

Electronic Supplementary Information

Table S1 The main composition and properties of the crude oil.

Density (g/mL)	Viscosity (mPa·s, 50 °C)	Freezing point (°C)	Sulfur (wt%)	Wax (wt%)	Gelatine+ Asphaltene (wt%)	Acid number (mgKOH/g)
0.962	608	-0.3	0.16	4.7	27.6	3.3

Table S2 The composition of the used formation brine.

Na ⁺ +K ⁺ (mg/L)	Mg ²⁺ (mg/L)	Ca ²⁺ (mg/L)	Cl ⁻ (mg/L)	SO ₄ ²⁻ (mg/L)	HCO ₃ ⁻ (mg/L)	CO ₃ ²⁻ (mg/L)
490	11	33	279	43	868	25

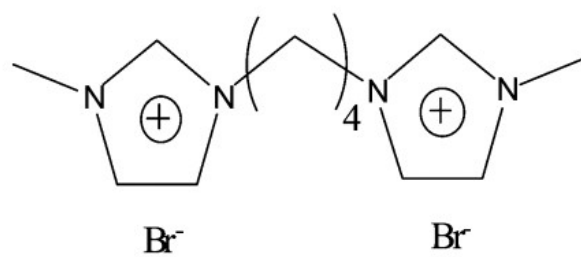


Fig. S1. Molecular structure of butane-1,4-bis (methylimidazolium bromide) (BBMB).⁴⁰

Table S3 The IFT between BBMB aqueous solutions and model oils

BBMB concentration (mg/L)	0	5000	10000	50000
IFT (mN/m)	20.605	20.198	19.631	18.983

Table S4 IFT values between the mixed surfactant (5000 mg/L) and BBMB aqueous solutions and model oil at 30 °C

Molar ratio (surfactant:BBMB)	IFT (mN/m)		
	SBDS/BBMB system	SDS/BBMB system	M12/BBMB system
1:0	0.701	0.967	4.319
2:1	0.0714	0.922	3.832
1:1	0.0550	0.858	3.018
1:2	0.0443	0.484	2.491

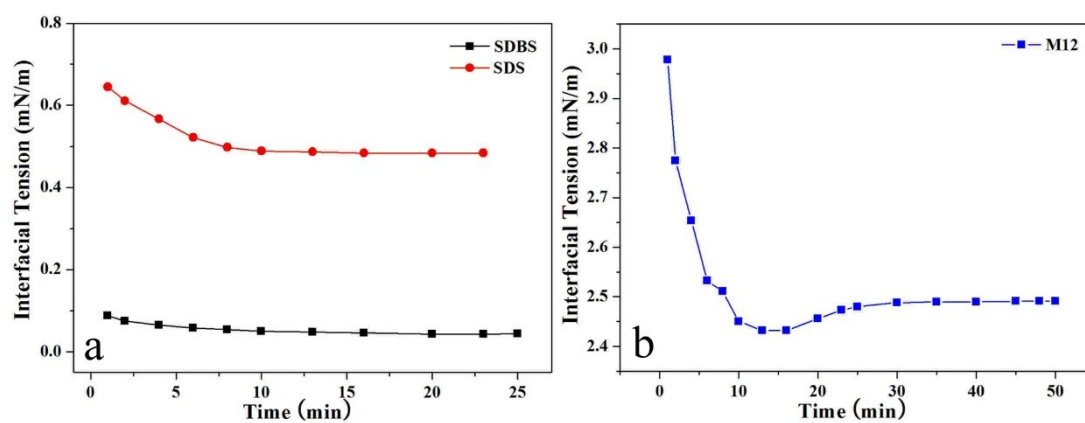


Fig. S2. Effects of additional BBMB molecules on the dynamic IFT between different surfactant aqueous solutions (5000 mg/L, Surfactant/BBMB molar ratio is 1:2) and model oil at 30 °C.