

Electronic Supplementary Information for Dramatic micellar rate enhancement of the Cu^{2+} catalyzed vinologous Friedel-Crafts alkylation in water

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General remarks

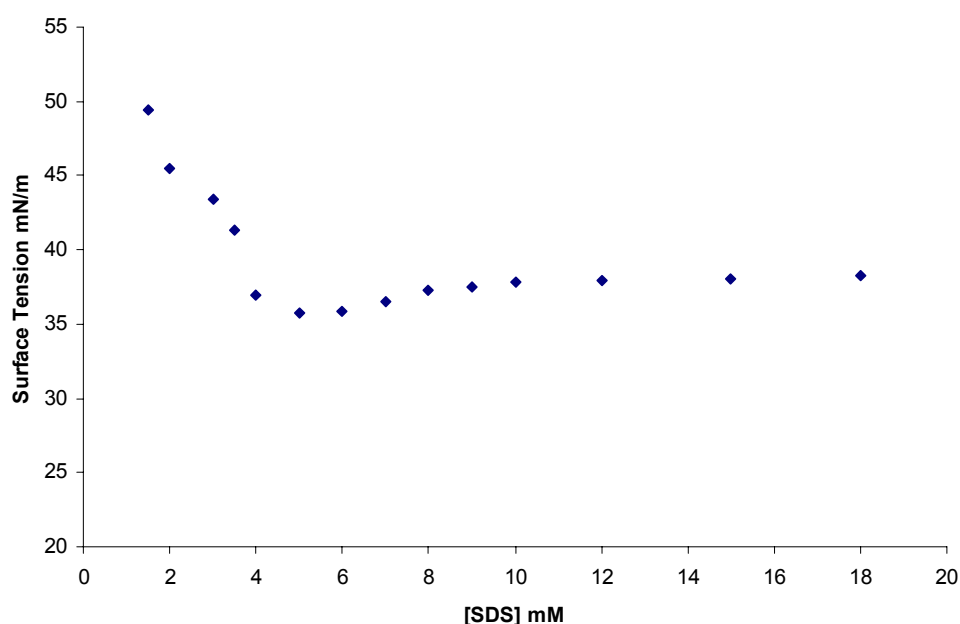
All the substrates were synthesized following published procedures;ⁱ 5-methoxyindole, SDS and $\text{Cu}(\text{NO}_3)_2$ were purchased from Sigma-Aldrich and used without further purification.

Representative procedure for catalytic Friedel-Crafts reactions: An aliquot of a stock solution of $\text{Cu}(\text{NO}_3)_2$ (0.15 mM final concentration) was added to a buffered solution (MOPS 20 mM, pH = 6) of SDS (8 mM final concentration) in a final volume of 250 mL. To this solution 2-acyl imidazole **1a**, **b**, **d** (0.30 mmol) and 5-methoxyindole (1.5 mmol) both dissolved in a minimal amount of DMSO were added consecutively. The reaction was performed at room temperature and was stopped after 30 min by addition of diethyl ether. The organic layer was separated and dried over Na_2SO_4 and concentrated in vacuo. The product was purified by column chromatography (SiO_2 AcOEt: Pentane 1/1).

Kinetic measurements. All kinetic measurements were performed using UV-visible spectroscopy (JASCO V-560 or JASCO V-570 spectrophotometers) monitoring the decrease of the absorption of the dienophile at 25 °C. The decrease of the absorption at 326 (**1c-e**) and at 440 nm (**1a-b**) was followed in time until the reaction was complete. Pseudo-first-order rate constants were obtained using Grafit 3.0 (Erithacus software Ltd., 1992) to the exponential equation $A_t = A_\infty + A_0 \cdot e^{-k_{\text{app}} t}$, giving the observed rate constants (k_{obs}) directly. The (k_{obs}) was plotted against the concentration of 5-methoxyindole, and the k_{app} was subsequently determined from the slope of this graph.

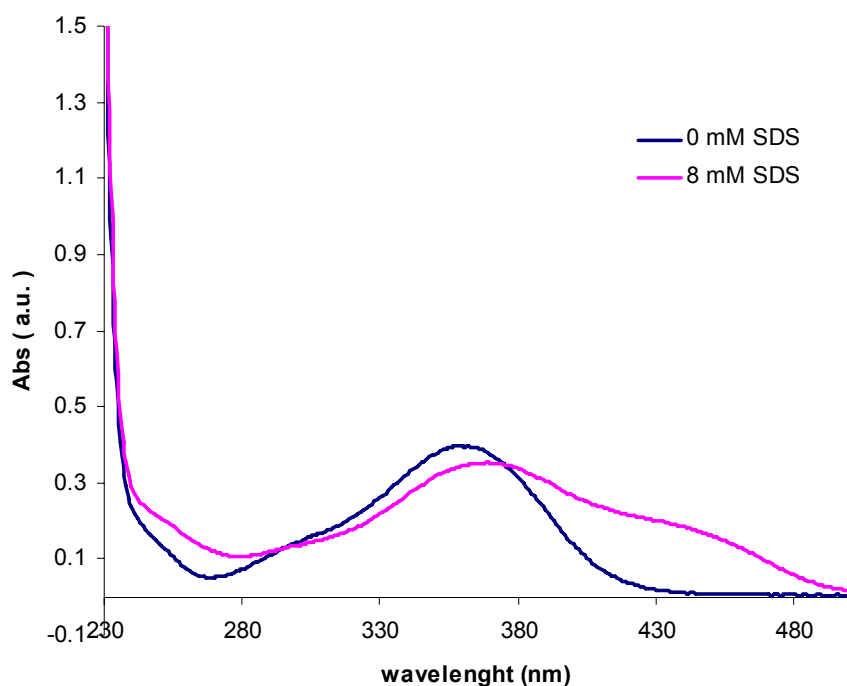
Cmc measurement: The measurements were performed under reaction conditions (MOPS buffer, 20 mM, pH = 6 and $\text{Cu}(\text{NO}_3)_2$ 0.15 mM) using Lauda Drop-volume tensiometer device.

Fig. S1 Cmc determination of SDS in presence of 0.15 mM $\text{Cu}(\text{NO}_3)_2$



UV spectra: The UV-Vis spectra were measured on a JASCO V-660 at 25°C

Fig. S2 UV spectra of the substrate 1a / Cu(NO₃)₂ in absence and in presence of 8 mM SDS



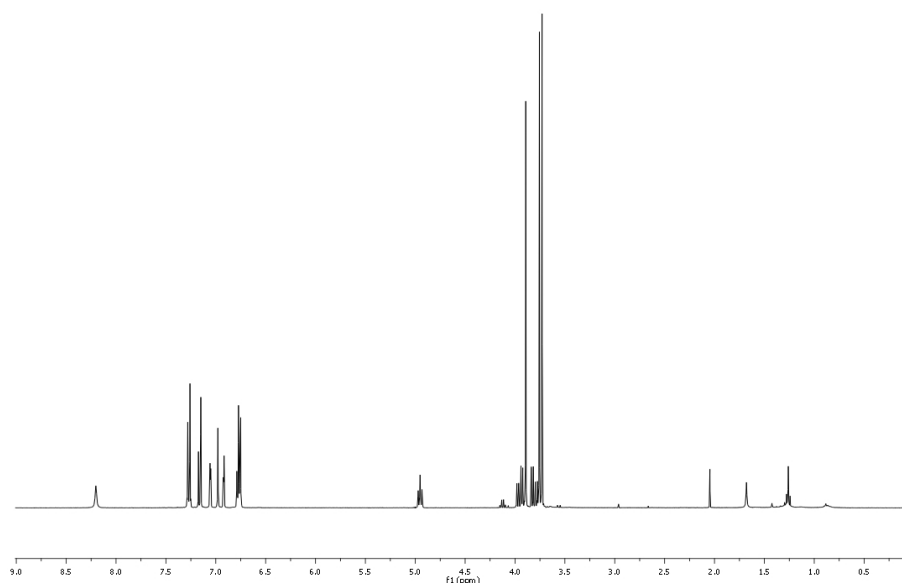
[Cu²⁺] = 0.15 mM; [1a] = 0.015 mM

Characterization of products from preparative scale reactions.

¹H-NMR-spectra

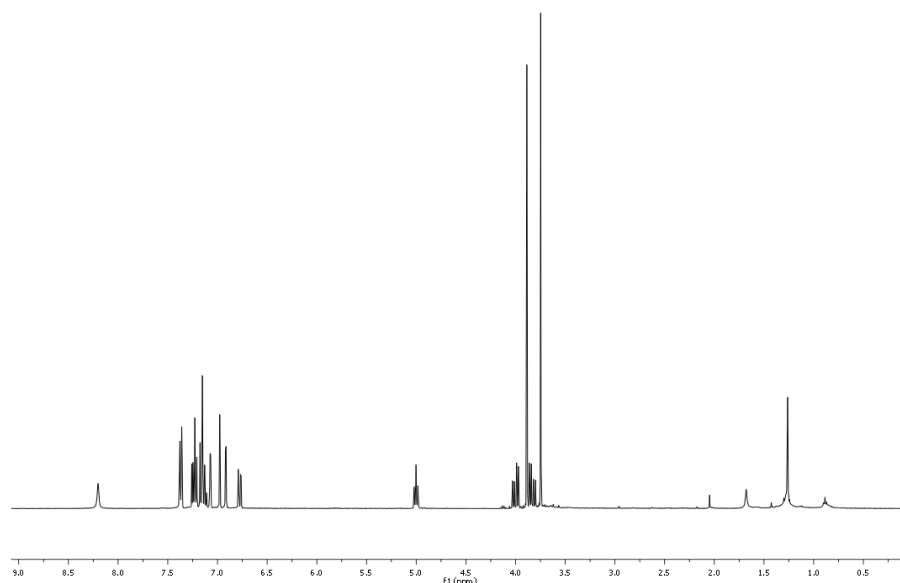
3-(5-methoxy-1H-indol-3-yl)-3-(4-methoxyphenyl)-1-(1-methyl-1H-imidazol-2-yl)propan-1-one (2a)

δ_{H} (400 MHz, CDCl₃) 8.20 (br s, 1H), 7.15 (m, 1H), 7.05 (d, *J* = 2.2 Hz, 2H), 6.98 (d, *J* = 2.4 Hz, 1H), 6.92 (s, 1H), 6.79- 6.74 (m, 3H), 4.93 (t, *J* = 7.6 Hz, 1H), 3.98 -3.92 (dd, *J* = 16.3, *J* = 7.1, 1H), 3.89 (s, 3H), 3.84-3.78 (dd, *J* = 16.3, *J* = 8.2, 1H), 3.76 (s, 3H), 3.73 (s, 3H).



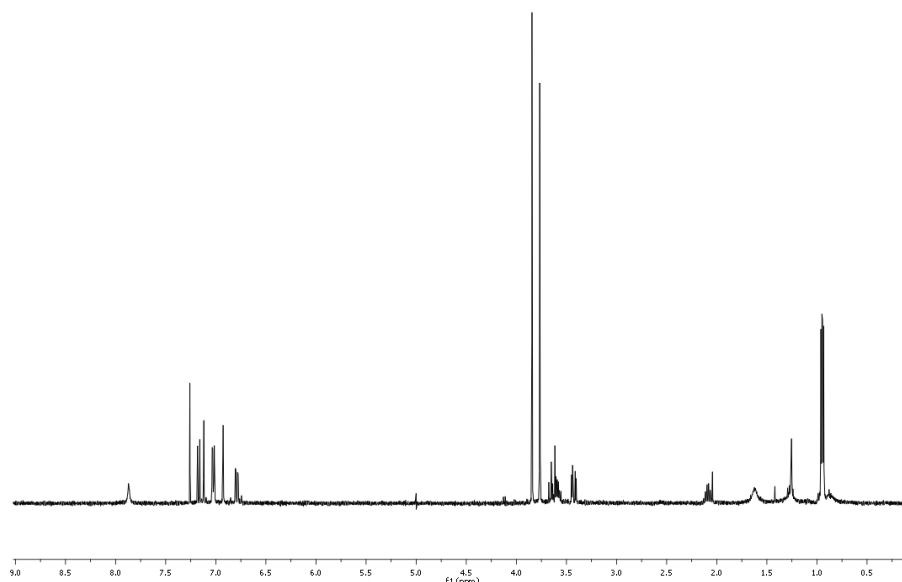
3-(5-methoxy-1H-indol-3-yl)-1-(1-methyl-1H-imidazol-2-yl)-3-phenylpropan-1-one (2b)

δ_{H} (400 MHz, CDCl_3) 8.20 (br s, 1H), 7.36 (d, $J = 8.4$, 2H), 7.21- 7.18 (m, 2H), 7.18-7.11 (m, 2H), 7.07 (d, $J = 2.3$ Hz, 1H), 6.98 (m, 1H), 6.91 (d, $J = 2.4$ Hz, 1H), 6.77 (dd, $J = 8.8$ Hz, $J = 2.4$ Hz, 1H), 4.98 (t, $J = 7.6$ Hz, 1H), 4.03-3.96 (dd, $J = 16.4$ Hz, $J = 7.3$ Hz, 1H), 3.89 (s, 3H), 3.86-3.80 (dd, $J = 16.4$ Hz, $J = 7.9$ Hz, 1H), 3.75 (s, 3H).



3-(5-methoxy-1H-indol-3-yl)-4-methyl-1-(1-methyl-1H-imidazol-2-yl)pentan-1-one (2d)

δ_{H} (400 MHz, CDCl_3) 7.87 (br s, 1H), 7.16 (d, $J = 8.8$ Hz, 1H), 7.12 (m, 1H), 7.04-7.01 (dd, $J = 6.1$ Hz, $J = 2.4$ Hz, 2H), 6.93 (s, 1H), 6.80- 6.78 (dd, $J = 8.8$ Hz, $J = 2.3$ Hz, 1H), 3.84 (s, 3H), 3.77 (s, 3H), 3.68- 3.56 (m, 2H), 3.45- 3.40 (m, 1H), 2.11- 2.04 (m, 1H), 0.95 (d, $J = 4.2$ Hz, 3H), 0.93 (d, $J = 4.2$ Hz, 3H).



- i. D. A. Evans, K. R. Fandrick and H. J. Song, *J. Am. Chem. Soc.*, 2005, **127**, 8942-8943; M. C. Myers, A. R. Bharadwaj, B. C. Milgram and K. A. Scheidt, *J. Am. Chem. Soc.*, 2005, **127**, 14675-14680.