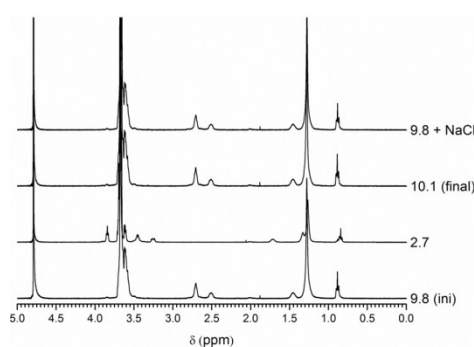


**Fig. S1:** pH-titration of Ethomeen solution at 1.16 mM (0.1 %) with nitric acid excess by sodium hydroxide at 0.1 M. Red lines represent the graphical method (half equivalent point method) used to determine surfactant  $pK_a$  and the vertical grey line divide the pH titration curve in two domains:  $\text{HNO}_3$  titration domain and Ethomeen titration domain.

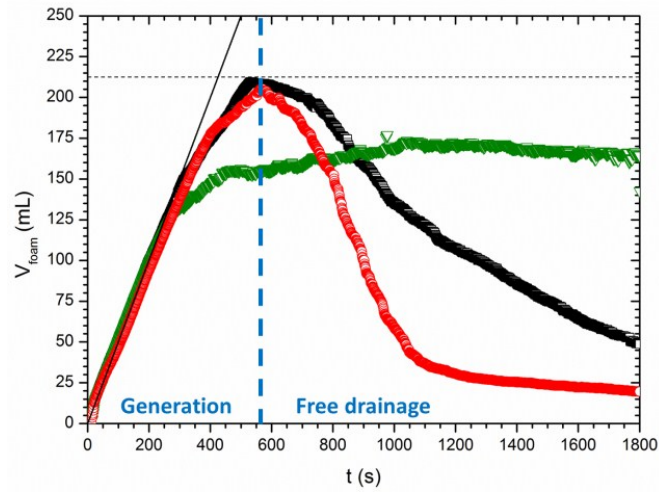


**Fig. S2:**  $^1\text{H}$ NMR spectra of Ethomeen C/25 as function of pH to verify the non-degradation product. The initial solution at pH 9.8 (ini) was acidified to a pH 2.7 with  $\text{DNO}_3$  and then basified with  $\text{NaOD}$  to a pH 10.1 (final). In parallel,  $\text{NaCl}$  was added to the initial solution in order to reach the same ionic strength as the final solution (see upper spectra 9.8 +  $\text{NaCl}$ ).

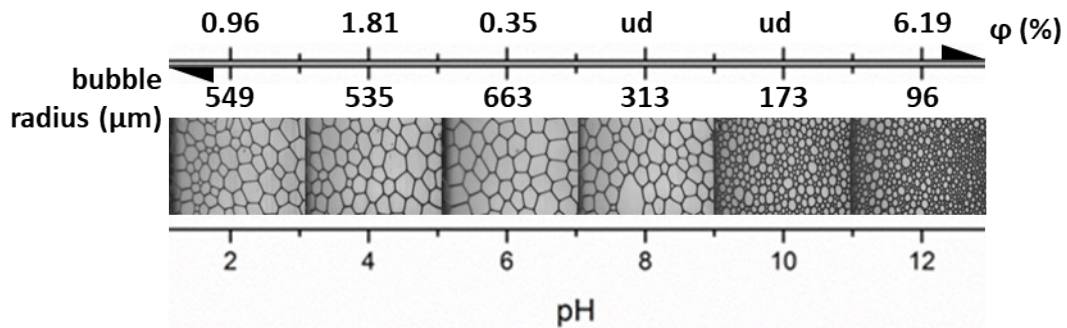
**Table 1:** Critical Micelle Concentration ( $\text{CMC}_1$ ,  $\text{CMC}_2$ ), Area per Head Group ( $A_1$ ,  $A_2$ ), and Surface Excess ( $\Gamma_1$ ,  $\Gamma_2$ ) at  $21^\circ\text{C}$ . The subscripts 1 and 2 refer respectively to the high concentration range (above  $10^{-4}$  M) and the low concentration range (below  $10^{-4}$  M). Quantities are obtained from surface tension curves (see Figure 2 in the main article).

pH	$\text{CMC}_1$ ( $\mu\text{M}$ )	$A_1$ ( $\text{\AA}^2$ )		$\Gamma_1$ ( $\mu\text{mol}/\text{m}^2$ )	$\text{CMC}_2$ ( $\mu\text{M}$ )	$A_2$ ( $\text{\AA}^2$ )		$\Gamma_2$ ( $\mu\text{mol}/\text{m}^2$ )
		$n = 1$	$n = 1 + \alpha$			$n = 1$	$n = 1 + \alpha$	
1.999	175.59	29.05	58.10	5.72	-	-	-	-
3.014	210.82	27.93	55.86	5.95	-	-	-	-
3.85	271.76	23.45	46.89	7.08	-	-	-	-
6.057	225.50	35.35	70.37	4.70	-	-	-	-
8.067	147.01	39.82	60.48	4.17	-	-	-	-
9.057	164.96	58.63	64.46	2.83	-	-	-	-
9.733	170.49	25.93	26.52	6.40	60.86	59.61	60.97	2.79
10.02	220.06	68.81	69.63	2.41	96.82	68.06	68.87	2.44

11.04	233.11	270.03	270.34	0.61	19.14	58.65	58.72	2.83
11.98	-	-	-	-	20.32	96.19	96.20	1.73



**Fig. S3:** Variation of foam volume as function of time for different pH ( $\nabla$ ) 3.78, ( $\circ$ ) 8.08, and ( $-$ ) 11.28 during foam generation and free drainage. Free drainage mode starts when the foam volume  $V_{\text{foam}}$  reach 212 mL, the full flotation column. . This was not the case for pH 8.01 for which the foam was still be produced. Foams are generated under 30 mL/min air flowrate. The black continuous line corresponds to a foam with a foaming capacity of 1 (all injected gas is captured).



**Fig. S4:** Pictures of foams at the millimeter scale (with averaged size and interstitial solution volume fraction) as a function of pH taken at a foam height of 7.5 cm above the liquid/foam interface just before free drainage (“ud” means undetermined).