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APPENDICES

APPENDIX A

Preparation of *N*-alkyl Chitosan Films

Table A-1 Water contact angle of chitosan film after reductive *N*-alkylation for 2h as a function of aldehyde concentration

Aldehyde	Concentration (M)	Water Contact angle (degree)
-	Chitosan Film	79.8±3.1
Formaldehyde	0.05	87.2±3.3
	0.1	80.8±0.8
	0.2	80.5±1.3
	0.4	71.2±1.8
	0.7	70.6±0.9
Acetaldehyde	0.05	82.8±0.8
	0.1	74.8±1.6
	0.4	71.4±2.4
	0.8	71.6±1.5
Propionaldehyde	0.1	83.6±1.5
	0.4	90.1±0.7
	0.8	90.6±0.5
	1.0	94.1±1.9
Butyraldehyde	0.1	85.4±1.4
	0.4	86.3±2.1
	0.8	90.9±1.7
	1.0	91.9±0.4
	1.6	92.1±0.9
Benzaldehyde	0.1	85.4±1.5
	0.4	98.6±2.0
	0.8	93.4±2.7
	1.0	95.5±0.5
	1.6	97.3±1.0

Table A-2 Water contact angle of chitosan film after reductive *N*-alkylation using the optimized concentration of each aldehyde as a function of reaction time

Aldehyde	Concentration (M)	Reaction time (h)	Water Contact angle (degree)
-	-	Chitosan	79.8±3.1
Formaldehyde	0.4	0.5	75.1±1.3
		1.0	73.6±1.3
		1.5	71.2±0.8
		2.0	71.2±1.8
Acetaldehyde	0.4	0.5	76.0±1.0
		1.0	75.4±1.5
		1.5	72.1±0.7
		2.0	71.4±2.4
Propionaldehyde	1.0	1.0	82.2±1.5
		2.0	94.3±0.8
		4.0	94.0±1.0
		8.0	95.0±1.9
Butyraldehyde	1.0	1.0	82.4±2.1
		2.0	90.9±1.7
		4.0	93.8±0.8
		8.0	94.6±4.9
		24.0	62.4±2.7
Benzaldehyde	1.0	1.0	83.8±1.3
		2.0	93.4±1.8
		4.0	93.0±2.3
		8.0	85.4±1.5
		24.0	81.7±2.0

Preparation of Quaternized *N*-alkyl Chitosan Films

Table A-3 Water contact angle of *N*-methyl chitosan films after quaternization for 12 h as a function of alkyl iodide concentration

Alkyl iodide	Concentration (M)	Water Contact angle (degree)
-	<i>N</i> -methyl Chitosan Films	71.2±0.83
Ethyl iodide (EtI)	0.4	69.8±2.2
	0.8	74.8±0.8
	1.2	80.8±1.0
	1.6	86.6±0.5
	2.0	87.2±0.8
Butyl iodide (BuI)	0.8	83.2±2.0
	1.2	87.0±1.4
	1.6	93.0±1.8
	2.0	98.8±1.7
	2.4	100.0±1.2
Octyl iodide (OcI)	0.8	64.4±1.2
	1.2	66.5±1.1
	1.6	66.7±0.9
	2.0	65.0±1.3
	2.4	66.5±1.1
	3.0	64.8±0.9

Table A-4 Water contact angle of *N*-methyl chitosan films after quaternization using the optimized concentration of each alkyl iodide as a function of reaction time

Alkyl iodide	Concentration (M)	Reaction time (M)	Water Contact angle (degree)
-	-	<i>N</i> -methyl Chitosan Films	71.2±0.83
Ethyl iodide (EtI)	1.6	3	78.8±2.1
		6	86.6±0.5
		9	92.4±1.9
		12	96.6±1.1
		24	98.0±1.2
Butyl iodide (BuI)	2.0	8	90.8±1.4
		12	97.2±2.2
		16	97.6±1.3
		24	100.6±1.3

Table A-5 Water contact angle of *N*-alkyl chitosan films after quaternization for 12 h as a function of methyl iodide concentration

<i>N</i> -alkyl Chitosan Films	Concentration of MeI (M)	Water Contact angle(degree)
<i>N</i> -ethyl Chitosan Film	0.4	84.0±0.5
	0.8	80.0±0.8
	1.2	71.7±0.9
	1.6	72.0±1.3
<i>N</i> -propyl Chitosan Film	0.4	93.8±2.2
	0.8	99.0±1.2
	1.2	83.6±1.6
	1.6	83.8±1.9
<i>N</i> -butyl Chitosan Film	0.4	93.4±2.0
	0.8	97.4±0.9
	1.2	96.2±1.9
	1.6	84.6±1.1
	2.0	83.2±1.5
<i>N</i> -benzyl Chitosan Film	0.8	93.8±0.8
	1.2	95.2±1.0
	1.6	77.4±2.0
	2.0	75.4±1.1
	2.4	76.5±1.1
	3.0	74.0±1.9

Table A-6 Water contact angle of *N*-alkyl chitosan films after quaternization using the optimized concentration of methyl iodide for each substrate as a function of reaction time

<i>N</i> -alkyl Chitosan Films	Concentration of MeI (M)	Reaction time (h)	Water Contact angle (degree)
<i>N</i> -ethyl Chitosan Film	1.2	4	85.8±0.8
		8	78.0±1.9
		12	71.7±0.9
		24	69.5±1.0
<i>N</i> -propyl Chitosan Film	1.2	4	95.0±1.2
		8	87.8±1.9
		12	83.6±1.6
		24	82.0±2.5
<i>N</i> -butyl Chitosan Film	1.6	4	95.4±1.5
		8	91.6±2.0
		12	84.6±1.1
		24	83.1±1.7
<i>N</i> -benzyl Chitosan Film	2.0	4	86.0±1.2
		8	95.4±1.5
		12	77.4±1.9
		16	73.5±2.0
		24	74.0±2.0

APPENDIX B

Testing of Antibacterial Activity

Table B-1 Relationship between OD₆₀₀ and cell concentration (g/L) of *S. aureus* and *E. coli* suspension

<i>S. aureus</i>			<i>E. coli</i>		
Time (h)	OD ₆₀₀	Cell conc. (g/L)	Time (h)	OD ₆₀₀	Cell conc. (g/L)
0	0.055	0.40	0	0.062	0.58
4	0.42	1.58	4	1.10	2.42
8	1.17	3.70	8	2.20	4.82
12	1.92	5.82	12	2.20	4.56
16	1.92	5.84	16	2.20	4.96
20	1.90	5.78	20	2.20	4.64
24	1.92	5.80	24	2.20	4.67

Table B-2 Cell concentration (g/L) of *S. aureus* and *E. coli* in the presence of different quaternized *N*-alkyl chitosan films

Materials	Cell Concentration (g/L) of <i>S. aureus</i>	Cell Concentration (g/L) of <i>E. coli</i>
Control	6.8	3.9±0.5
Chitosan	6.8	4.0±0.1
DME	4.6	3.3±0.1
DMP	3.8	3.2±0.1
DMBu	3.5	2.7±0.1
DMBz	2.9	2.8

Table B-3 Cell concentration (g/L) of *S. aureus* in the presence of DMBz films having different degrees of quaternization (varied as a function of MeI)

Material	Cell Concentration (g/L) of <i>S. aureus</i>
Control	7.4±0.3
Chitosan	7.2
0.4DMBz	7.6
0.8DMP	6.5±0.3
1.2DMBu	6.3
1.6DMBz	4.2±0.2
2.0DMBz	4.3

Table B-4 Optical density (OD₆₀₀) of *S. aureus* and *E. coli* solution in the presence of different quaternized *N*-alkyl chitosan films having similar zeta potential

Materials	Optical Density at 600nm of <i>S. aureus</i>	Optical Density at 600nm of <i>E. coli</i>
Control	1.023±0.09	0.927±0.05
Chitosan	1.081±0.05	0.863±0.04
DME	0.198±0.01	0.242±0.02
DMP	0.768±0.02	0.653±0.02
DMBu	0.326±0.08	0.304±0.06
DMBz	0.697±0.03	0.754±0.02

Table B-5 Optical density (OD₆₀₀) of *S. aureus* and *E. coli* in solution in the presence of DMBz films having different degrees of quaternization (varied as a function of MeI)

Materials	Optical Density at 600nm of <i>S. aureus</i>	Optical Density at 600nm of <i>E. coli</i>
Control	1.023±0.09	0.927±0.05
Chitosan	1.081±0.05	0.863±0.04
0.4DMBz	0.938±0.03	0.836±0.08
0.8DMP	0.636±0.02	0.548±0.03
1.2DMBu	0.382±0.04	0.397±0.02
1.6DMBz	0.138±0.01	0.086±0.01
2.0DMBz	0.195±0.07	0.090±0.01

VITAE

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