

# **Supplementary Tables and Figures**

**Preventing bacterial adhesion to skin by altering their physicochemical cell surface properties specifically.**

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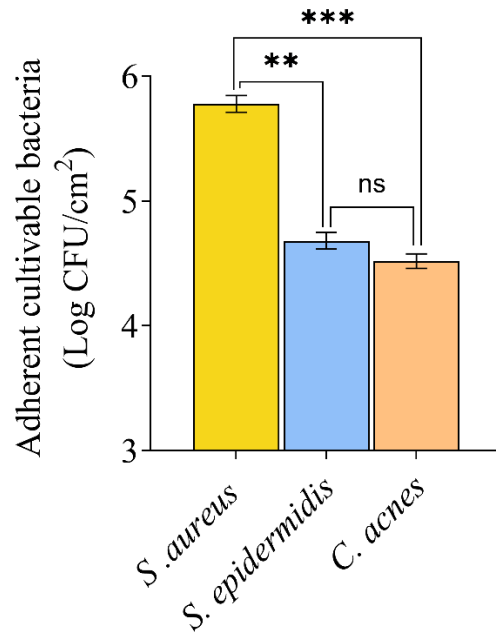
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#Equivalent contribution

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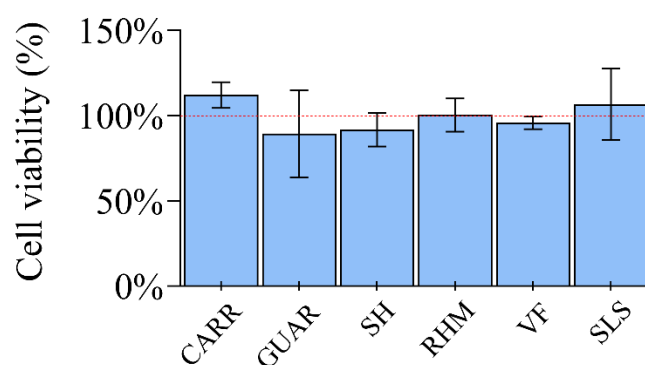


**Supplementary Figure 1: Native adhesion of wild-type skin bacteria after 2 h of incubation on the 3D skin model.**

Results are expressed in *Log*<sub>10</sub> of the number of bacteria adhered per cm<sup>2</sup> of reconstructed skin of the 3D skin model. Error bars show standard error of the mean (SEM) of independent treatments (n > 3). 3 wild-type *S. aureus* strains and *C. acnes* strains and 2 wild-type *S. epidermidis* strains. Strains used are from clinical origins. Statistical significance was calculated by a multiple comparison of strains using the Tukey's test following one-way ANOVA. (\*) for p < 0.05, (\*\*) for p < 0.01 and (\*\*\*).

**Supplementary Table 1: wild-type strains used in Supplementary Figure 1**

Bacteria	Id. Strain	Origin	Ref.
<i>Staphylococcus aureus</i>	AD08 <sub>cc1</sub>	Human Atopic dermatitis	Fleury <i>et al</i> , 2017 <sup>1</sup>
	BC1406	Human Atopic dermatitis	This Study
	BC1407	Human Atopic dermatitis	This Study
<i>Staphylococcus epidermidis</i>	BC1190	Human normal skin	Landemaine <i>et al</i> , 2023 <sup>2</sup>
	45A6	Human Atopic dermatitis	Landemaine <i>et al</i> , 2023 <sup>2</sup>
<i>Cutibacterium acnes</i>	BC1089	Human normal skin	This Study
	BC1083	Human oily skin	This Study
	BC1077	Human normal skin	This Study



**Supplementary Figure 2: Preservation of 3d skin cell viability after topical compound exposure**

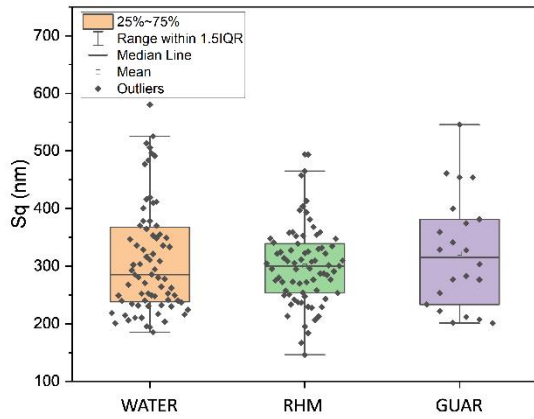
MTT assay demonstrating the maintenance of 3D skin model viability following a 2-hour topical treatment of 3D skin cell to the tested compounds. Results are expressed as percentage of viability relative to the water-treated control. SLS : Sodium Laureth Sulfate ; CARR: Carrageenan ; GUAR: Guar Hydroxypropyltrimonium Chloride ; SH: Sodium Hyaluronate ; RHM: Rhamnolipids ; VF : *Vitreoscilla filiformis* extract. Error bars represent standard deviation (SD) of two independent experiments ( $n \geq 2$ ).

**Supplementary Table 2: Contact angle measurement after application of tested compounds using the 3D skin model epidermal surface.**

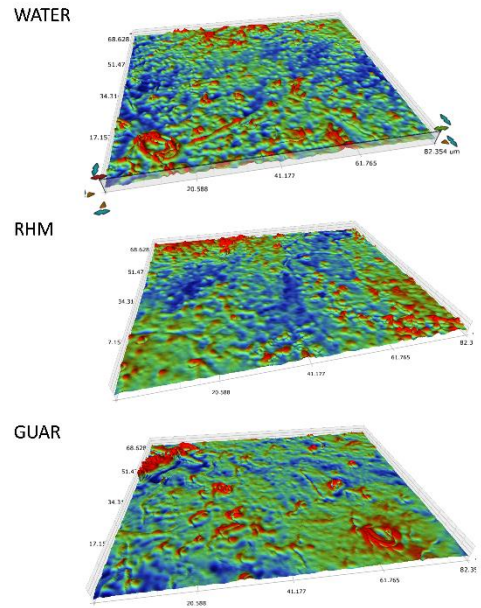
	Water	Cosmetic raw materials					
		CARR	GUAR	SH	RHM	VF	SLS
<b>Angle contact</b>	34.6 ± 5.9	24.4 ± 2.6	10.4 ± 1.4	19.8 ± 5.7	31.5 ± 1.3	26.1 ± 1.2	8 ± 0.0

\* Angle contacts are expressed in degrees. Values are defined from at least three independent experiments ± standard error of the mean (SEM).

a)



b)



**Supplementary Figure 3: Roughness characterization of the treated 3D skin model using optical profilometry.**

**a)** Box plots representing  $S_q$  (root mean square height) values obtained from optical profilometry measurements. Each data point represents a single profilometry image. **b)** Representative profilometry images ( $80 \times 69 \mu\text{m}^2$ ) for each condition. GUAR: Guar Hydroxypropyltrimonium Chloride ; RHM: Rhamnolipids. Error bars represent standard deviation (SD) of a minimum of 22 images per condition, with three biological replicates for RHM and water controls and two biological replicates for GUAR.

**Supplementary Table 3: Surface polarity and Lewis-acid balance of treated skin bacteria with tested compounds.**

Bacteria	Physicochemical parameters*	Compounds tested					
		CARR	GUAR	SH	RHM	VF	SLS
<i>S. aureus</i>	Hydrophobic (%)	86.3 ± 3.0	70.2 ± 6.4	95.2 ± 1.1	0.0 ± 0.0	65.1 ± 3.1	28.1 ± 1.5
	Lewis acid $\gamma^+$	23.4 ± 4.0	3.6 ± 1.6	10.0 ± 2.4	39.0 ± 1.1	8.5 ± 3.0	41.6 ± 7.3
	Lewis base $\gamma^-$	12.1 ± 4.3	14.9 ± 4.2	3.5 ± 1.2	0.1 ± 0.1	5.2 ± 1.1	10.2 ± 3.9
<i>C. acnes</i>	Hydrophobic (%)	55.6 ± 11.7	65.0 ± 10.9	71.2 ± 10.7	4.0 ± 1.2	33.0 ± 4.6	0.0 ± 0.0
	Lewis acid $\gamma^+$	18.1 ± 3.1	13.5 ± 0.2	8.8 ± 1.5	32.1 ± 3.8	6.8 ± 0.9	20.2 ± 1.3
	Lewis base $\gamma^-$	18.5 ± 4.3	16.2 ± 3.1	9.0 ± 1.0	10.5 ± 2.7	19.3 ± 1.0	3.0 ± 1.3

\*Parameters are expressed in percent for hydrophobicity and in arbitrary units for Lewis acid/base. Values are defined from at least three independent MATS experiments ± standard error of the mean (SEM).

**Supplementary Table 4. Differential RNA expression analysis ( $\geq 1.5$ -fold ;  $p_{adj} < 0.1$ ) of *S. aureus* between compounds-treated conditions and water-treated condition.**

Locus tag	Description	log2FoldChange				
		CARR	GUAR	SH	RHM	VF
SAOUHSC_00198	AMP-dependent synthetase and ligase				1.70	
SAOUHSC_00199	Hypothetical unknow protein belongs to the 3-oxoacid CoA-transferase family				1.84	
SAOUHSC_00420	Hypothetical unknow protein belongs to the sodium neurotransmitter symporter (SNF) (TC 2.A.22) family				1.59	
SAOUHSC_00465	Biofilm formation stimulator VEG	-2.25				
SAOUHSC_00767	Ribosomal S30AE domain containing protein	-1.71				
SAOUHSC_00786	Hypothetical unknow protein		-1.96			
SAOUHSC_00914	pyruvate carboxyltransferase		1.52			
SAOUHSC_00975	DoxX family transmembrane protein	-2.21				
SAOUHSC_01036	Hypothetical unknow protein belongs to the UPF0356 family		-1.70			
SAOUHSC_01144	Cell division protein	-1.53				
SAOUHSC_01349	Hypothetical unknow protein belongs to the HesB/IscA family iron-sulfur cluster assembly accessory protein	-1.56				
SAOUHSC_01704	Hypothetical unknow protein	-1.66				
SAOUHSC_01764	peptidase A24A, prepilin type IV	-1.67				
SAOUHSC_01782	MutT/nudix hydrolases		-1.56			
SAOUHSC_01902	Hypothetical unknow protein	-1.68				
SAOUHSC_02118	gatC – glutamyl-tRNA(Gln) amidotransferase, C subunit	-1.56	-1.53			
SAOUHSC_02176	Hypothetical unknow protein		-1.90			
SAOUHSC_02286	leuB – 3-isopropylmalate dehydrogenase				1.60	
SAOUHSC_02288	leuD – 3-isopropylmalate dehydratase, small subunit				1.64	
SAOUHSC_02320	Hypothetical unknow protein		3.15			
SAOUHSC_02523	Hypothetical unknow protein	-1.64				
SAOUHSC_02853	Hypothetical unknow protein belongs to the UPF0346 family	-2.09				
SAOUHSC_03017	N-acetyltransferase		-2.24			
SAOUHSC_03045	Cold shock protein				1.82	
SAOUHSC_T00012	tRNAasp		-2.98			

## Supplementary References

- 1 Fleury, O. M. *et al.* Clumping Factor B Promotes Adherence of *Staphylococcus aureus* to Corneocytes in Atopic Dermatitis. *Infect Immun* **85** (2017). <https://doi.org/10.1128/iai.00994-16>
- 2 Landemaine, L. *et al.* *Staphylococcus epidermidis* isolates from atopic or healthy skin have opposite effect on skin cells: potential implication of the AHR pathway modulation. *Frontiers in Immunology* **14** (2023). <https://doi.org/10.3389/fimmu.2023.1098160>