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APPENDICES

APPENDIX A

A-1. Calculation of weight of chitosan in the reaction.

Weight of chitosan needed in the reaction can be calculated from

$$M = [M_{\text{NH}_2} + ((100-b)/b) \times M_{\text{NHCOCH}_3}] \times a \dots \dots \dots (1)$$

When

M = weight of chitosan which is used for the reaction

M_{NH_2} = molecular weight of glucosamine unit = 162

M_{NHCOCH_3} = molecular weight of *N*-acetyl glucosamine = 204

a = mole of glucosamine unit

b = %deacetylation of chitosan

For chitosan having %DD of 95 ($b = 95$) and the required number of glucosamine unit of 6 mmol-

Using Eq. (1)

$$\begin{aligned} M &= [M_{\text{NH}_2} + ((100-b)/b) \times M_{\text{NHCOCH}_3}] \times a \\ &= 1.03 \end{aligned}$$

So, the weight of chitosan for the reaction is 1.03 g.

A-2. Calculation for %yield of *N*-alkyl chitosan

For chitosan-

Molecular weight of the repeating unit of chitosan = X

$$X = (162 \times 0.95) + (204 \times 0.05) = 164$$

For *N*-butyl chitosan-

Molecular weight of *N*-butyl chitosan (using 0.5 eq. of aldehyde) = $Y_{0.5}$

$$Y_{0.5} = (162 \times 0.475) + (218 \times 0.475) + (204 \times 0.05) = 191$$

A theoretical amount of *N*-butyl chitosan when starting from chitosan 1 g is

$$\frac{191 \times 1}{164} = 1.16 \text{ g}$$

Thus %yield of *N*-butyl chitosan when NH_2 :ald. is 1:0.5 (Table 3.1) is

$$(0.83/1.16) \times 100 = \underline{72 \%}$$

Molecular weight of *N*-butyl chitosan (using 1 or 2 mole(s) of aldehyde) = Y_1

$$Y_1 = (218 \times 0.95) + (204 \times 0.05) = 217$$

A theoretical amount of *N*-butyl chitosan when starting from chitosan 1 g is

$$\frac{217 \times 1}{164} = 1.32 \text{ g}$$

Thus %yield of *N*-butyl chitosan when NH_2 :ald. is 1:1 (Table 3.1) is

$$(1.04/1.32) \times 100 = \underline{79\%}$$

Thus %yield of *N*-butyl chitosan when NH_2 :ald. is 1:2 (Table 3.1) is

$$(1.28/1.32) \times 100 = \underline{97\%}$$

For *N*-benzyl chitosan-

Molecular weight of *N*-benzyl chitosan (using 0.5 mole of aldehyde) = $Z_{0.5}$

$$Z_{0.5} = (162 \times 0.475) + (252 \times 0.475) + (204 \times 0.05) = 207$$

A theoretical amount of *N*-benzyl chitosan when starting from chitosan 1 g is

$$\frac{207 \times 1}{164} = 1.26 \text{ g}$$

Thus %yield of *N*-benzyl chitosan when NH_2 :ald. is 1:0.5 (Table 3.1) is

$$(0.78/1.26) \times 100 = \underline{62\%}$$

Molecular weight of *N*-benzyl chitosan (using 1 or 2 mole(s) of aldehyde) = Z_1

$$Z_1 = (252 \times 0.95) + (204 \times 0.05) = 250$$

A theoretical amount of *N*-benzyl chitosan when starting from chitosan 1 g is

$$\frac{250 \times 1}{164} = 1.52 \text{ g}$$

Thus %yield of *N*-benzyl chitosan when NH_2 :ald. is 1:1 (Table 3.1) is

$$(0.98/1.52) \times 100 = \underline{64\%}$$

Thus %yield of *N*-benzyl chitosan when NH_2 :ald. is 1:2 (Table 3.1) is

$$(1.22/1.52) \times 100 = \underline{80\%}$$

APPENDIX B

NMR spectrum of quaternized *N*-alkyl chitosan

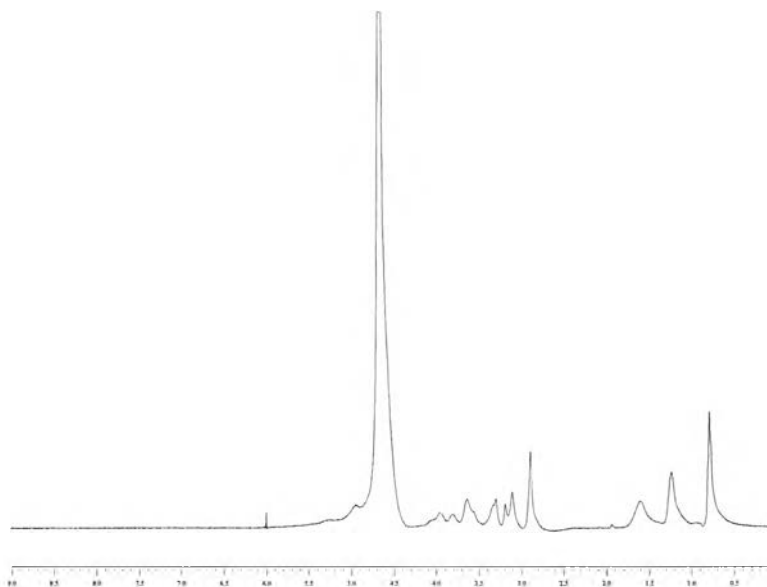


Figure B-1 Q1 *N*-butyl (1) chitosan with methyl iodide 12 folds

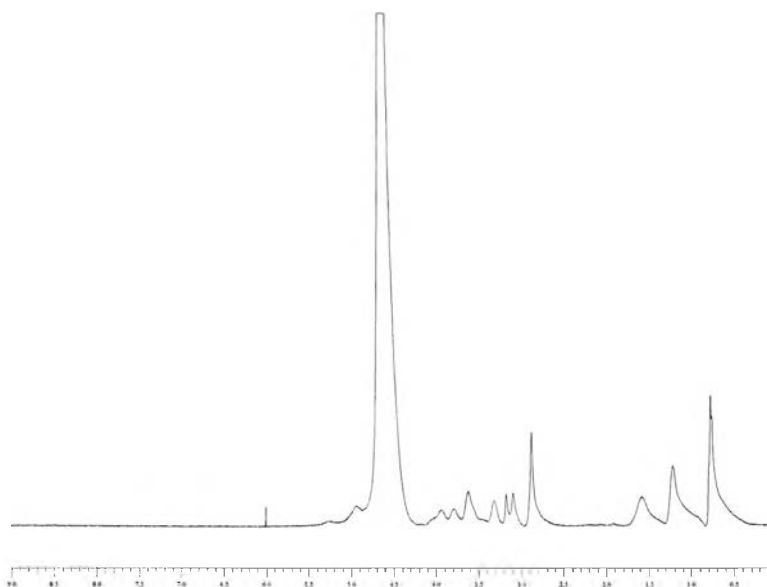


Figure B-2 Q2 *N*-butyl (1) chitosan with methyl iodide 12 folds

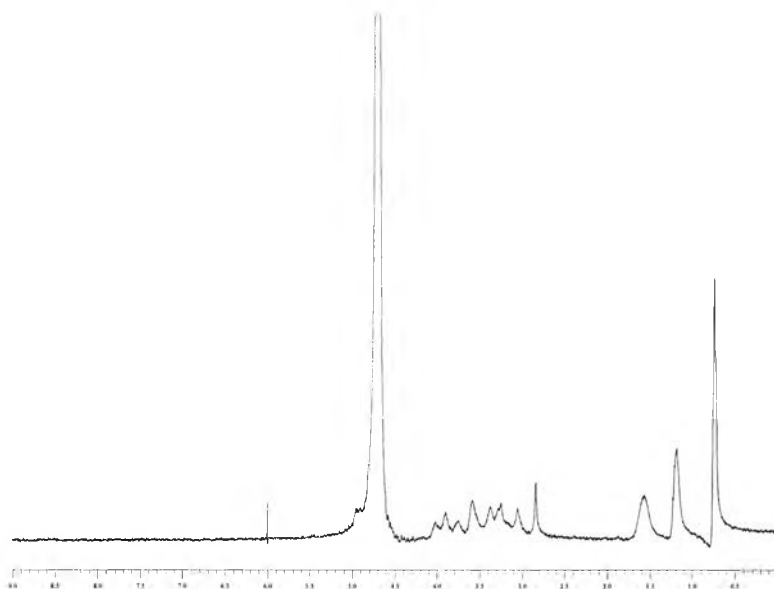


Figure B-3 Q3 *N*-butyl (1) chitosan with methyl iodide 12 folds

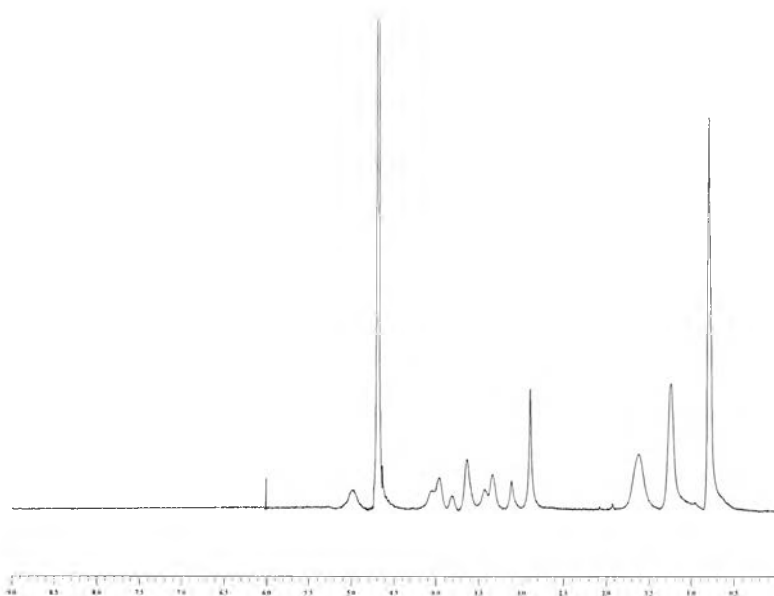


Figure B-4 Q1 *N*-butyl (2) chitosan with methyl iodide 12 folds

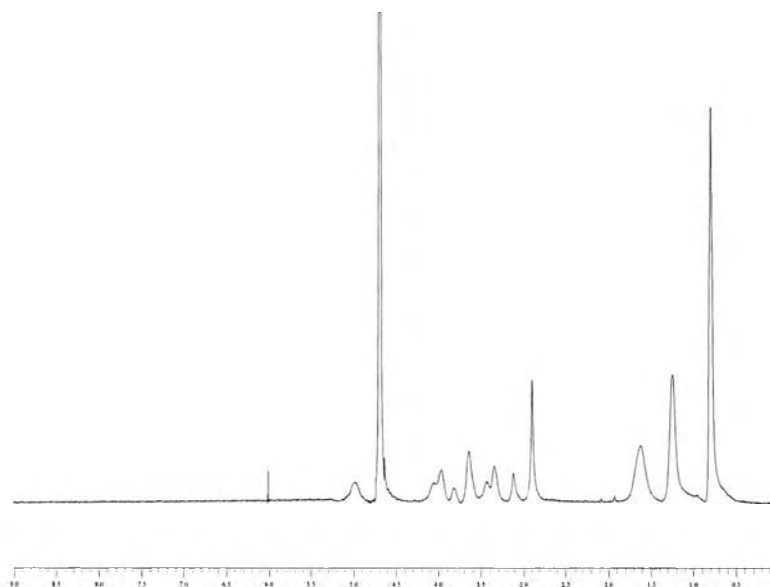


Figure B-5 Q2 *N*-butyl (2) chitosan with methyl iodide 12 folds

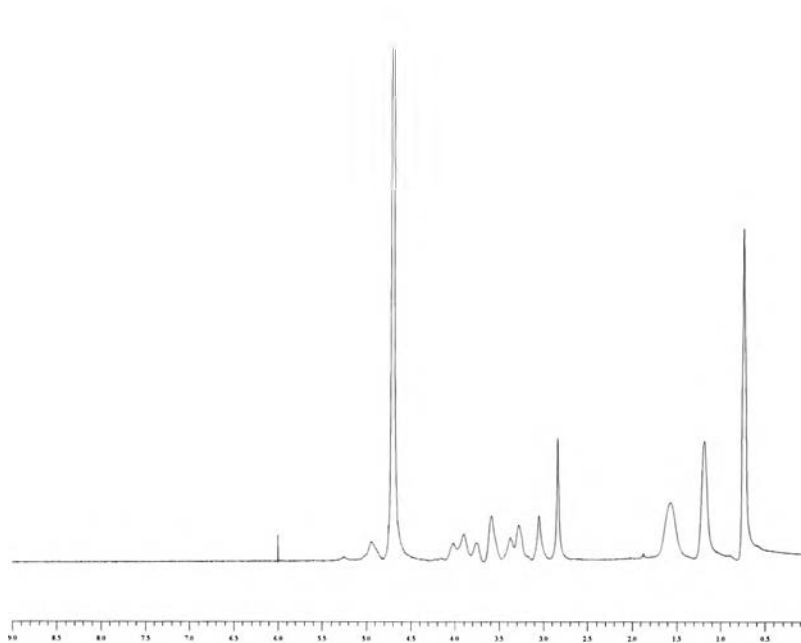


Figure B-6 Q3 *N*-butyl (2) chitosan with methyl iodide 12 folds

APPENDIX C

Weight loss data of banana-coating study

Table C-1 The weight of banana without coating

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	2.68	2.59	2.56	2.55	2.59	0.06
4	5.86	5.60	5.73	5.73	5.73	0.11
6	14.91	14.82	14.79	14.54	14.77	0.16
8	24.58	24.38	24.81	24.39	24.54	0.20
10	34.62	34.32	35.19	34.62	34.69	0.36

Table C-2 The weight of banana with 0.5%acetic acid

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	3.07	3.18	3.17	3.35	3.19	0.12
4	6.68	6.40	6.57	6.66	6.58	0.13
6	14.44	14.49	14.51	14.38	14.45	0.06
8	24.92	25.30	24.97	24.88	25.02	0.19
10	35.17	35.23	35.31	35.20	35.23	0.06

Table C-3 The weight of banana with 20% chitosan in 0.5%acetic acid

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	2.58	2.77	2.77	2.46	2.65	0.15
4	5.47	5.78	5.74	5.82	5.70	0.16
6	11.44	12.00	11.79	12.23	11.86	0.33
8	21.24	21.65	22.07	21.59	21.64	0.34
10	31.28	31.70	32.23	31.43	31.66	0.41

Table C-4 The weight of banana with 20% Q1 *N*-butyl (0.5) chitosan in 0.5%acetic acid

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	2.56	2.89	2.77	2.89	2.78	0.16
4	5.58	6.26	5.93	6.40	6.04	0.37
6	13.46	14.26	13.92	14.20	13.96	0.37
8	22.21	23.29	22.80	23.08	22.84	0.47
10	31.97	32.64	32.41	32.13	32.29	0.30

Table C-5 The weight loss of banana with 20% Q1 *N*-benzyl (0.5) chitosan in 0.5%acetic acid

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	2.90	2.90	2.86	2.89	2.89	0.02
4	5.90	5.77	5.74	5.78	5.80	0.07
6	14.22	13.66	13.92	13.94	13.94	0.23
8	23.31	22.58	22.74	22.78	22.85	0.32
10	33.28	32.63	32.58	32.34	32.71	0.40

Table C-6 The weight loss of banana with Q1 *N*-butyl (0.5) chitosan in DI-water

Day	Sample 1	Sample 2	Sample 3	Sample 4	Aver.	std
2	2.82	2.71	2.73	2.66	2.73	0.07
4	6.09	5.99	5.74	5.92	5.93	0.15
6	13.55	13.57	13.58	13.60	13.58	0.02
8	22.80	23.04	23.09	23.03	22.99	0.13
10	32.60	32.54	32.38	32.51	32.51	0.09



VITAE

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