

Online Resource

Tailoring selectivity and efficiency: pyrazolyl-1*H*-1,2,4-triazole MCM-41 and silica hybrid materials for efficient Cadmium(II) removal from water

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Equipments

The characterization of silica particles was performed using scanning electron microscopy (SEM) with a Hitachi S4100 equipped with energy-dispersive spectroscopy. The specific surface area and pore size distribution were determined using the Brunauer-Emmett-Teller (BET) and Barrett-Joyner-Halenda (BJH) methods on a Micromeritics Gemini 2380 surface area analyzer, with a sample weight of approximately 50 mg. Solid-state ^{13}C Nuclear Magnetic Resonance (NMR) spectra were recorded on a Bruker Avance III 400 spectrometer. Elemental analysis was conducted using a LECO CHNS-932 apparatus. Attenuated Total Reflectance Fourier Transform Infrared (ATR-FTIR) spectra were obtained using a FT Mattson 7000 Galaxy series spectrophotometer. Powder X-ray diffraction (PXRD) patterns were collected on a D8-Advance diffractometer (Bruker, Germany) with Cu K α radiation ($\lambda = 1.5148\text{\AA}$) operating at 40 kV and 30 mA. Nitrogen adsorption-desorption measurements were carried out with a Thermoquest Sorpsomatic 1990 analyzer. Mass loss determinations were performed in a 90:10 oxygen/nitrogen atmosphere using a TGA Q50 V6.7 Build 203 instrument at a heating rate of 10 °C/min. Atomic absorption measurements were conducted using a Spectra Varian A.A. 400 spectrophotometer. Calibration curves were prepared using commercially pure 1000 ppm metal standard solutions in 2% nitric acid.

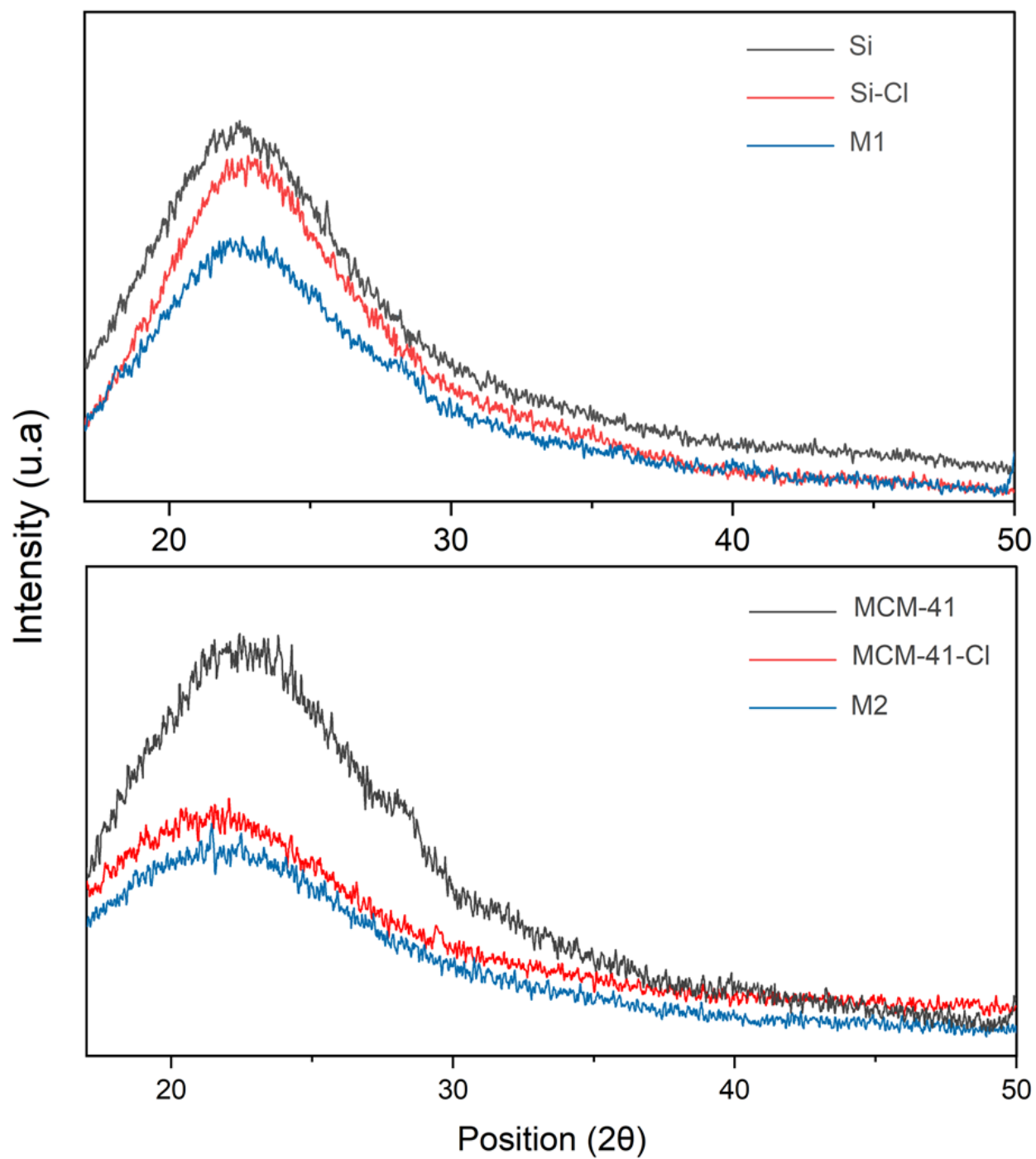


Figure OR1. X-ray diffraction patterns of **M1**(A) and **M2** (B) in comparison to their precursors.

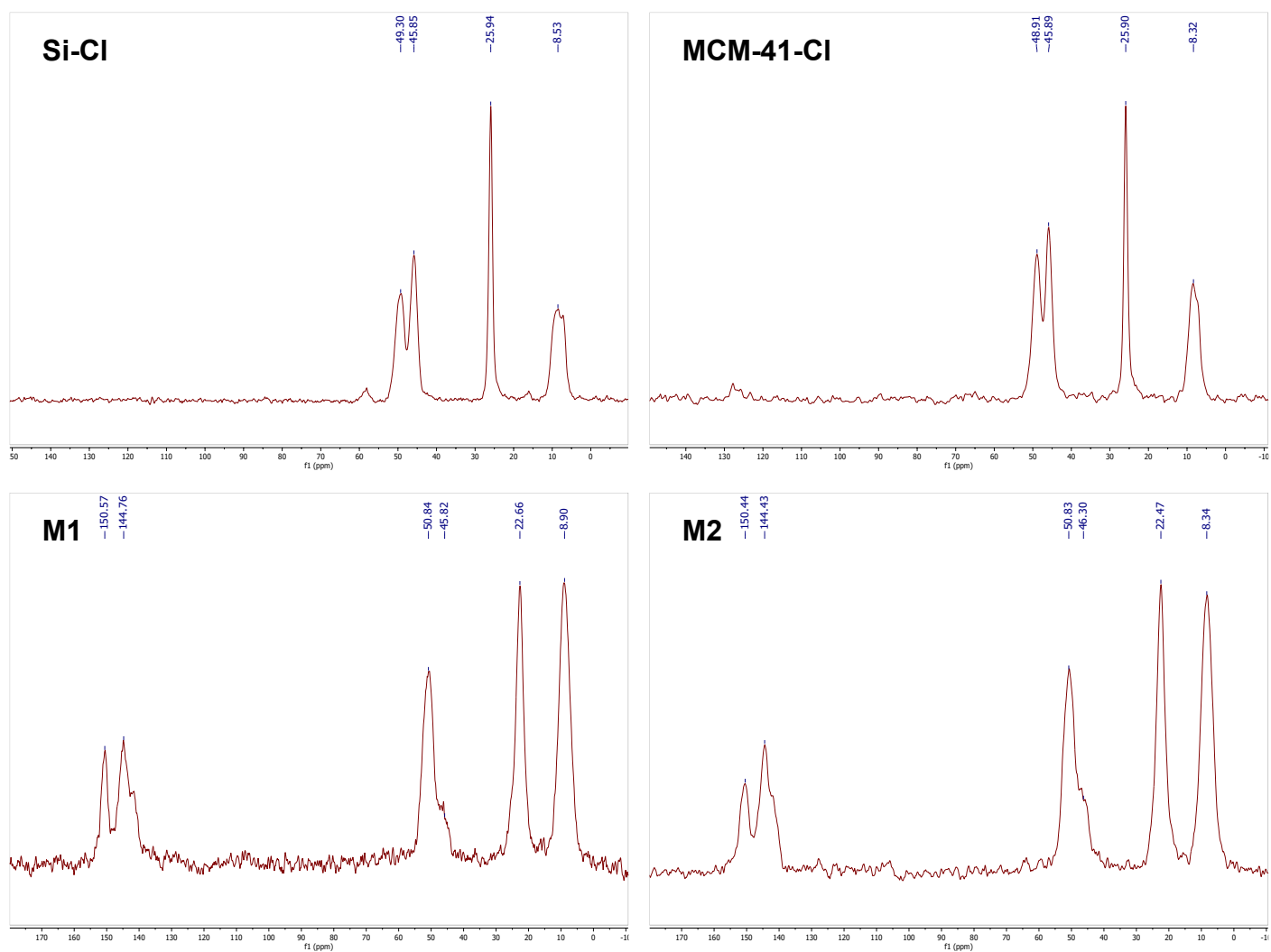


Figure OR2. Top: Solid state ^{13}C NMR spectrum of precursors **Si-Cl** (left) and **MCM-41-Cl** (right).
Bottom: Solid state ^{13}C NMR spectrum of **M1** (left) and **M2** (right).

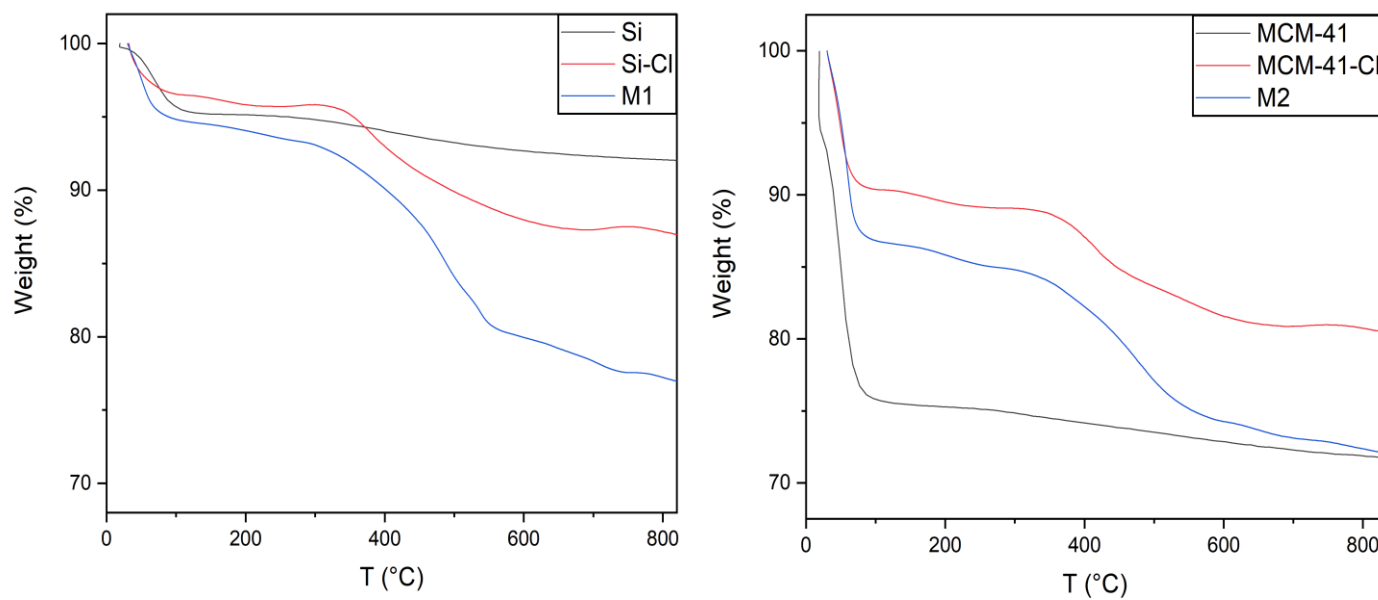


Figure OR3. Thermogravimetric plots of **M1** (left), **M2** (right) and of the corresponding precursors.