1}{n}\right] \ln C_e$
Temkin model	$q_e = \frac{RT}{b_T} \ln K_T C_e$
Thermodynamics	**Equations**
$\log K_C = -\frac{\Delta H^o}{2.303\ R} X \frac{1}{T} + C$	
$-\Delta G^o = 2.303\ RT \log K_C$	
$\Delta G^o = \Delta H^o - T\ \Delta S^o$	

qe (mg g^{-1}) is the equilibrium concentration of Cd(II) ions, and qt (mg g^{-1}) is the adsorbed amount of Cd(II) ions after time t (min), k_1 (min^{-1}) and k_2 (min^{-1}) are the rate constants for the pseudo first and second order, respectively. K_{id} (mg/g. $min^{0.5}$) is a rate constant, and C is the thickness of the boundary layer. Ce (mg L^{-1}) is equilibrium concentration of Cd(II) ions, q_{max} (mg g^{-1}) is the theoretical adsorption capacity, K_L is Langmuir constant, K_F and n are Freundlich constants. b_T is Temkin constant that refers to the adsorption heat, and K_T (L min^{-1}) is the equilibrium binding constant. K_C is a non-dimensional equilibrium constant and it equals K_d X 1000 X ρ **[1]**; T is the temperature (K), $\boldsymbol{R}$ is the universal gas constant (8.314 J mol^{-1}. K^{-1}), ρ is solution denisty g/ L, and C is a constant.

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Table S2: *Cd(II) recovery from loaded MC-AC sorbent using different solutions (5.0 g/L, room temperature; 240 min).*

Desorption investigation		
Eluent Type	**Concentration, M**	**%**
Hydrochloric acid	0.5	93.5
Sulfuric acid	0.5	74.4
Nitric acid	0.5	56.2