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Green Activated Magnetic Graphitic Carbon Oxide and Its Application for Hazardous Water Pollutants Removal

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Received: 6 August 2019; Accepted: 24 August 2019; Published: date

1. Materials and methods

1.1. Materials

The materials used were of analytical reagent grade unless stated here. The edible sugar used in the preparation of graphitic carbon was procured from a Seoul local market, Korea. Samchun Pure Chemicals Co., Ltd. (Pyeongtaek, Korea) supplied the reagents Pb(II)$(NO_3)_2.6H_2O$, methylene blue (MB), HCl, and NaOH. HCl and NaOH were used to adjust the pH of the aqueous solutions. Thorium nitrate (ICP Stand, ICP-61N-1 solution) dissolved in 5% nitric acid was purchased from Accu Standard, New Heaven, USA, and was used for the Th(IV) ion standard solutions in the present investigations.

2.2. Analytical Methods

A D/Max-2500 X-ray diffractometer (Rigaku, Tokyo, Japan) was used to evaluate the crystallinity and textural properties of the prepared adsorbents. The elemental composition was analyzed using a PHI Quantera-II XPS (Ulvac-PHI, Kanagawa, Japan). A scanning electron microscope (S-4300 and EDX-350, Hitachi, Tokyo, Japan) was used to investigate the surface morphology of the adsorbents. HR-TEM (JEM-4010, JEOL, Peabody, MA, USA) was used to measure the shape and particle size of the adsorbents. N_2 adsorption–desorption isotherms of the prepared materials were constructed using an Autosorb-1 (Quantachrome Instruments, Boynton Beach, FL, USA) instrument that was also used to measure the surface area, pore-volume, and pore diameter. FT-Raman spectroscopy was carried out with BRUKER OPTICKGMBH and ESCALAB–210 (Spain) instruments.

2. Results and Discussion

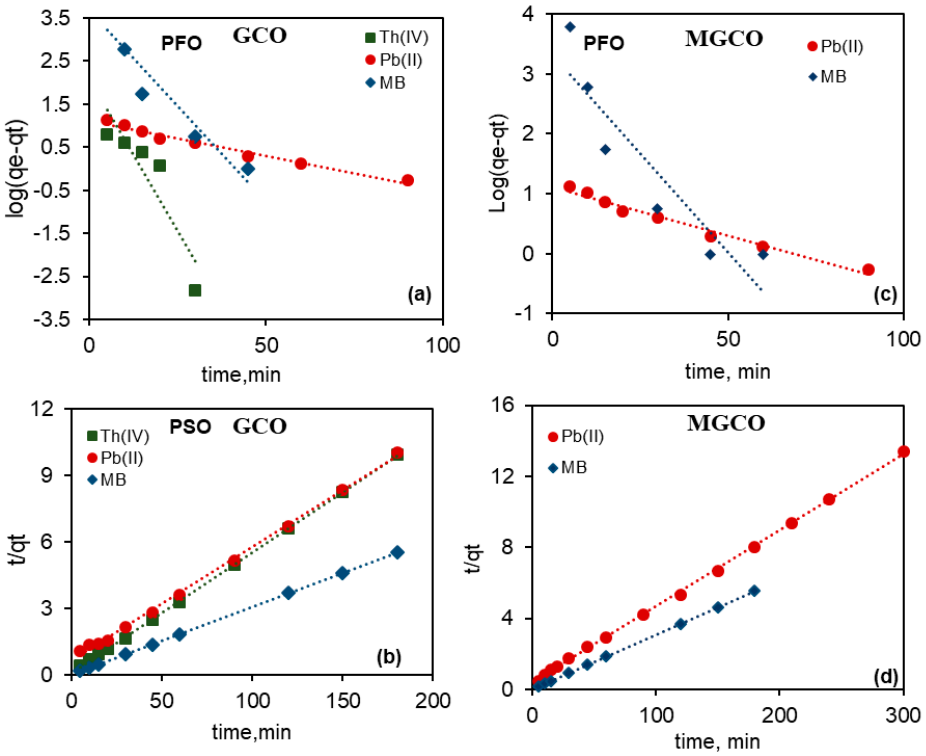

Figure 1. Adsorption kinetic models of Th(IV), Pb(II) and MB on to (**a**,**b**) GCO and (**c**,**d**) MGCO. (Experimental conditions: pH 5.0 for Th(IV), Pb(II) and MB, dosage: 0.3g·L^{-1}; Equilibrium time: 30 min for Th(IV) on GCO and 45 min for MB on GCO and MGCO and 120 min for Pb(II) GCO and MGCO; Temperature: 298 K, initial concentration of Th(IV), Pb(II) and MB: 10 mg·L^{-1}).

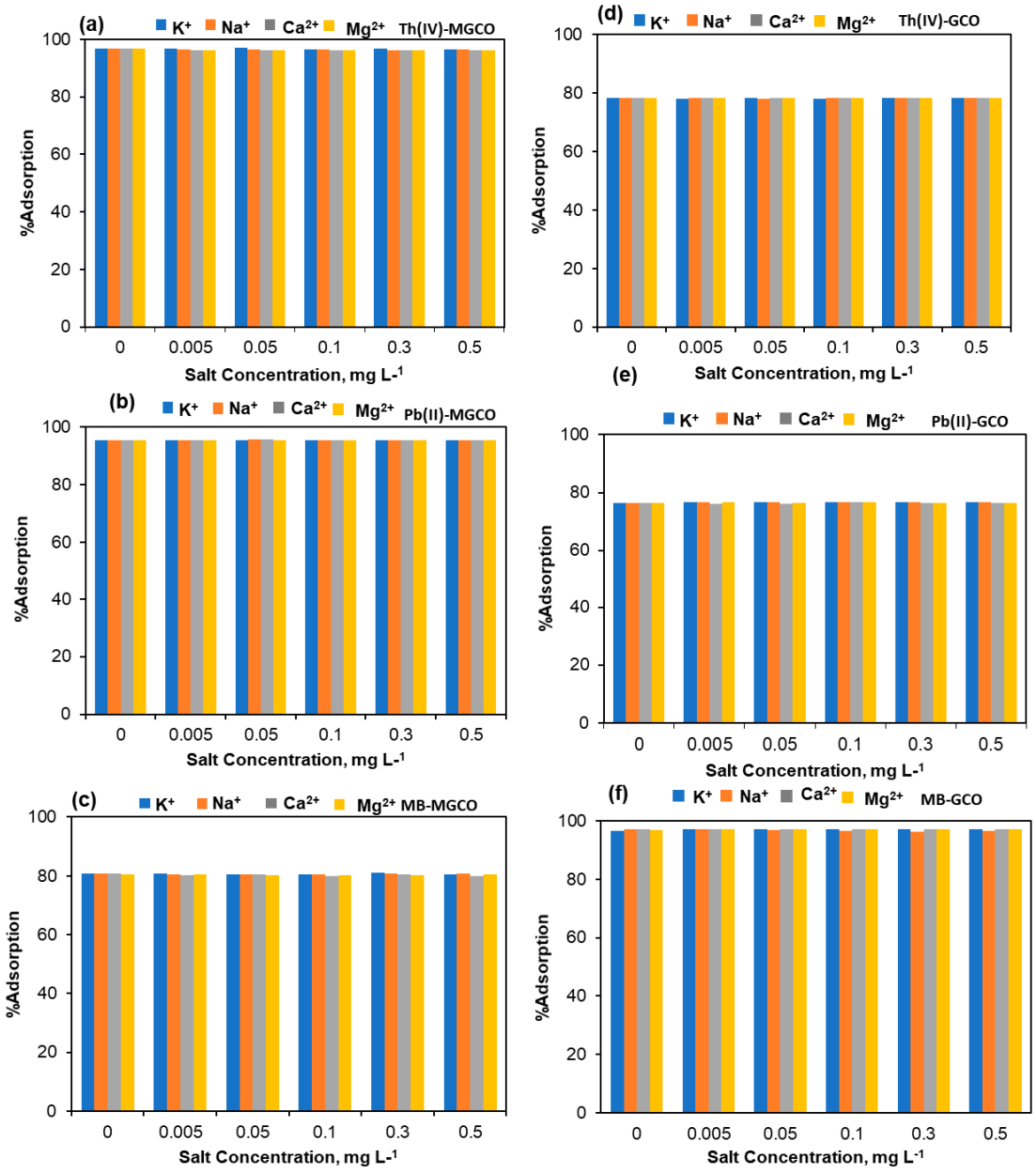

Figure 2. Salt effect of Th(IV),Pb(II) and MB on to (**a–c**) MGCO and (**d–f**) GCO. (Experimental conditions: pH 5.0 for Th(IV), Pb(II) and MB, dosage: 0.3g·L^{-1}; Equilibrium time: 30 min for Th(IV) on GCO and 45 min for MB on GCO and MGCO and 120 min for Pb(II) GCO and MGCO; Temperature: 298 K, initial concentration of Th(IV), Pb(II) and MB: 10 mg·L^{-1}).

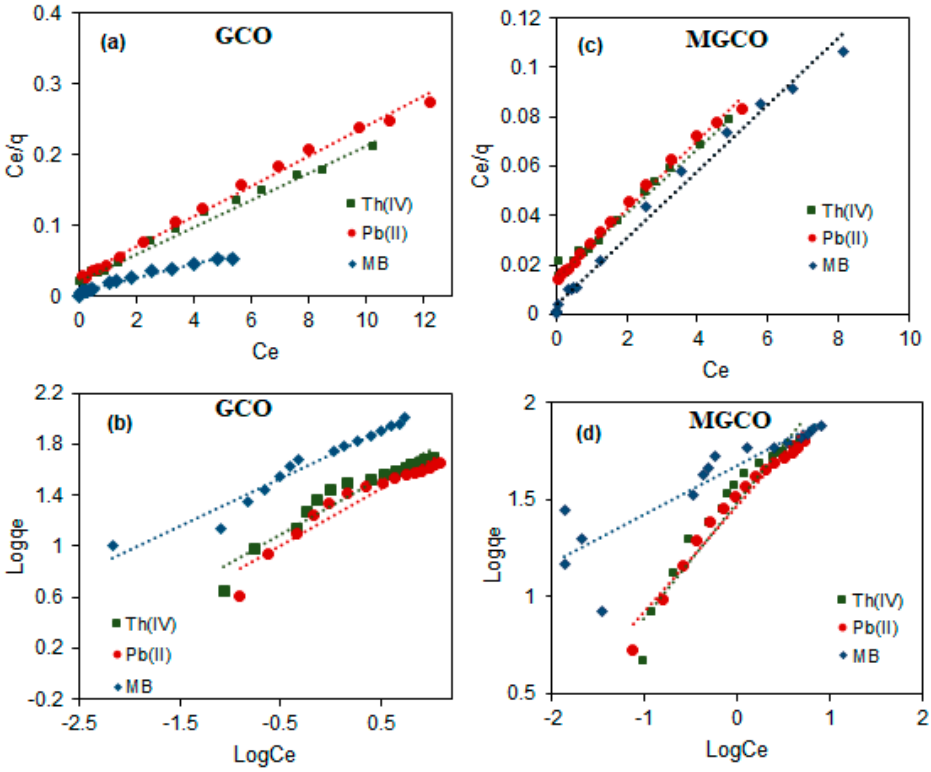

Figure 3. Adsorption isotherms models of Th(IV),Pb(II) and MB on to (**a**,**b**) GCO and (**c**,**d**) MGCO. (Experimental conditions: pH 5.0 for Th(IV), Pb(II) and MB, dosage: 0.3 g·L^{-1}; Equilibrium time: 30 min for Th(IV) on GCO and 45 min for MB on GCO and MGCO and 120 min for Pb(II) GCO and MGCO; Temperature: 298 K).