

SUPPLEMENTARY INFORMATION

Synthesis, toxicity, biodegradability and physicochemical properties of 4-benzyl-4-methylmorpholinium-based ionic liquids

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Antimicrobial activity

The antimicrobial activity was determined by the tube dilution method¹. The lowest concentration of compound at which there was no visible growth (turbidity) was taken as representing the MIC (minimum inhibitory concentration). The lowest concentration of compound supporting no colony formation was defined as the MBC for bacteria and MFC for fungi. The following microorganisms were used: *Micrococcus luteus* NCTC 7743, *Staphylococcus aureus* NCTC 4163, *Staphylococcus epidermidis* ATCC 49134, *Enterococcus faecium* ATCC 49474, *Moraxella catarrhalis* ATCC 25238, *Escherichia coli* ATCC 25922, *Serratia marcescens* ATCC 8100, *Proteus vulgaris* NCTC 4635, *Pseudomonas aeruginosa* NCTC 6749, *Bacillus subtilis* ATCC 6633, *Candida albicans* ATCC 10231, and *Rhodothorula rubra* (Demml 1889, Lodder 1934). Standard strains were supplied by the National Collection of Type Cultures (NCTC) London and the American Type Culture Collection (ATCC). *Rhodothorula rubra* was obtained from the Department of Pharmaceutical Bacteriology, University of Medical Sciences, Poznan.

Table S1 summarizes the results of the MIC, MBC and MFC for all the synthesized ionic liquids and a reference - benzalkonium chloride [BA][Cl].

¹ J. Feder-Kubis, M. Kubicki and J. Pernak, *Tetrahedron: Asymmetry*, 2010, 21, 2709.

Table S1: MIC, MBC and MFC values^a for the morpholinium ILs, [BMmorf][Cl]^b and [BA][Cl]^c

Strain	ILs																	[BMmorf]	[BA]		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	[Cl] ^b	[Cl] ^c		
<i>M. luteus</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	250	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	0.5	
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	250	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	4
<i>S. aureus</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	125	> 500	250	> 500	> 500	> 500	> 500	> 500	> 500	> 500	1
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	125	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	8
<i>S. epidermidis</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	125	> 500	250	> 500	> 500	> 500	> 500	> 500	> 500	> 500	0.5
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	2
<i>E. faecium</i>	MIC	> 500	> 500	> 500	500	500	250	250	250	250	250	500	250	> 500	> 500	> 500	> 500	> 500	> 500	> 500	2
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	500	> 500	250	> 500	> 500	> 500	> 500	> 500	> 500	> 500	8
<i>M. catarrhalis</i>	MIC	> 500	> 500	> 500	250	250	250	250	250	62	250	250	> 500	> 500	> 500	> 500	> 500	250	250	0.2	
	MBC	> 500	> 500	> 500	500	500	250	250	250	125	500	250	> 500	> 500	> 500	> 500	> 500	250	250	0.5	
<i>E. coli</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	125	> 500	250	> 500	> 500	> 500	> 500	250	250	1	
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	125	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	1
<i>S. marcescens</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	62	
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	62
<i>P. vulgaris</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	500	> 500	250	> 500	> 500	> 500	> 500	> 500	> 500	> 500	31
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	31
<i>P. aeruginosa</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	62
	MBC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	62
<i>B. subtilis</i>	MIC	> 500	> 500	> 500	500	500	250	250	250	250	125	500	250	> 500	> 500	> 500	> 500	250	250	1	
	MBC	> 500	> 500	> 500	500	500	250	250	250	250	125	500	250	> 500	> 500	> 500	> 500	250	250	1	
<i>C. albicans</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	4	
	MFC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	31
<i>R. rubra</i>	MIC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	250	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	8	
	MFC	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	> 500	31

^a in ppm; ^b 4-benzyl-4methylmorpholinium chloride; ^c benzalkonium chloride²

² J. Cybulski, A. Wiśniewska, A. Kulig-Adamiak, Z. Dąbrowski, T. Praczyk, A. Michalczyk, F. Walkiewicz, K. Materna, J. Pernak, *Tetrahedron Letters*, **2011**, 52, 1325.