"Green" anionic wormlike micelles induced by choline

Yixiu Han,[bc] Zonglin Chu,[b] Huanquan Sun,[a] Zhenquan Li,[a] and Yujun Feng*[ab]

[a] EOR Laboratory, Research Institute of Geological Sciences, Shengli Oilfield Company of Sinopec, Dongying 257015, P. R. China
[b] Chengdu Institute of Organic Chemistry, Chinese Academy of Sciences, Chengdu 610041, P. R. China. Fax: + 86 (28) 8523 6874; Tel: + 86 (28) 8523 6874; E-mail: yjfeng@cioc.ac.cn
[c] The Second Research Institute of Civil Aviation Administration of China (CAAC), Chengdu 610041, P. R. China

Phase behavior

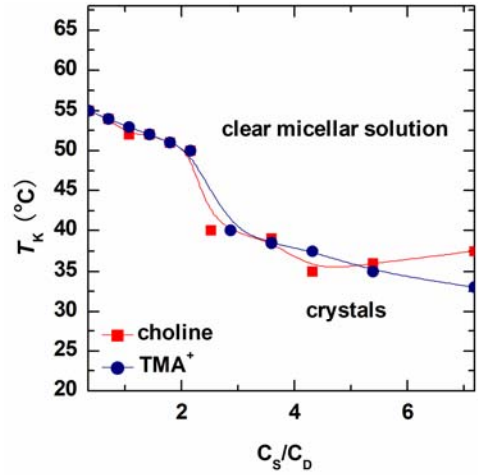


Figure S1. Krafft temperature plotted as a function of molar ratio of organic salt to NaOEr, C_S/C_D, where C_D is fixed at 1 wt%.

NaOEr is hardly soluble in pure water at room temperature, which impeded its practical applications. So it is necessary to decrease its Krafft point (T_K), i.e., the temperature at which 1 wt% surfactant is solubilized,[1] to satisfy the demand of researches and potential applications. The plots of T_K values against molar ratios of C_S/C_D were shown in Figure S1. With increasing C_S/C_D, T_K decreases monotonously and these two counterions show similar ability to enhance the solubility of NaOEr, which is consistent with previous report.[2]

Additional Figures for the effect of hydrotrope concentration on rheological behaviors

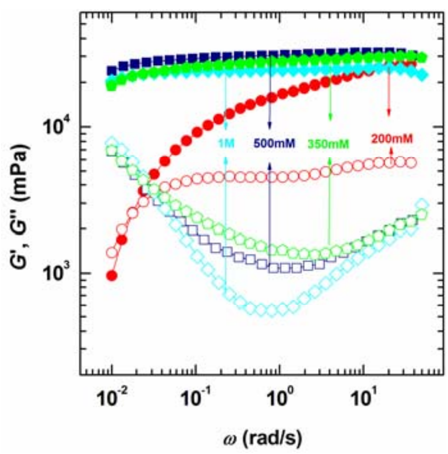


Figure S2. Additional dynamical rheogram for "NaOEr–choline" system with varied choline concentration. NaOEr concentration is held constant at 100 mM. All the measurements are carried out at 50 ºC.

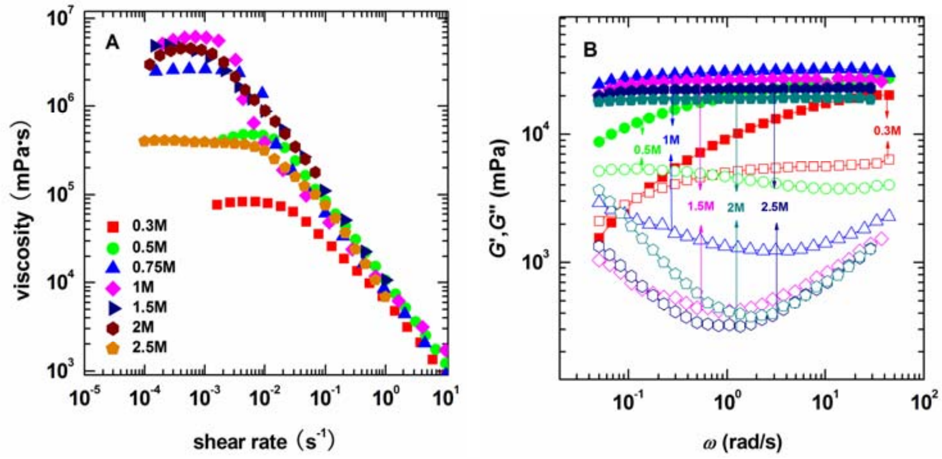


Figure S3. Additional dynamical rheogram for "NaOEr–TMA$^+$" system with varied TMA$^+$ concentration. (A) steady rheology; (B) dynamic rheology. NaOEr concentration is held constant at 100 mM. All the measurements are carried out at 50 ºC.

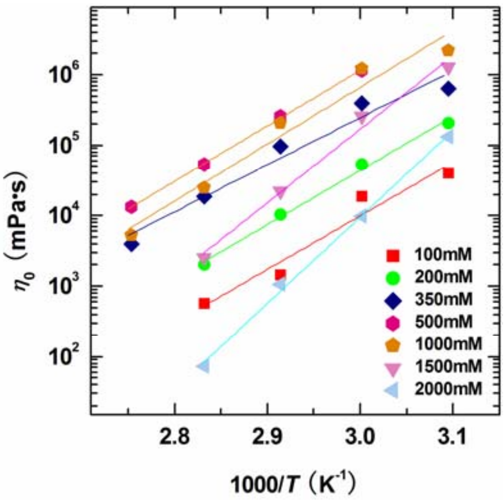
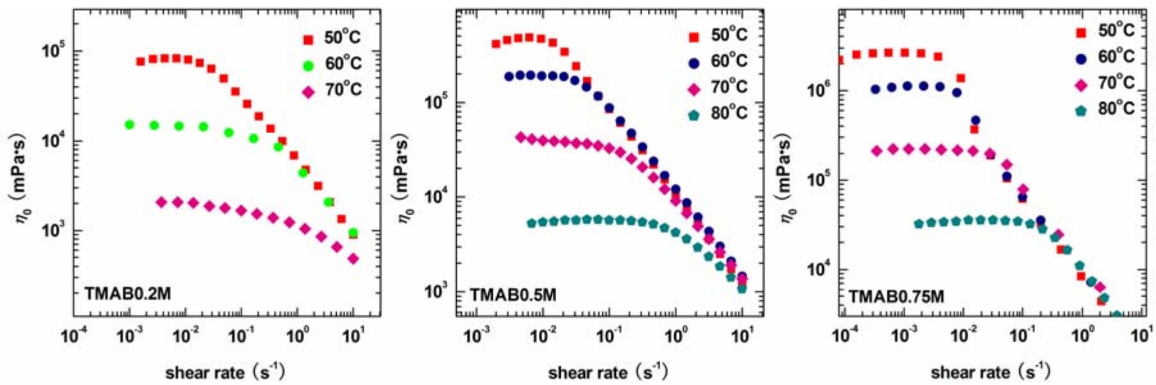


Figure S4. Arrhenius plots of η_0 vs 1/T at different choline concentrations.

Figure S4 illustrates the dependence of η_0 in semi-log plots versus the reciprocal of the absolute temperature at different choline concentrations. These plots all fall on straight lines and demonstrate that η_0 obeys Arrhenius behavior. From the slopes of these plots the activation energies were estimated.

Additional Figures for effect of temperature on rheological behaviors.



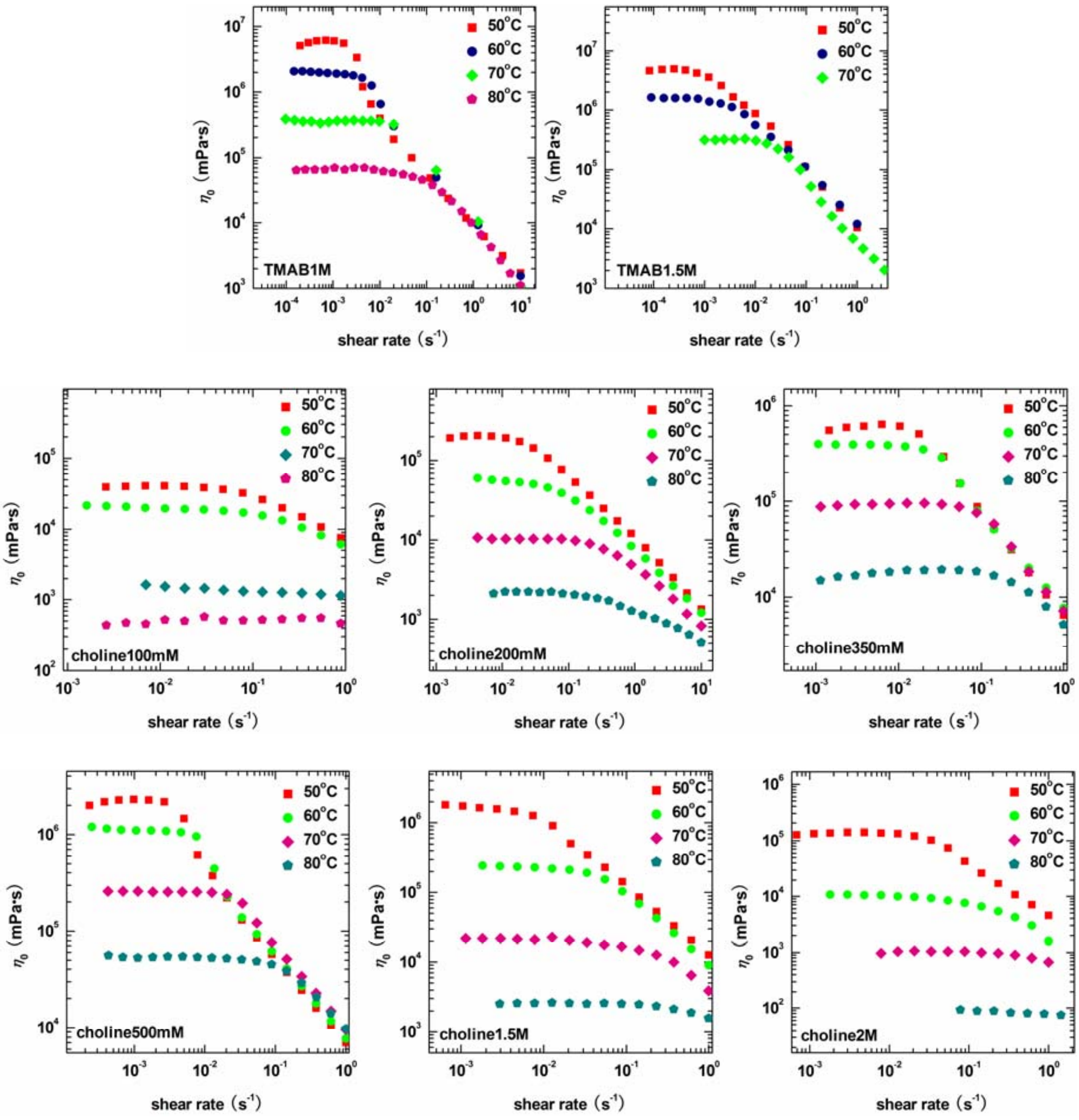


Figure S5. The effect of temperature on viscosity at different counterion concentrations. All the measurements are carried out at 50 ºC.

References

1. R. G. Laughlin. The aqueous phase behavior of surfactants. Academic Press, San Diego, 1994.
2. R. Klein, D. Touraud and W. Kunz, Green Chem., 2008, **10**, 433–435.