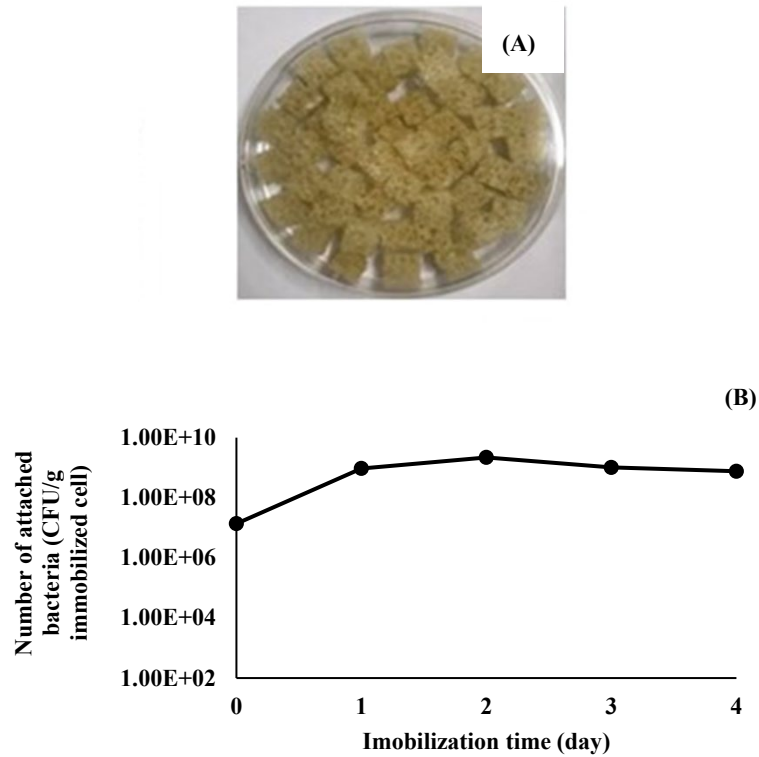
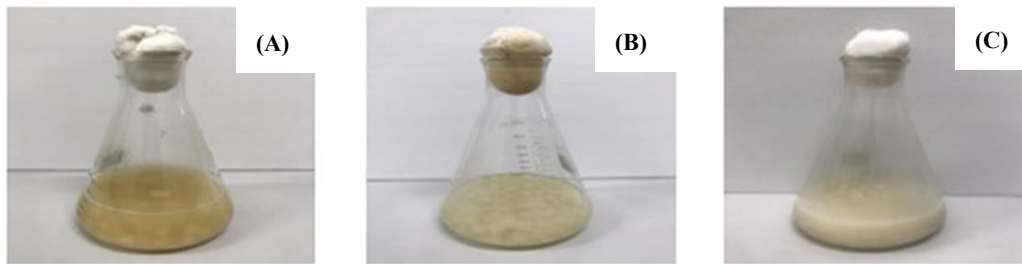


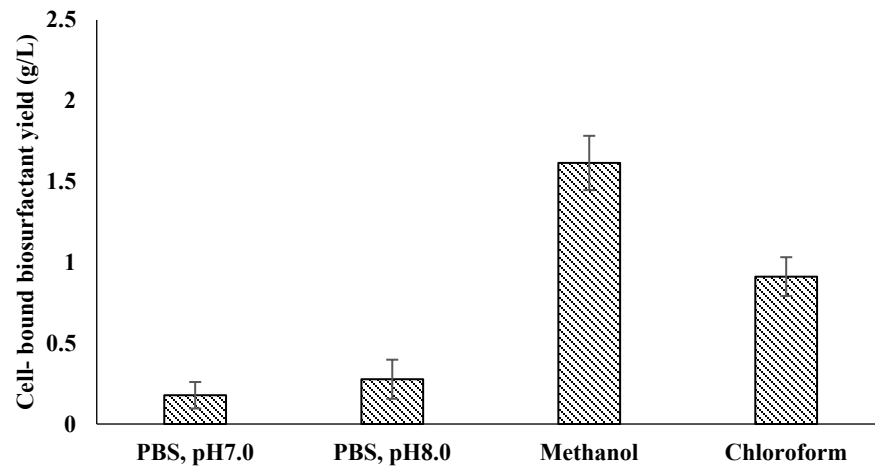
Supplementary Material



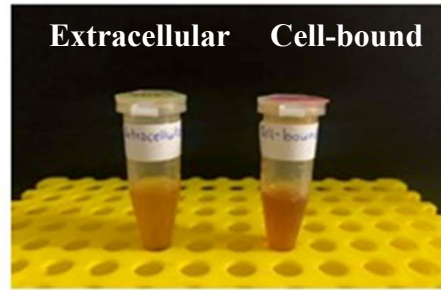
Supplementary Figure 1. The characteristics of aquaporousgel after biosurfactant production (A). The numbers of attached bacteria during cell immobilization were monitored (B).



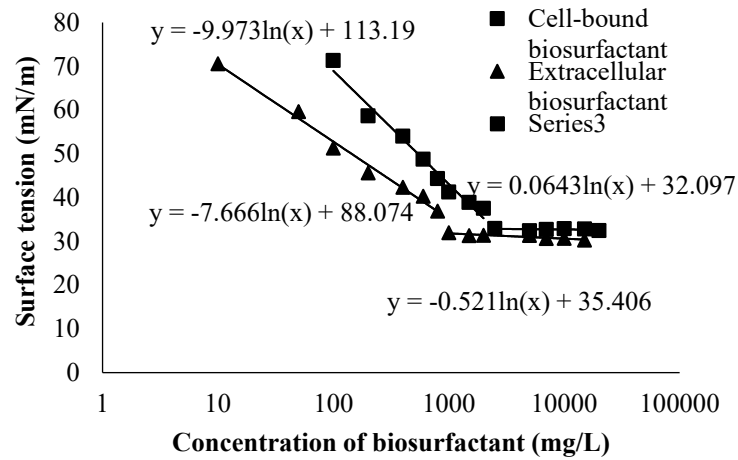
Supplementary Figure 2. Immobilized *Weissella cibaria* PN3 in LB broth during immobilization process (A) and in basal medium supplemented with 2% (v/v) soybean oil before (B) and after biosurfactant production (C).



Supplementary Figure 3. The yields of cell-bound biosurfactant after resuspending the cell pellets in PBS, methanol and chloroform.



Supplementary Figure 4. Crude extracellular and cell-bound biosurfactant from immobilized-*Weissella cibaria* PN3



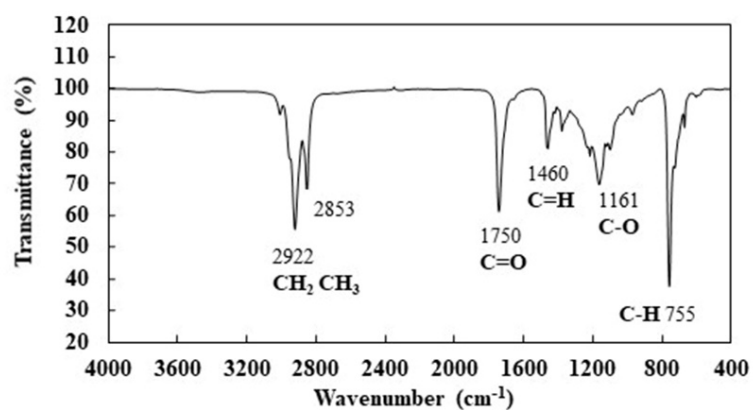
Supplementary Figure 5. Evaluation of critical micelle concentration (CMC) of crude extracellular and cell-bound biosurfactants.

Supplementary Table1. Surface tension of crude extracellular and cell-bound biosurfactants at the CMC value.

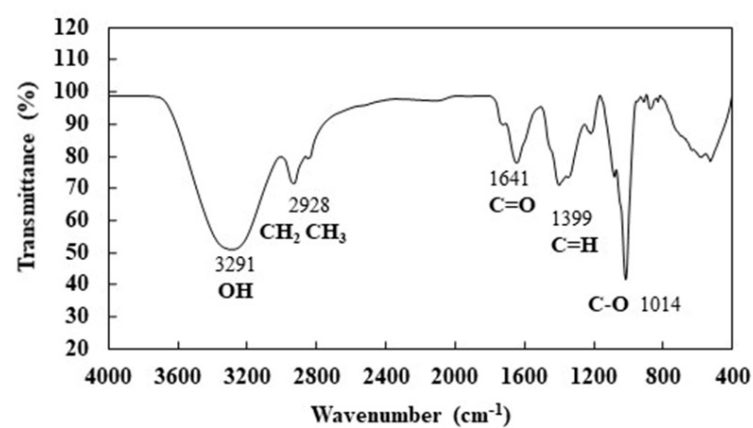
Biosurfactant types	Equation	Surface tension	Average surface tension (mN/m)
Extracellular biosurfactant	$Y = -7.621\ln(x) + 87.970$	31.32	31.32±0.08
	$Y = -7.710\ln(x) + 88.179$	31.41	
	$Y = -7.66\ln(x) + 88.065$	31.25	
Cell-bound biosurfactant	$Y = -9.983\ln(x) + 112.992$	32.58	32.59±0.03
	$Y = -9.973\ln(x) + 113.194$	32.62	
	$Y = -9.965 \ln (x) + 112.890$	32.56	

*Surface tension of PBS was 68.32±0.25 mN/m

(A)



(B)



Supplementary Figure 6. FTIR spectrum of crude extracellular (a) and cell-bound biosurfactant (b) from *Weissella cibaria* PN3.