Influence of amine group on the adsorptive removal of basic dyes from water using two nanoporous isoreticular Zn(II)-based metal organic frameworks

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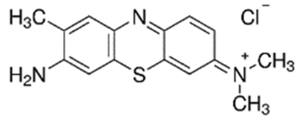
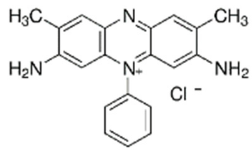
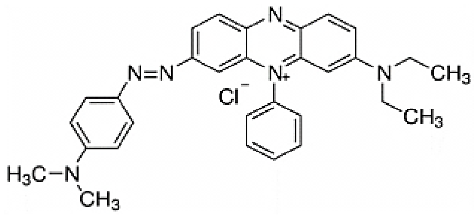
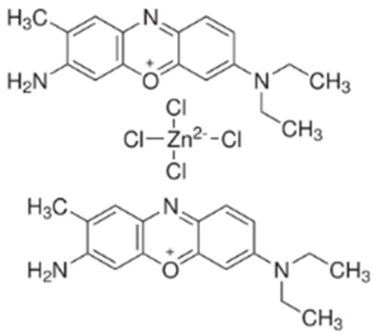
ABSTRACT

Dyes are the most abundant hazardous components existing in the environment because of their extensive use in industries. So, in the present study, two isoreticular Zn(II)-MOFs, TMU-16 and TMU-16-NH_2, were used for the adsorptive removal of harmful cationic dyes from aquatic medium. In order to improve the removal efficiency, optimization of the experimental conditions was carried out as a function of pH, MOF dosage, dye concentration and contact time. The maximum removal capacity was obtained at pH 12, 10 mg of MOF and 20 min as the contact time. The adsorption isotherms of each dye over both sorbents matched with the Langmuir model, and the adsorption kinetics followed the pseudo-second order kinetic model. The dye adsorption over TMU-16-NH_2 is higher than that over TMU-16, indicating that the addition of amine groups in MOF network played an important role in the adsorption process, because of electrostatic interactions and hydrogen bonding. Thermodynamic studies indicated that adsorption process is spontaneous and endothermic.

Table S1: Chemical structure of cationic dyes used in this study.

Cationic dye	Chemical structure
Toluidine Blue O	
Safranin O	
Janus Green B	
Brilliant Cresyl Blue	

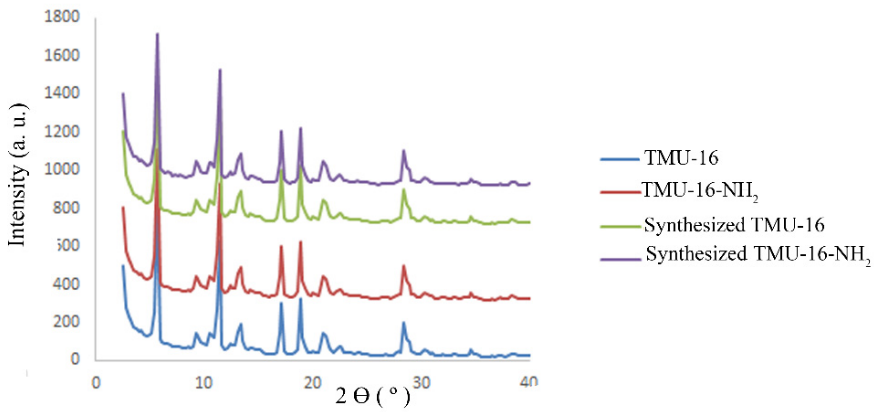


Fig. S1 XRD patterns of TMU-16 and TMU-16-NH_2.

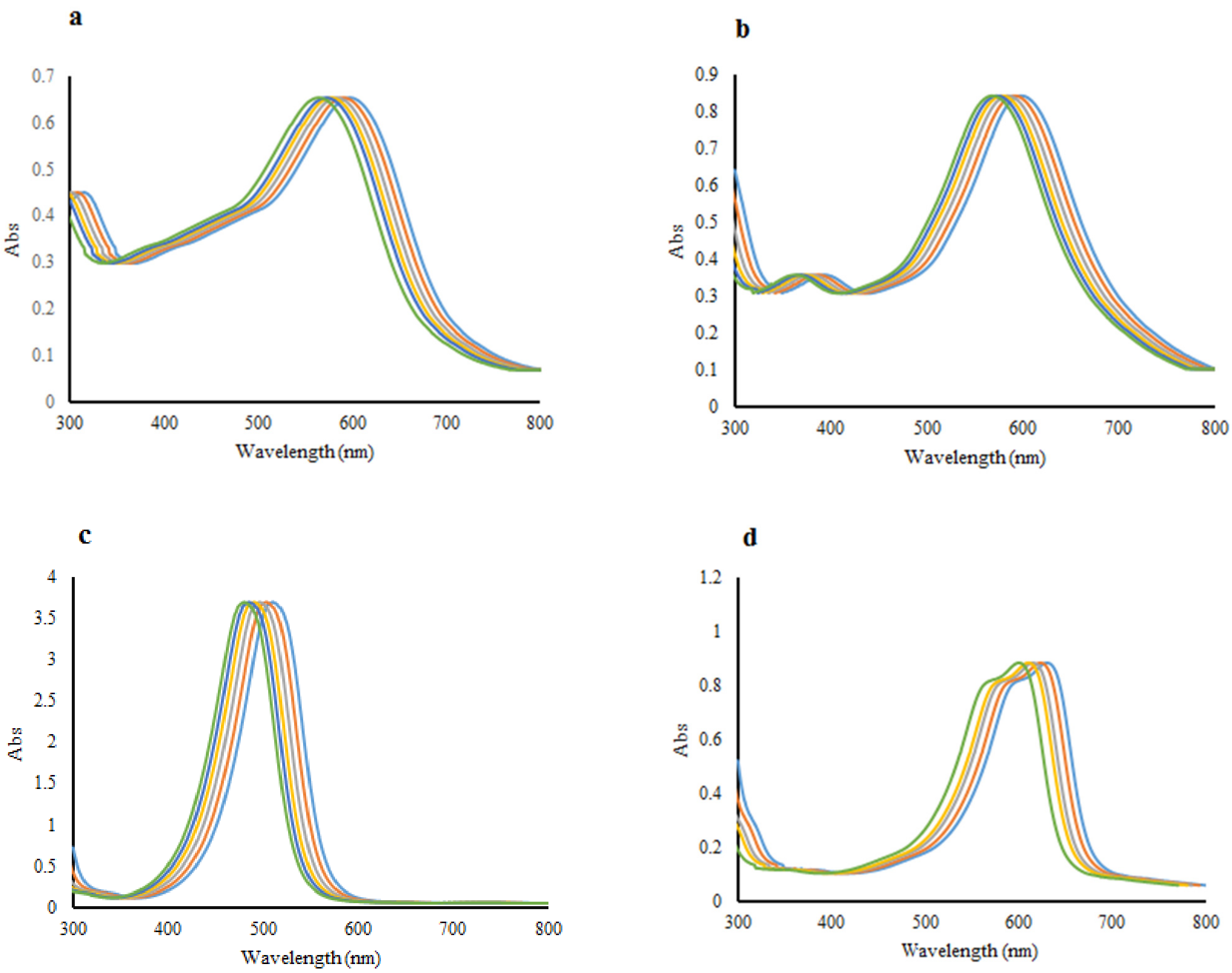


Fig. S2 UV-Vis spectra of (a) Brilliant Cresyl Blue, (b) Janus Green B, (c) Safranin O, and (d) Toluidine Blue O at various acidic and basic conditions: pH=1 (light blue), pH=3 (red), pH=5 (gray), pH=7 (yellow), pH=9 (dark blue), and pH=12 (green).

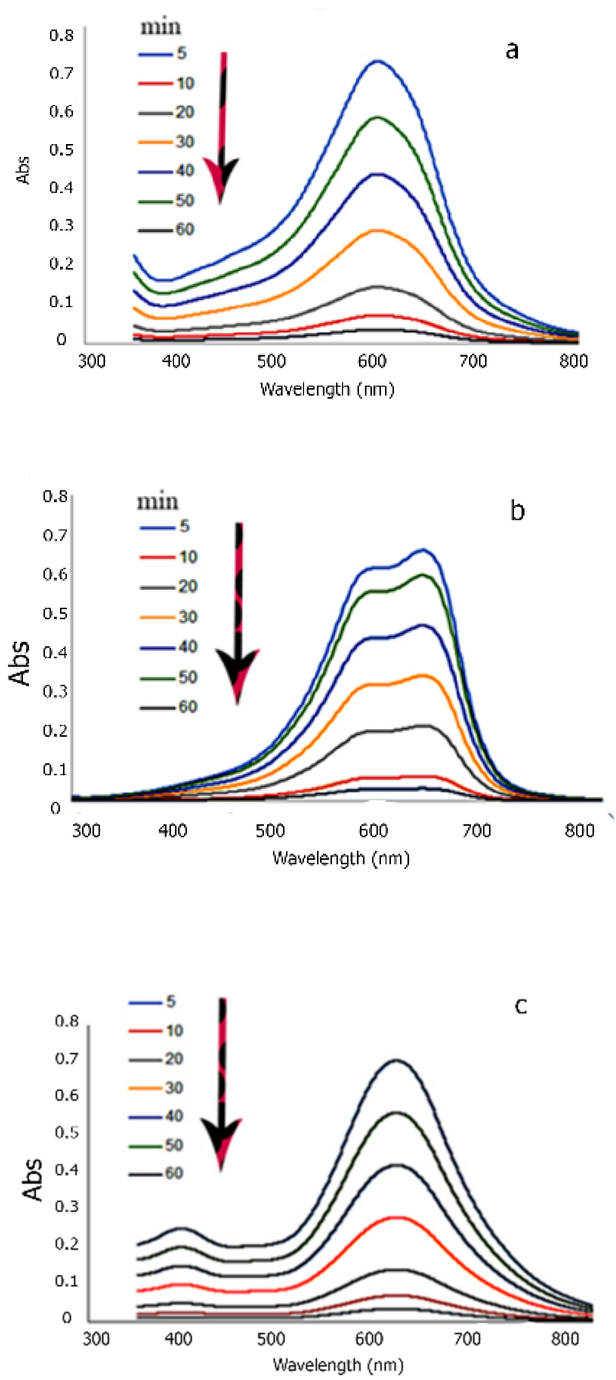


Fig. S3 UV-Vis absorption spectra of the dyes during the adsorption process: (a) Brilliant Cresyl Blue over TMU-16 (b) Toluidine Blue O and (c) Janus Green B over TMU-16-NH_2.