

**Table S1A.** Assignment of the bands observed in the MIR spectra.

Chitosan	NCC	NOCC	OCC	Assignment of the bands
3440sh,3417sh	3523sh,3482sh	3344m	3439sh	$\nu(\text{OH})_{\text{HB}}$
3386vs,3352vs	3346m,3249sh 3213sh	3288m	3356m, 3285m	$\nu(\text{NH}_2)$
3188sh, 3071sh	3107sh	3175sh	3183sh	$\nu(\text{NH}_2)$
	3055sh	3085sh	3092sh	$\nu(\text{NH})$
2913m	2924sh	2913sh	2909sh	$\nu_{\text{as}}(\text{CH}_3)$
2872m	2875sh	2864m	2867m	$\nu_{\text{s}}(\text{CH}_3)$
1646s	1657w		1649w	$\nu(\text{CO})$
1587s				$\nu(\text{NH}_2)$
	1590w	1593m	1591w	$\nu(\text{COO})$
1565sh, 1543 sh				$\nu(\text{NH}_2)$
1455sh	1458m	1445sh	1455sh	$\delta(\text{CH})+\omega(\text{CH}_2)+\nu(\text{OH})$
1418m	1424m	1424vs	1425vs	$\delta(\text{CH})+\delta(\text{OH})$
		1390sh	1414s	$\nu(\text{COO})$
1375m	1381m		1377sh	$\delta(\text{CH}_2)+\delta(\text{CH})+\delta(\text{OH})+\nu(\phi)$
1319m	1340s	1319w	1319w	$\nu(\text{CN})+\delta(\text{CH})$
	1272m	1262sh	1283 sh	$\nu(\text{CCOO})$
1266m	1255m 1223sh	1266sh	1300sh 1264sh	$\delta(\text{OH}\cdots\text{O})+\nu(\text{C-C})+\nu(\text{C-O})+\delta(\text{CH})+\rho(\text{CH}_3)$
1150s	1159w	1145sh	1150w	$\nu(\text{C-O-C})+\nu(\phi)+\nu(\text{C-OH})+\nu(\text{C-CH}_3)+\rho(\text{CH}_2)+\rho(\text{CH}_3)$
	1130m			$\nu(\text{CH}_2\text{-C})$
1061vs	1077w	1062m	1062m	$\nu(\text{C-O-C})+\nu(\phi)+\nu(\text{C-OH})+\nu(\text{C-CH}_3)+\rho(\text{CH}_2)+\rho(\text{CH}_3)$
1025vs	1026m	1020m	1024s	$\nu(\phi)+\delta(\text{CH})$
993vs	995vs	997m	991m	$\nu(\phi)+\delta(\text{CH})$
944sh	943s		940sh	$\nu(\text{C-N})$
893m	883vw	879m	880m	$\nu(\phi)+\rho(\text{CH}_2)$
	822s			$\nu(\phi)+\rho(\text{CH}_2)$
	773w			$\nu(\phi)+\rho(\text{CH}_2)$
703sh	707w	701w	701vw	$\omega(\text{NH}_2)+\delta(\phi)$
698vw	694sh	695w	694vw	$\delta(\text{COO})$
666sh 660m	676vw	654w	661w	$\gamma(\text{OH}\cdots\text{O}), \delta(\phi)$
557m	575 vw	574w 565w	564w	$\gamma(\text{NH})+\gamma(\text{C-C=O})+\omega(\text{CH}_3)$
518m	524vw	518vw 512vw	523vw	$\delta(\phi)+\omega(\text{CH}_3)$
	461vw			$\gamma(\text{OH})+\gamma(\phi)$

$\phi$  - pyranoid ring;  $\nu$  - stretching;  $\delta$  - in-plane bending;  $\gamma$ ,  $\omega$  - out-of-plane bending, HB – hydrogen bond.

**Table S1B.** Assignment of the bands observed in the Raman spectra.

Chitosan	NCC	NOCC	OCC	Assignment of the bands
3362w				$\nu(\text{OH})_{\text{HB}}$
3308w				$\nu(\text{OH})_{\text{H B}}$
2932vs	2929w	2940m 2916m	2930s	$\nu_{\text{as}}(\text{CH}_3)$
2885vs	2895m	2896s	2888vs	$\nu(\text{CH}_2)$
2818sh		2812vw		$\nu_{\text{s}}(\text{CH}_3)$
2743w		2715vw	2731vw	$\nu(\text{CH})$
1654w		1656vw	1657vw	$\nu(\text{CO})$
1591m	156vw 1528vw	1598w	1596vw	$\delta(\text{NH}_2)$ and $\nu(\text{COO})$
1458m	1460w	1462vw 1445vw	1461w	$\delta(\text{CH})+\omega(\text{CH}_2)+\delta(\text{OH})$
1411m	1400w	1414w	1411w	$\delta_{\text{s}}(\text{CH}_3)+\delta(\text{CH})$
1377vs	1375m	1376m	1376m	$\delta(\text{CH}_2)+\delta(\text{CH})+\delta(\text{OH})+\nu(\phi)$
1325m	1345sh	1327vw		$\nu(\text{CN})+\delta(\text{CH})$
1263m	1264w	1261w	1261w	$\delta(\text{OH}\cdots\text{O})+\nu(\text{C-C})+\nu(\text{C-O})+\delta(\text{CH})+\rho(\text{CH}_3)$
1146m	1149sh	1147w	1150w	$\nu(\text{C-O-C})+\nu(\phi)+\nu(\text{C-OH})+\nu(\text{C-CH}_3)+\rho(\text{CH}_2)+\rho(\text{CH}_3)$
1114s	1113w	1115m	1115m	$\nu(\text{C-O-C})+\nu(\phi)+\nu(\text{C-OH})+\nu(\text{C-CH}_3)+\rho(\text{CH}_2)+\rho(\text{CH}_3)$
1093s	1087sh	1080vs	1080vs	$\nu(\text{C-O-C})+\nu(\phi)+\nu(\text{C-OH})+\nu(\text{C-CH}_3)+\rho(\text{CH}_2)+\rho(\text{CH}_3)$
1044sh	1073sh	1070m 1042sh	1072m 1045w	$\rho(\text{CH}_3)+\delta(\text{CH})+\delta(\text{OH})$
991vw	993vw		994vw	$\nu(\phi)+\delta(\text{CH})$
936w				$\nu(\text{C-N})$
896m	901vw 887w	905m 893sh	898m	$\nu(\phi)+\rho(\text{CH}_2)$ , $\delta(\text{COO})$
784w 768w	768vs	785w	788vw 778vw	$\omega(\text{NH}_2)+\delta(\phi)$
703w	696vw	701w	701w	$\gamma(\text{OH}\cdots\text{O})$
606w	592w 579vs	596vw		$\delta(\phi)$ , $\omega(\text{COO})$
566sh				$\gamma(\text{NH})+\gamma(\text{C-C=O})+\omega(\text{CH}_3)$
		517vw 493vw	491w	$\delta(\text{CO-NH})+\delta(\text{C-CH}_3)$
493m			477vw	$\delta(\text{COC})$
479m			448vw 425w	$\gamma(\text{OH})+\gamma(\phi)$ , $\rho(\text{COO})$
444m, 424m	465m 406w	421vw	373w 362w	$\gamma(\text{OH})+\gamma(\phi)$
370sh	391w	373w		$\gamma(\text{OH})+\gamma(\phi)$
357m	345w	358w	354w	$\gamma(\text{OH})+\gamma(\phi)$ , $\gamma(\text{COO})$
330m	323sh	330w	290vw	
285m	276vw	273w	278w	$\delta(\text{C-MH-C})+\gamma(\text{OH})$
216m	206vw	195vw	195vw	$\delta(\text{C-MH-C})+\gamma(\text{OH})$

$\phi$  - pyranoid ring;  $\nu$  - stretching;  $\delta$  - in-plane bending;  $\gamma$ ,  $\omega$  - out-of-plane bending, HB – hydrogen bond.