

Quaternary Ammonium Compounds (QACs) and Ionic Liquids (ILs) as Biocides: From Simple Antiseptics to Tunable Antimicrobials

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Table S1. Antimicrobial activity of common ILs *

IL	Acronym	Species	MIC, $\mu\text{g mL}^{-1}$	MBC, $\mu\text{g mL}^{-1}$	Method	Notes	Ref.
1-Ethyl-3-methylimidazolium chloride	[C ₂ Mim][Cl]	<i>L. monocytogenes</i> ATCC13932	>5000		Broth microdilution		[1]
		<i>B. cereus</i> ATCC 11778	>5000				
		<i>S. aureus</i> ATCC 6538	>5000				
		<i>E. faecalis</i> ATCC 19433	>5000				
		<i>L. sakei</i> ATCC 15521	>5000				
		<i>L. lactis</i> ATCC 19435	>5000				
		<i>S. typhimurium</i> ATCC 14028	>5000				
		<i>E. coli</i> ATCC 25922	>5000				
1-(2-Hydroxyethyl)-3-methylimidazolium chloride	[HOC ₂ Mim][Cl]	<i>C. freundii</i> ATCC 27853	>5000		Broth microdilution		
		<i>E. coli</i> ATCC 25922	5000 μM				
		<i>E. coli</i> TEM CTX M9	>5000 μM				
		<i>E. coli</i> CTX M2	2500 μM				
		<i>E. coli</i> AmpC MOX2	5000 μM				
		<i>K. pneumoniae</i> (clinical isolate)	>5000 μM				
		<i>S. aureus</i> ATCC 25293	>5000 μM				
		<i>S. epidermidis</i> (clinical isolate)	5000 μM				
1-Butyl-3-methylimidazolium chloride	[C ₄ Mim][Cl]	<i>E. faecalis</i> (clinical isolate)	5000 μM		Agar disk diffusion / agar well diffusion, broth microdilution	Weak anti-adhesive activity ^a	[1, 3]
		<i>P. aeruginosa</i> PTCC1310	12500	12500			
		<i>S. aureus</i> PTCC1112	50000	50000			
		<i>S. aureus</i> ATCC 6538	>5000				
		<i>E. coli</i> PTCC 1338	12500	12500			
		<i>E. coli</i> ATCC 25922	>5000				
		<i>B. cereus</i> PTCC 1015	50000	50000			

		<i>B. cereus</i> ATCC 11778	>5000				
		<i>S. typhimurium</i> (wild type)	12500	50000			
		<i>S. typhimurium</i> ATCC 14028	>5000				
		<i>K. pneumonia</i> PTCC 1290	25000	N.D.			
		<i>B. subtilis</i> PTCC 1715	50000	N.D.			
		<i>L. monocytogenes</i> ATCC 13932	>5000				
		<i>E. faecalis</i> ATCC 19433	>5000				
		<i>L. sakei</i> ATCC 15521	4167				
		<i>L. lactis</i> ATCC 19435	3333				
		<i>C. freundii</i> ATCC 27853	>5000				
1-Butyl-3-methylimidazolium iodide	[C ₄ Mim][I]	<i>P. aeruginosa</i> PTCC 1310	12500	12500	Agar disk diffusion / agar well diffusion	Weak anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	12500	25000			
		<i>E. coli</i> PTCC 1338	25000	25000			
		<i>B. cereus</i> PTCC 1015	50000	50000			
		<i>S. typhimurium</i> (wild type)	12500	25000			
		<i>K. pneumonia</i> PTCC 1290	25000	25000			
		<i>B. subtilis</i> PTCC 1715	25000	25000			
1-Butyl-3-methylimidazolium hexafluorophosphate	[C ₄ Mim][PF ₆]	<i>P. aeruginosa</i> PTCC 1310	25000	50000	Agar disk diffusion / agar well diffusion		[3]
		<i>S. aureus</i> PTCC 1112	25000	25000			
		<i>E. coli</i> PTCC 1338	12500	12500			
		<i>B. cereus</i> PTCC 1015	50000	50000			
		<i>S. typhimurium</i> (wild type)	50000	50000			
		<i>K. pneumonia</i> PTCC 1290	25000	25000			
		<i>B. subtilis</i> PTCC 1715	50000	50000			
1-Butyl-3-methylimidazolium tetrafluoroborate	[C ₄ Mim][BF ₄]	<i>P. aeruginosa</i> PTCC 1310	12500	50000	Agar disk diffusion / agar well diffusion		[3]
		<i>S. aureus</i> PTCC 1112	12500	12500			
		<i>E. coli</i> PTCC 1338	12500	12500			
		<i>B. cereus</i> PTCC 1015	50000	50000			
		<i>S. typhimurium</i> (wild type)	12500	12500			
		<i>K. pneumonia</i> PTCC 1290	25000	N.D.			
		<i>B. subtilis</i> PTCC 1715	50000	N.D.			

1-Butyl-3-methylimidazolium hydrogen sulfate	[C ₄ Mim][HSO ₄]	<i>P. aeruginosa</i> PTCC 1310	6250	12500	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	3120	3120			
		<i>E. coli</i> PTCC 1338	3120	3120			
		<i>B. cereus</i> PTCC 1015	3120	3120			
		<i>S. typhimurium</i> (wild type)	6250	6250			
		<i>K. pneumonia</i> PTCC 1290	3120	6250			
		<i>B. subtilis</i> PTCC 1715	3120	3120			
1-Butyl-3-methylimidazolium methyl sulfate	[C ₄ Mim][C ₁ OSO ₃]	<i>P. aeruginosa</i> PTCC 1310	12500	12500	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	12500	12500			
		<i>E. coli</i> PTCC 1338	12500	12500			
		<i>B. cereus</i> PTCC 1015	12500	12500			
		<i>S. typhimurium</i> (wild type)	12500	12500			
		<i>K. pneumonia</i> PTCC 1290	12500	50000			
		<i>B. subtilis</i> PTCC 1715	12500	12500			
1-Butyl-3-methylimidazolium tosylate	[C ₄ Mim][PTS]	<i>P. aeruginosa</i> PTCC 1310	25000	50000	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	50000	50000			
		<i>E. coli</i> PTCC 1338	25000	25000			
		<i>B. cereus</i> PTCC 1015	50000	50000			
		<i>S. typhimurium</i> (wild type)	25000	25000			
		<i>K. pneumonia</i> PTCC 1290	25000	25000			
		<i>B. subtilis</i> PTCC 1715	25000	25000			
1-Butyl-3-methylimidazolium nitrate	[C ₄ Mim][NO ₃]	<i>P. aeruginosa</i> PTCC 1310	12500	50000	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	12500	12500			
		<i>E. coli</i> PTCC 1338	12500	12500			
		<i>B. cereus</i> PTCC 1015	50000	50000			
		<i>S. typhimurium</i> (wild type)	12500	12500			
		<i>K. pneumonia</i> PTCC 1290	25000	25000			
		<i>B. subtilis</i> PTCC 1715	50000	50000			
1-Butyl-3-methylimidazolium dicyanamide	[C ₄ Mim][N(CN) ₂]	<i>P. aeruginosa</i> PTCC 1310	25000	25000	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	25000	25000			
		<i>E. coli</i> PTCC 1338	25000	25000			
		<i>B. cereus</i> PTCC 1015	25000	25000			
		<i>S. typhimurium</i> (wild type)	25000	25000			
		<i>K. pneumonia</i> PTCC 1290	25000	25000			

		<i>B. subtilis</i> PTCC 1715	25000	25000			
1-Butyl-3-methylimidazolium thiocyanate	[C ₄ Mim][SCN]	<i>P. aeruginosa</i> PTCC 1310	6250	6250	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[3]
		<i>S. aureus</i> PTCC 1112	3120	3120			
		<i>E. coli</i> PTCC 1338	6250	6250			
		<i>B. cereus</i> PTCC 1015	25000	25000			
		<i>S. typhimurium</i> (wild type)	6250	12500			
		<i>K. pneumonia</i> PTCC 1290	6250	6250			
		<i>B. subtilis</i> PTCC 1715	25000	25000			
1-Hexyl-3-methylimidazolium chloride	[C ₆ Mim][Cl]	<i>S. aureus</i>	1560	1560	Agar disk diffusion / agar well diffusion, broth microdilution	Anti-adhesive activity ^a	[4, 5]
		<i>S. aureus</i> ATCC 29213	>1644 μ M	>1644 μ M			
		<i>E-MRSA 15</i>	>1644 μ M	>1644 μ M			
		<i>MRSA</i> (clinical strain 201)	>1644 μ M	>1644 μ M			
		<i>S. aureus</i> ATCC 6538	833				
		<i>K. pneumoniae</i>	3120	3120			
		<i>S. typhimurium</i>	6250	6250			
		<i>S. typhimurium</i> ATCC 14028	5000				
		<i>P. aeruginosa</i>	6250	12500			
		<i>P. aeruginosa</i> PA01	>1644 μ M	>1644 μ M			
		<i>E. coli</i>	3120	3120			
		<i>E. coli</i> ATCC 27325	>1644 μ M	>1644 μ M			
		<i>E. coli</i> ATCC 25922	1250				
		<i>B. tequilensis</i>	6250	6250			
		<i>B. subtilis</i>	6250	12500			
		<i>S. epidermidis</i> ATCC 12228	>1644 μ M	>1644 μ M			
		<i>S. epidermidis</i> ATCC 35984	>1644 μ M	>1644 μ M			
		<i>K. aerogenes</i> NCTC 7427	>1644 μ M	>1644 μ M			
		<i>B. cenocepacia</i> J2315	>1644 μ M	>1644 μ M			
		<i>P. mirabilis</i> NCTC 12442	>1644 μ M	>1644 μ M			

		<i>C. tropicalis</i> NCTC 7393	>1644 μ M	>1644 μ M			
		<i>L. monocytogenes</i> ATCC13932	3750				
		<i>B. cereus</i> ATCC 11778	5000				
		<i>E. faecalis</i> ATCC 19433	4167				
		<i>L. sakei</i> ATCC 15521	208				
		<i>L. lactis</i> ATCC 19435	625				
		<i>C. freundii</i> ATCC 27853	3333				
1-Hexyl-3-methylimidazolium iodide	[C ₆ Mim][I]	<i>S. aureus</i>	780	780	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	6250	6250			
		<i>S. typhimurium</i>	6250	12500			
		<i>P. aeruginosa</i>	1560	1560			
		<i>E. coli</i>	1560	6250			
		<i>B. tequilensis</i>	12500	12500			
		<i>B. subtilis</i>	3120	3120			
1-Hexyl-3-methylimidazolium hexafluorophosphate	[C ₆ Mim][PF ₆]	<i>S. aureus</i>	3120	3120	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	25000	25000			
		<i>S. typhimurium</i>	25000	25000			
		<i>P. aeruginosa</i>	25000	25000			
		<i>E. coli</i>	12500	12500			
		<i>B. tequilensis</i>	25000	25000			
		<i>B. subtilis</i>	50000	50000			
1-Hexyl-3-methylimidazolium tetrafluoroborate	[C ₆ Mim][BF ₄]	<i>S. aureus</i>	1560	1560	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	3120	6250			
		<i>S. typhimurium</i>	6250	6250			
		<i>P. aeruginosa</i>	6250	6250			
		<i>E. coli</i>	6250	6250			
		<i>B. tequilensis</i>	6250	6250			
		<i>B. subtilis</i>	6250	6250			
1-Hexyl-3-methylimidazolium bis(trifluoromethylsulfonyl)trifluoroborate	[C ₆ Mim][NTf ₂]	<i>S. aureus</i>	780	780	Agar disk diffusion / Agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	12500	12500			
		<i>S. typhimurium</i>	12500	12500			

lfonyl)imide		<i>P. aeruginosa</i>	25000	25000			
		<i>E. coli</i>	6250	6250			
		<i>B. tequilensis</i>	6250	6250			
		<i>B. subtilis</i>	3120	3120			
1-Hexyl-3-methylimidazolium tosylate	[C ₆ Mim][PT S]	<i>S. aureus</i>	6250	6250	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	6250	6250			
		<i>S. typhimurium</i>	25000	25000			
		<i>P. aeruginosa</i>	12500	12500			
		<i>E. coli</i>	3120	12500			
		<i>B. tequilensis</i>	6250	12500			
		<i>B. subtilis</i>	12500	12500			
1-Hexyl-3-methylimidazolium nitrate	[C ₆ Mim][NO ₃]	<i>S. aureus</i>	780	780	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	3120	3120			
		<i>S. typhimurium</i>	3120	3120			
		<i>P. aeruginosa</i>	6250	6250			
		<i>E. coli</i>	780	780			
		<i>B. tequilensis</i>	1560	1560			
		<i>B. subtilis</i>	3120	3120			
1-Octyl-3-methylimidazolium chloride	[C ₈ Mim][Cl]	<i>S. aureus</i> ATCC 29213	722 µM (MBEC 2708 µM)	>1444 µM	Broth microdilution, MBEC assay		[5]
		<i>E-MRSA 15</i>	722 µM (MBEC 2708 µM)	>1444 µM			
		<i>MRSA</i> (clinical strain 201)	1444 µM (MBEC 21666 µM)	>1444 µM			
		<i>S. epidermidis</i> ATCC 12228	361 µM	1444 µM			
		<i>S. epidermidis</i> ATCC 35984	722 µM (MBEC 10833 µM)	1444 µM			
		<i>E. coli</i> NCTC 8196	722 µM (MBEC 21666 µM)	1444 µM			
		<i>P. aeruginosa</i> PA01	>1444 µM (MBEC 21666 µM)	>1444 µM			
		<i>K. aerogenes</i> NCTC 7427	1444 µM (MBEC 43331 µM)	>1444 µM			
		<i>B. cenocepacia</i> J2315	>1444 µM	>1444 µM			

			(MBEC 43331 μM)				
		<i>P. mirabilis</i> NCTC 12442	1444 μM (MBEC 43331 μM)	>1444 μM			
		<i>C. tropicalis</i> NCTC 7393	1444 μM (MBEC >43331 μM)	>1444 μM			
1-Hexyl-2,3-dimethylimidazolium tetrafluoroborate	[C ₆ MMim][BF ₄]	<i>S. aureus</i>	3120	3120	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	6250	6250			
		<i>S. typhimurium</i>	12500	12500			
		<i>P. aeruginosa</i>	3120	6250			
		<i>E. coli</i>	1560	3120			
		<i>B. tequilensis</i>	12500	12500			
		<i>B. subtilis</i>	6250	6250			
<i>N</i> -Butylpyridinium nitrate	[C ₄ Py][NO ₃]	<i>S. aureus</i>	6250	6250	Agar disk diffusion / agar well diffusion	Anti-adhesive activity ^a	[4]
		<i>K. pneumoniae</i>	50000	50000			
		<i>S. typhimurium</i>	50000	50000			
		<i>P. aeruginosa</i>	6250	12500			
		<i>E. coli</i>	25000	25000			
		<i>B. tequilensis</i>	50000	50000			
		<i>B. subtilis</i>	12500	25000			
<i>N</i> -Hexylpyridinium nitrate	[C ₆ Py][NO ₃]	<i>S. aureus</i>	1560	1560	Agar disk diffusion / agar well diffusion	Best anti-adhesive activity among the ILs tested in the current work.	[4]
		<i>K. pneumoniae</i>	6250	6250			
		<i>S. typhimurium</i>	6250	6250			
		<i>P. aeruginosa</i>	3120	3120			
		<i>E. coli</i>	1560	1560			
		<i>B. tequilensis</i>	3120	6250			
		<i>B. subtilis</i>	3120	3120			
<i>N</i> -Octylpyridinium bromide	[C ₈ Py][Br]	<i>M. luteus</i> ATCC 9341	R		Broth microdilution	R, resistant at the highest concentration tested (256 $\mu\text{g mL}^{-1}$).	[6]
		<i>S. epidermidis</i> ATCC155-1	940 μM				
		<i>S. aureus</i> ATCC 25178	R				
		<i>E. coli</i> ATCC 27325	R				
		<i>K. pneumonia</i> ATCC 9721	R				
		<i>P. aeruginosa</i> ATCC 9721	R				

		<i>C. albicans</i> ATCC10231	R				
		<i>B. subtilis</i> ATCC6633	R				
<i>N</i> -Decylpyridinium bromide	[C ₁₀ Py][Br]	<i>M. luteus</i> ATCC 9341	R		Broth microdilution	R, resistant at the highest concentration tested (256 µg mL ⁻¹).	[6]
		<i>S. epidermidis</i> ATCC155-1	428 µM				
		<i>S. aureus</i> ATCC 25178	428 µM				
		<i>E. coli</i> ATCC 27325	428 µM				
		<i>K. pneumonia</i> ATCC 9721	R				
		<i>P. aeruginosa</i> ATCC 9721	R				
		<i>C. albicans</i> ATCC10231	R				
		<i>B. subtilis</i> ATCC6633	428 µM				
<i>N</i> -Butyl- <i>N</i> -methylpyrrolidinium chloride	[C ₄ C ₁ Pyr][Cl]	<i>L. monocytogenes</i> ATCC13932	5000		Broth microdilution		[1]
		<i>B. cereus</i> ATCC 11778	5000				
		<i>S. aureus</i> ATCC 6538	5000				
		<i>E. faecalis</i> ATCC 19433	5000				
		<i>L. sakei</i> ATCC 15521	3333				
		<i>L. lactis</i> ATCC 19435	4167				
		<i>S. typhimurium</i> ATCC 14028	>5000				
		<i>E. coli</i> ATCC 25922	5000				
		<i>C. freundii</i> ATCC 27853	>5000				
<i>N</i> -Butyl- <i>N</i> -methylpyrrolidinium bromide	[C ₄ C ₁ Pyr][Br]	<i>S. aureus</i>	64505 µM		Broth microdilution		[7]
		<i>E. coli</i>	83333 µM				
<i>N</i> -Hexyl- <i>N</i> -methylpyrrolidinium bromide	[C ₆ C ₁ Pyr][Br]	<i>S. aureus</i>	14920 µM		Broth microdilution		[7]
		<i>E. coli</i>	2988 µM				
<i>N</i> -Octyl- <i>N</i> -methylpyrrolidinium bromide	[C ₈ C ₁ Pyr][Br]	<i>S. aureus</i>	1808 µM		Broth microdilution		[7]
		<i>E. coli</i>	1899 µM				
<i>N</i> -Decyl- <i>N</i> -methylpyrrolidinium bromide	[C ₁₀ C ₁ Pyr][Br]	<i>S. aureus</i>	559 µM		Broth microdilution		[7]
		<i>E. coli</i>	622 µM				
Triethylmethylammonium chloride	[C _{2,2,2,1} N][Cl]	<i>L. monocytogenes</i> ATCC13932	>5000		Broth microdilution		[1]

		<i>B. cereus</i> ATCC 11778	>5000				
		<i>S. aureus</i> ATCC 6538	>5000				
		<i>E. faecalis</i> ATCC 19433	>5000				
		<i>L. sakei</i> ATCC 15521	>5000				
		<i>L. lactis</i> ATCC 19435	>5000				
		<i>S. typhimurium</i> ATCC 14028	>5000				
		<i>E. coli</i> ATCC 25922	>5000				
		<i>C. freundii</i> ATCC 27853	>5000				
Tetraethylammonium bromide	[C _{2,2,2,2} N][Br]	<i>E. coli</i> ATCC 25922	>5000 µM		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9	>5000 µM				
		<i>E. coli</i> CTX M2	2500 µM				
		<i>E. coli</i> AmpC MOX2	>5000 µM				
		<i>K. pneumoniae</i> (clinical isolate)	>5000 µM				
		<i>S. aureus</i> ATCC 25293	2500 µM				
		<i>S. epidermidis</i> (clinical isolate)	>5000 µM				
		<i>E. faecalis</i> (clinical isolate)	>5000 µM				
Di(2-hydroxyethyl)butyl methylammonium bromide	[(HOC ₂) ₂ C _{4,1} N][Br]	<i>B. subtilis</i> ATCC 6633	>500		Broth microdilution		[8]
		<i>M. smegmatis</i> ATCC 607	N.A.				
		<i>K. pneumonia</i> ATCC 9997	N.A.				
		<i>E. faecalis</i> ATCC 29212	>500				
		VRE ATCC 51299	>500				
		<i>S. aureus</i>	N.A.				
		MRSA CIP 106760	N.A.				
		<i>E. coli</i> ATCC 25922	N.A.				
		<i>P. aeruginosa</i> ATCC 27853	N.A.				
		<i>C. albicans</i> ATCC 10231	N.T.				
		<i>S. cerevisiae</i> ATCC 2601	N.T.				
Cholinium chloride	[Chol][Cl]	<i>E. coli</i> ATCC 25922	>5000 µM		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9	>5000 µM				
		<i>E. coli</i> CTX M2	>5000 µM				
		<i>E. coli</i> AmpC MOX2	>5000 µM				
		<i>K. pneumoniae</i> (clinical isolate)	>5000 µM				
		<i>S. aureus</i> ATCC 25293	2500 µM				

		<i>S. epidermidis</i> (clinical isolate)	>5000 µM				
		<i>E. faecalis</i> (clinical isolate)	>5000 µM				
Gentamycin		<i>S. typhimurium</i> ATCC 14028	0.25		Broth microdilution		[9]
		<i>E. coli</i> ATCC 25922	0.25				
		<i>C. freundii</i> ATCC 27853	1				
		<i>B. subtilis</i> KCTC1914	1				
		<i>S. typhimurium</i> KCTC1926	0.5				
Kanamycin		<i>S. aureus</i> 209 KCTC1916			Broth microdilution		[9]
		<i>S. aureus</i> R209 KCTC1928					
		<i>E. coli</i> KCTC1924					
		<i>B. subtilis</i> KCTC1914					
		<i>S. typhimurium</i> KCTC1926					
Fuconazole		<i>C. tropicalis</i> 17A	0.125 (MBEC 4)		Broth microdilution	The clinical isolates 72A, 72P, and 94P are resistant to fluconazole, amphotericin B, voriconazole and anidulafungin.	[10]
		<i>C. tropicalis</i> 57A	0.125 (MBEC 64)				
		<i>C. tropicalis</i> 72A	128 (MBEC 8)				
		<i>C. tropicalis</i> 72P	128 (MBEC 128)				
		<i>C. tropicalis</i> 94P	64 (MBEC 32)				
		<i>C. tropicalis</i> 102A	0.125 (MBEC 128)				
Colistin		<i>E. coli</i> ATCC 25922	2		Broth microdilution		[11]
		<i>P. aeruginosa</i> ATCC 27853	1				
		<i>K. pneumonia</i> ATCC BAA-1705	2				
		<i>A. baumannii</i> AB01	4				
Vancomycin		<i>B. subtilis</i> ATCC 6633	<0.48		Broth microdilution		[8]
		<i>K. pneumonia</i> ATCC 9997	15.62				
		<i>E. faecalis</i> ATCC 29212	1.95				
		VRE ATCC 51299	3.91				
		<i>S. aureus</i>	7.82				
		MRSA CIP 106760	3.91				
Rifampicin		<i>M. smegmatis</i> ATCC 607	<0.48		Broth microdilution		[8]

		<i>E. coli</i> ATCC 25922	0.98				
Norfloxacin		<i>P. aeruginosa</i> ATCC 27853	<0.48		Broth microdilution		[8]
Amphotericin B		<i>C. albicans</i> ATCC 10231	<0.48		Broth microdilution		[8]
		<i>S. cerevisiae</i> ATCC 2601	<0.48				

^a IZ, inhibition zone; MIC, minimum inhibitory concentration; MBC, minimum bactericidal concentration; MBEC, minimum biofilm eradication concentration; MRSA, methicillin-resistant *S. aureus*; N.A., not active; N.D., not determined; N.T., not tested; VRE, vancomycin-resistant *E. faecalis*.

^a Anti-adhesive activity varies depending on the species.

Table S2. Antimicrobial activity of API-ILs*

IL	Acronym	Species	IZ, mm	MIC $\mu\text{g mL}^{-1}$	MBC, $\mu\text{g mL}^{-1}$	Method	Notes	Ref.
1-Ethyl-3-methylimidazolium ampicillinate	[C ₂ Mim][Amp]	<i>E. coli</i> ATCC 25922		>5000 μM		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9		>5000 μM				
		<i>E. coli</i> CTX M2		>5000 μM				
		<i>E. coli</i> AmpC MOX2		>5000 μM				
		<i>K. pneumoniae</i> (clinical isolate)		>5000 μM				
		<i>S. aureus</i> ATCC 25293		>5000 μM				
		<i>S. epidermidis</i> (clinical isolate)		>5000 μM				
		<i>E. faecalis</i> (clinical isolate)		>5000 μM				
1-(2-Hydroxyethyl)-3-methylimidazolium ampicillinate	[HOC ₂ Mim][Amp]	<i>E. coli</i> ATCC 25922		5000 μM		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9		>5000 μM				
		<i>E. coli</i> CTX M2		>5000 μM				
		<i>E. coli</i> AmpC MOX2		5000 μM				
		<i>K. pneumoniae</i> (clinical isolate)		>5000 μM				
		<i>S. aureus</i> ATCC 25293		>5000 μM				
		<i>S. epidermidis</i> (clinical isolate)		2500 μM				

		<i>E. faecalis</i> (clinical isolate)		5000 μ M				
Tetraethylammonium ampicillinate	[C _{2,2,2,2} N][Amp]	<i>E. coli</i> ATCC 25922		>5000 μ M		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9		>5000 μ M				
		<i>E. coli</i> CTX M2		>5000 μ M				
		<i>E. coli</i> AmpC MOX2		>5000 μ M				
		<i>K. pneumoniae</i> (clinical isolate)		>5000 μ M				
		<i>S. aureus</i> ATCC 25293		>5000 μ M				
		<i>S. epidermidis</i> (clinical isolate)		>5000 μ M				
		<i>E. faecalis</i> (clinical isolate)		>5000 μ M				
Cholinium ampicillinate	[Chol][Amp]	<i>E. coli</i> ATCC 25922		>5000 μ M		Broth microdilution	<i>E. coli</i> TEM CTX M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	[2]
		<i>E. coli</i> TEM CTX M9		>5000 μ M				
		<i>E. coli</i> CTX M2		>5000 μ M				
		<i>E. coli</i> AmpC MOX2		>5000 μ M				
		<i>K. pneumoniae</i> (clinical isolate)		>5000 μ M				
		<i>S. aureus</i> ATCC 25293		>5000 μ M				
		<i>S. epidermidis</i> (clinical isolate)		>5000 μ M				
		<i>E. faecalis</i> (clinical isolate)		>5000 μ M				
Nalidixic acid		<i>E. coli</i> BW25113 (wild-type)	11			Disk diffusion test, 10 μ g per disk	Deletions Δ rfaC, Δ rfaL, and Δ rfaG affect the cell surface hydrophobicity and membrane permeability.	[12]
		<i>E. coli</i> JW3596 (Δ rfaC)	20					
		<i>E. coli</i> JW3597 (Δ rfaL)	11					
		<i>E. coli</i> JW3606 (Δ rfaG)	18					
Ampicillin sodium		<i>S. aureus</i> ATCC 6538		27 μ M		Broth microdilution	<i>E. coli</i> TEM CTX	[2,

salt		<i>S. aureus</i> ATCC 25293		5 µM			M9, CTX M2, and AmpC MOX2 are ampicillin-resistant strains.	13]
		<i>S. epidermidis</i> (clinical isolate)		50 µM				
		<i>E. coli</i> O157:H7 ATCC 43895		12 µM				
		<i>E. coli</i> ATCC 25922		50 µM				
		<i>E. coli</i> TEM CTX M9		>5000 µM				
		<i>E. coli</i> CTX M2		>5000 µM				
		<i>E. coli</i> AmpC MOX2		>5000 µM				
		<i>E. faecium</i> ATCC 49474		17 µM				
		<i>E. faecalis</i> (clinical isolate)		50 µM				
		<i>K. pneumonia</i> ATCC 4352		20 µM				
		<i>K. pneumoniae</i> (clinical isolate)		2500 µM				
Benzalkonium chloride		<i>S. aureus</i> ATCC 6538		2 ppm	62.5 ppm	Tube dilution, broth microdilution		[9, 14]
		MRSA ATCC 43300		2 ppm	31.2 ppm			
		<i>S. aureus</i> 209 KCTC1916		8				
		<i>S. aureus</i> R209 KCTC1928		8				
		<i>E. faecium</i> ATCC 49474		4 ppm	31.2 ppm			
		<i>E. coli</i> ATCC25922		8 ppm	62.5 ppm			
		<i>M. luteus</i> ATCC 9341		4 ppm	31.2 ppm			
		<i>S. epidermidis</i> ATCC 12228		2 ppm	16 ppm			

		<i>K. pneumonia</i> ATCC 4352		4 ppm	31.2 ppm			
		<i>B. subtilis</i> KCTC1914		8				
		<i>C. albicans</i> ATCC 10231		8 ppm	16 ppm			
		<i>R. rubra</i> PhB		8 ppm	31.2 ppm			
		<i>S. mutans</i> PCM		2 ppm	16 ppm			
Didecyldimethylammonium chloride		<i>S. aureus</i> ATCC 6538		2 ppm	31.2 ppm	Tube dilution		[14]
		MRSA ATCC 43300		2 ppm	31.2 ppm			
		<i>E. faecium</i> ATCC 49474		4 ppm	31.2 ppm			
		<i>E. coli</i> ATCC25922		8 ppm	31.2 ppm			
		<i>M. luteus</i> ATCC 9341		2 ppm	31.2 ppm			
		<i>S. epidermidis</i> ATCC 12228		2 ppm	31.2 ppm			
		<i>K. pneumonia</i> ATCC 4352		4 ppm	16 ppm			
		<i>C. albicans</i> ATCC 10231		8 ppm	16 ppm			
		<i>R. rubra</i> PhB		4 ppm	31.2 ppm			
		<i>S. mutans</i> PCM		2 ppm	16 ppm			

* IZ, inhibition zone; MIC, minimum inhibitory concentration; MBC, minimum bactericidal concentration; MRSA, methicillin-resistant *S. aureus*.

Table S3. Antimicrobial activity of dicationic ILs*

IL	Acronym	Species	IZ, mm	MIC, $\mu\text{g mL}^{-1}$	MBC, $\mu\text{g mL}^{-1}$	Method	Ref.
1,1'-(Propane-1,3-diyl)bis(3-methyl-1H-imidazol-3-ium) dibromide	([C ₁ Im]-C ₃ -[C ₁ Im])[Br] ₂	<i>S. epidermidis</i> ATCC 35984		>10000		Broth microdilution	[15]
		<i>S. aureus</i> ATCC 6538		>10000			
		<i>E. coli</i> ATCC 25922		10000			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC		>10000			

		29212					
1,1'-Butane-1,4-diyl)bis(3-butyl-1H-imidazol-3-ium) dibromide	([C ₄ Im]-C ₄ -[C ₄ Im])[Br] ₂	<i>S. epidermidis</i> ATCC 35984		5000		Broth microdilution	[15]
		<i>S. aureus</i> ATCC 6538		>10000			
		<i>E. coli</i> ATCC 25922		>10000			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC 29212		10000			
1,1'-(Hexane-1,6-diyl)bis(3-methyl-1H-imidazol-3-ium) dibromide	([C ₁ Im]-C ₆ -[C ₁ Im])[Br] ₂	<i>S. epidermidis</i> ATCC 35984		10000		Broth microdilution	[15]
		<i>S. aureus</i> ATCC 6538		10000			
		<i>E. coli</i> ATCC 25922		>10000			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC 29212		>10000			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium) dibromide	([C ₁ Im]-C ₈ -[C ₁ Im])[Br] ₂	<i>S. sanguinis</i> 10556		79000 µM		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		79000 µM			
		<i>S. mutans</i> UA159		39000 µM			
		<i>S. gordonii</i> DL1.1		39000 µM			
		<i>S. uberis</i> 13419		20000 µM			
		<i>E. faecalis</i> V583		79000 µM			
		<i>P. aeruginosa</i> PA14		79000 µM			
		<i>S. epidermidis</i>		79000 µM			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium) diascorbate	([C ₁ Im]-C ₈ -[C ₁ Im])[Asc] ₂	<i>S. sanguinis</i> 10556		79000 µM		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		39000 µM			
		<i>S. mutans</i> UA159		39000 µM			
		<i>S. gordonii</i> DL1.1		39000 µM			
		<i>S. uberis</i> 13419		39000 µM			

		<i>E. faecalis</i> V583		156000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		10000 μ M			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium) diphenylalaninate	([C ₁ Mim]-C ₈ -[C ₁ Mim])[Phe] ₂	<i>S. sanguinis</i> 10556		20000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		20000 μ M			
		<i>S. mutans</i> UA159		10000 μ M			
		<i>S. gordonii</i> DL1.1		79000 μ M			
		<i>S. uberis</i> 13419		20000 μ M			
		<i>E. faecalis</i> V583		79000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		10000 μ M			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium) dileucinate	([C ₁ Im]-C ₈ -[C ₁ Im])[Leu] ₂	<i>S. sanguinis</i> 10556		39000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		20000 μ M			
		<i>S. mutans</i> UA159		10000 μ M			
		<i>S. gordonii</i> DL1.1		10000 μ M			
		<i>S. uberis</i> 13419		10000 μ M			
		<i>E. faecalis</i> V583		79000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		20000 μ M			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium) dihistidinate	([C ₁ Mim]-C ₈ -[C ₁ Mim])[His] ₂	<i>S. sanguinis</i> 10556		20000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		20000 μ M			
		<i>S. mutans</i> UA159		20000 μ M			
		<i>S. gordonii</i> DL1.1		10000 μ M			
		<i>S. uberis</i> 13419		20000 μ M			
		<i>E. faecalis</i> V583		79000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		10000 μ M			
1,1'-(Octane-1,8-diyl)bis(3-methyl-1H-imidazol-3-ium)	([C ₁ Im]-C ₈ -[C ₁ Im])[Met] ₂	<i>S. sanguinis</i> 10556		20000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		20000 μ M			
		<i>S. mutans</i> UA159		10000 μ M			
		<i>S. gordonii</i> DL1.1		20000 μ M			

dimethioninate		<i>S. uberis</i> 13419		20000 μ M			
		<i>E. faecalis</i> V583		79000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		10000 μ M			
1,1'-(Decane-1,10-diyl)bis(3-methyl-1H-imidazol-3-ium) dibromide	([C ₁ Mim]-C ₁₀ -[C ₁ Mim])[Br] ₂	<i>S. sanguinis</i> 10556		10000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		5000 μ M			
		<i>S. mutans</i> UA159		2000 μ M			
		<i>S. gordonii</i> DL1.1		5000 μ M			
		<i>S. uberis</i> 13419		2000 μ M			
		<i>E. faecalis</i> V583		39000 μ M			
		<i>P. aeruginosa</i> PA14		39000 μ M			
		<i>S. epidermidis</i>		2000 μ M			
1,1'-(Decane-1,10-diyl)bis(3-methyl-1H-imidazol-3-ium) diascorbate	([C ₁ Im]-C ₁₀ -[C ₁ Im])[Asc] ₂	<i>S. sanguinis</i> 10556		20000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		20000 μ M			
		<i>S. mutans</i> UA159		10000 μ M			
		<i>S. gordonii</i> DL1.1		20000 μ M			
		<i>S. uberis</i> 13419		10000 μ M			
		<i>E. faecalis</i> V583		79000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		20000 μ M			
1,1'-(Decane-1,10-diyl)bis(3-methyl-1H-imidazol-3-ium) diphenylalaninate	([C ₁ Im]-C ₁₀ -[C ₁ Im])[Phe] ₂	<i>S. sanguinis</i> 10556		10000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		5000 μ M			
		<i>S. mutans</i> UA159		5000 μ M			
		<i>S. gordonii</i> DL1.1		5000 μ M			
		<i>S. uberis</i> 13419		2000 μ M			
		<i>E. faecalis</i> V583		5000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		5000 μ M			
1,1'-(Decane-1,10-diyl)bis(3-methyl-1H-	([C ₁ Im]-C ₁₀ -[C ₁ Im])[Leu] ₂	<i>S. sanguinis</i> 10556		10000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		5000 μ M			
		<i>S. mutans</i> UA159		5000 μ M			

imidazol-3-ium) dileucinate		<i>S. gordonii</i> DL1.1		5000 μ M			
		<i>S. uberis</i> 13419		5000 μ M			
		<i>E. faecalis</i> V583		10000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		2000 μ M			
1,1'-(Decane- 1,10-diyl)bis(3- methyl-1H- imidazol-3-ium) dihistidinate	([C ₁ Im]-C ₁₀ - [C ₁ Im])[His] ₂	<i>S. sanguinis</i> 10556		10000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		5000 μ M			
		<i>S. mutans</i> UA159		5000 μ M			
		<i>S. gordonii</i> DL1.1		5000 μ M			
		<i>S. uberis</i> 13419		2000 μ M			
		<i>E. faecalis</i> V583		20000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		5000 μ M			
1,1'-(Decane- 1,10-diyl)bis(3- methyl-1H- imidazol-3-ium) dimethioninate	([C ₁ Im]-C ₁₀ - [C ₁ Im])[Met] ₂	<i>S. sanguinis</i> 10556		10000 μ M		Broth microdilution	[16]
		<i>S. salivarius</i> 13419		5000 μ M			
		<i>S. mutans</i> UA159		5000 μ M			
		<i>S. gordonii</i> DL1.1		5000 μ M			
		<i>S. uberis</i> 13419		5000 μ M			
		<i>E. faecalis</i> V583		20000 μ M			
		<i>P. aeruginosa</i> PA14		20000 μ M			
		<i>S. epidermidis</i>		2000 μ M			
1,1'-(Hexane-1,6- diyl)bis(3-butyl- 1H-imidazol-3-ium) dibromide	([C ₄ Im]-C ₆ - [C ₄ Im])[Br] ₂	<i>S. epidermidis</i> ATCC 35984		2500		Broth microdilution	[15]
		<i>S. aureus</i> ATCC 6538		5000			
		<i>E. coli</i> ATCC 25922		2500			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC 29212		10000			
1,1'-(Hexane-1,6-	([C ₁ Pyr]-C ₆ -	<i>S. epidermidis</i>		10000		Broth microdilution	[15]

diyl)bis(1-methylpyrrolidin-1-ium) dibromide	[C ₁ Pyr])[Br] ₂	ATCC 35984					
		<i>S. aureus</i> ATCC 6538		>10000			
		<i>E. coli</i> ATCC 25922		>10000			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC 29212		>10000			
3,3'-(((Oxybis(ethane-2,1-diyl))bis(oxy))bis(ethane-2,1-diyl))bis(1-methyl-1H-imidazol-3-ium) dibromide	([C ₁ Im]-C ₈ O ₃ -[C ₁ Im])[Br] ₂	<i>S. epidermidis</i> ATCC 35984		>10000		Broth microdilution	[15]
		<i>S. aureus</i> ATCC 6538		>10000			
		<i>E. coli</i> ATCC 25922		>10000			
		<i>P. aeruginosa</i> ATCC 27853		>10000			
		<i>E. faecalis</i> ATCC 29212		>10000			
Erythromycin		<i>S. aureus</i>	24	0.23	0.23	Disk diffusion (30 µg per well) ; broth microdilution	[17]
		<i>E. coli</i>	27	0.23	0.23		
		<i>K. pneumoniae</i>	26	0.23	0.23		
		<i>P. aeruginosa</i>	25	0.23	0.23		
		<i>P. vulgaris</i>	32	0.23	0.23		
Nalidixic acid		<i>S. aureus</i>	22	0.23	0.23	Disk diffusion (30 µg per well) ; broth microdilution	[17]
		<i>E. coli</i>	22	0.23	0.23		
		<i>K. pneumoniae</i>	27	0.23	0.23		
		<i>P. aeruginosa</i>	21	0.23	0.23		
		<i>P. vulgaris</i>	24	0.23	0.23		
Amikacin		<i>S. aureus</i>	19	0.23	0.23	Disk diffusion (30 µg per well) ; broth microdilution	[17]
		<i>E. coli</i>	20	0.23	0.23		
		<i>K. pneumoniae</i>	19	0.23	0.23		
		<i>P. aeruginosa</i>	17	0.23	0.23		
		<i>P. vulgaris</i>	17	0.23	0.23		

* IZ, inhibition zone; MIC, minimum inhibitory concentration; MBC, minimum bactericidal concentration; MRSA, methicillin-resistant *S. aureus*.

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