**FIGURE CAPTIONS**

**FIGURE 1.** The structures of TAFILs studied in this work.

**FIGURE 2.** (a) Comparison of CO2 solubilities in [Bmim][BF4] at 25 °C: Yokozeki30; Brennecke29; Our previous work19; This work; (b) Comparison of CH4 solubilities in [Cho][Cl]/urea at 45 °C: Xiaoyan Ji31; This work.

**FIGURE 3.** Density (a), viscosity (b) and TGA curves (c) of TAFIL/TMS binary absorbents.

**FIGURE 4.** The solubility of CO2 and CH4 in TAFIL/TMS binary absorbents at 40 °C.

**FIGURE 5.** CO2 (a) and CH4 (b) solubility in [Cho][Triz]/TMS with different mass ratios at 40 °C.

**FIGURE 6.** The fitting curves for CO2 solubility in [Cho][Triz]/TMS with different mass ratios at 40 °C.

**FIGURE 7.** The fitting curves of CO2 and CH4 solubility in [Cho][Triz] (a/b) and [Cho][Triz]/TMS (80 wt%/20 wt%, c/d) at different temperatures.

**FIGURE 8.** Chemical and physical solubility of CO2 in [Cho][Triz]/TMS (80 wt%/20 wt%) calculated by the modified deactivated model.

**FIGURE 9.** In-situ FTIR spectra for CO2 dissolution and desorption in [Cho][Triz]/TMS (80 wt%/20 wt%): (a) CO2 dissolution: 40 °C, 1 bar; (b) CO2 desorption: 80 °C, N2, 1 bar.

**FIGURE 10.** 13C NMR of [Cho][Triz]/TMS (80 wt%/20 wt%) before and after CO2 dissolution and after desorption.

**FIGURE 11.** The optimized structures of absorbents with CO2 and CH4 by DFT calculations.

**FIGURE 12.** Electrostatic potential surfaces of TAFILs.

**FIGURE 13.** Absorption-desorption performance of CO2 in [Cho][Triz]/TMS (80 wt%/20 wt%): Absorption: 40 °C, 1.00~1.20 bar; Desorption: 80 °C, N2, 1 bar.



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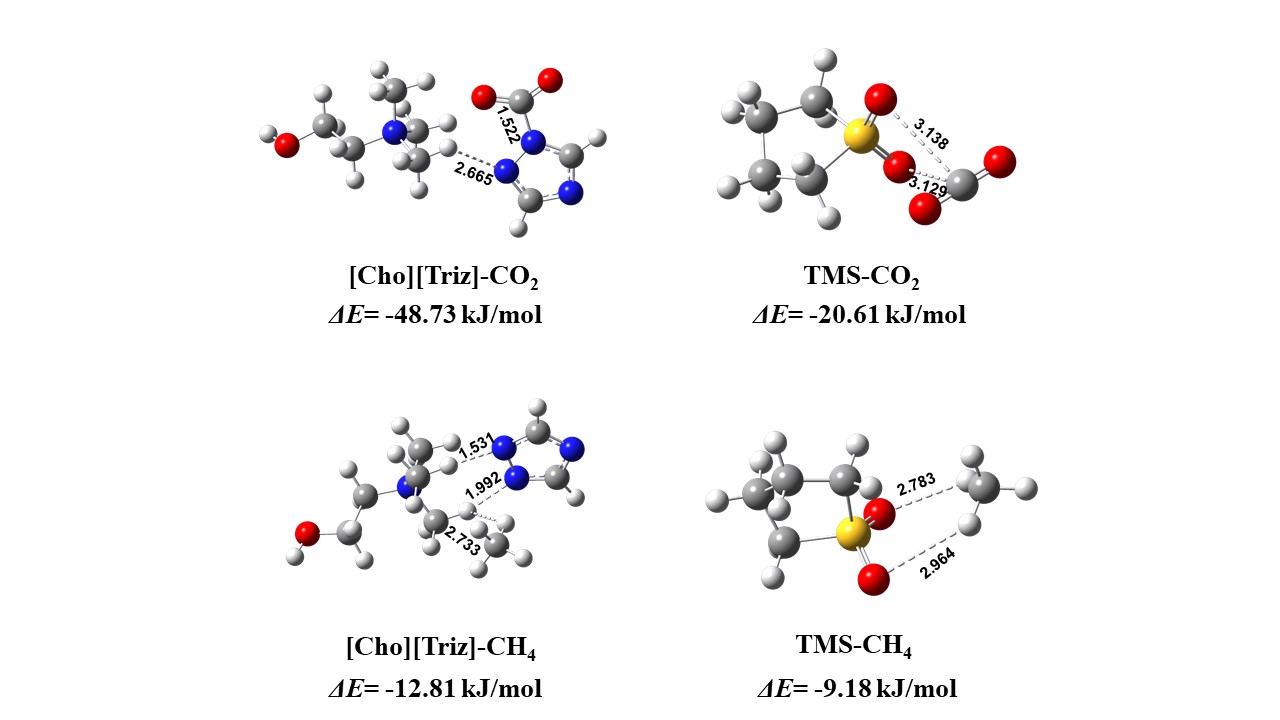




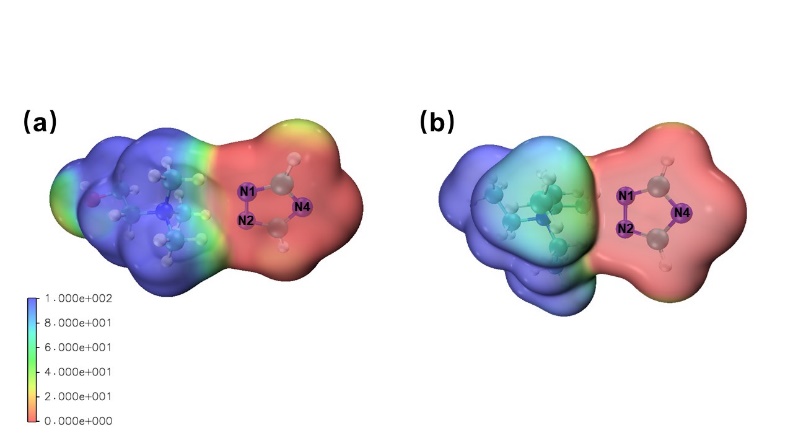
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