Electronic Supplementary Information

Comparative Analysis of Chitin Isolation Techniques from Mushrooms: Toward Sustainable Production of High-Purity Biopolymer

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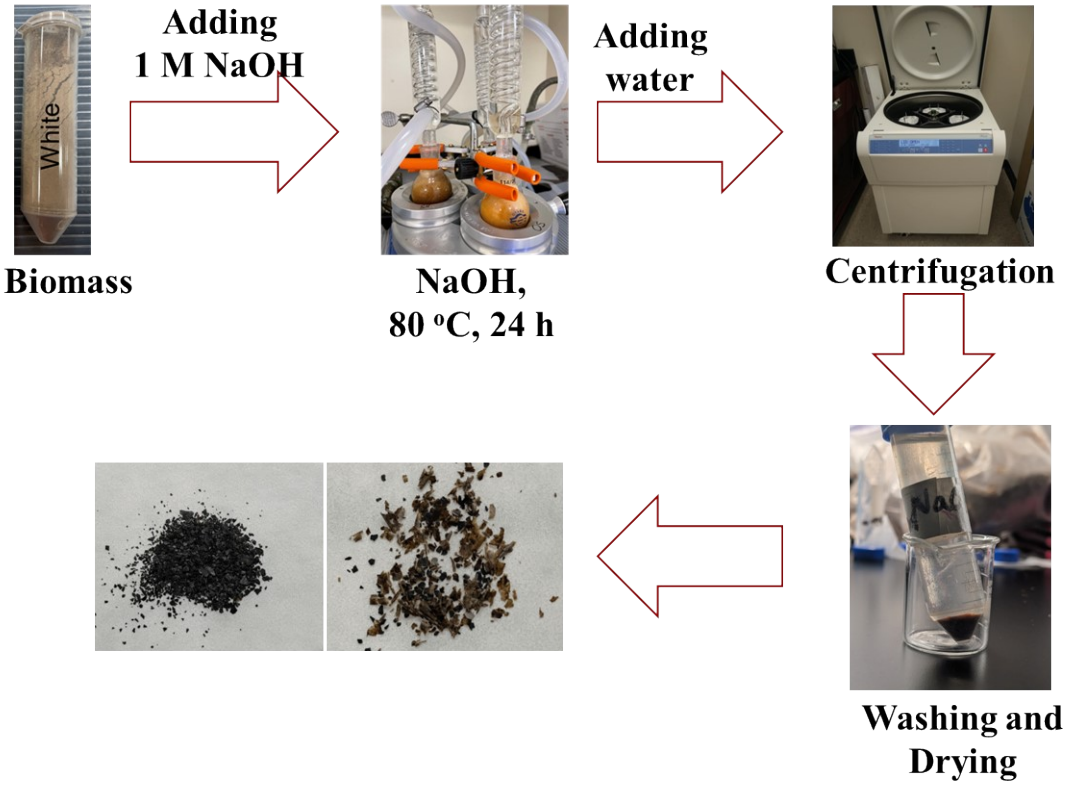


Figure S1. Process flow of pulping method with NaOH.

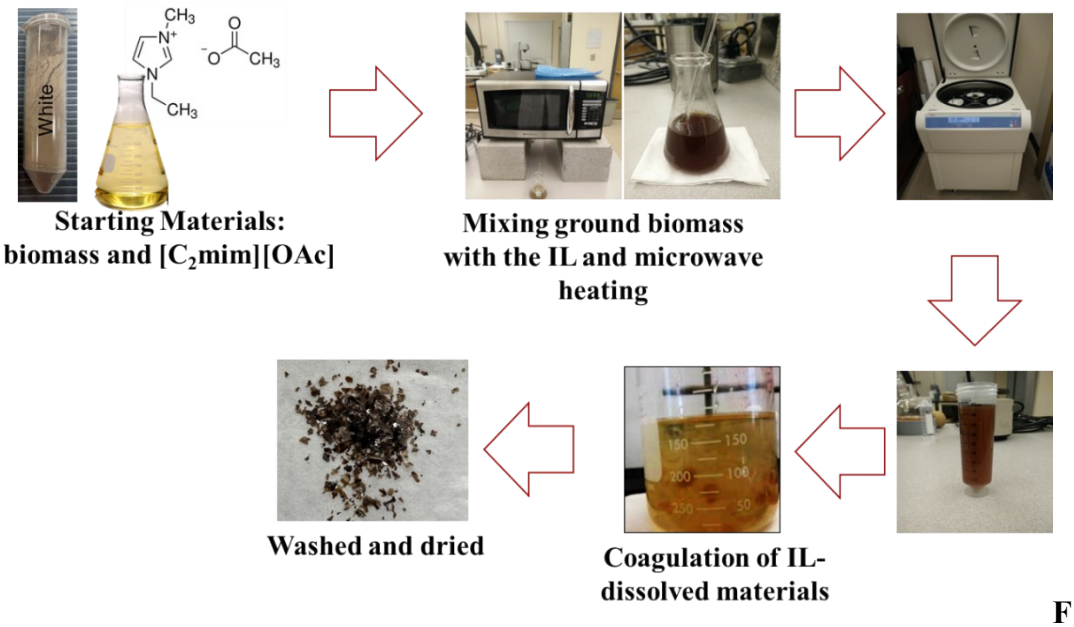


Figure S2. Process flow of extraction using the [C_2mim][OAc] microwave method.

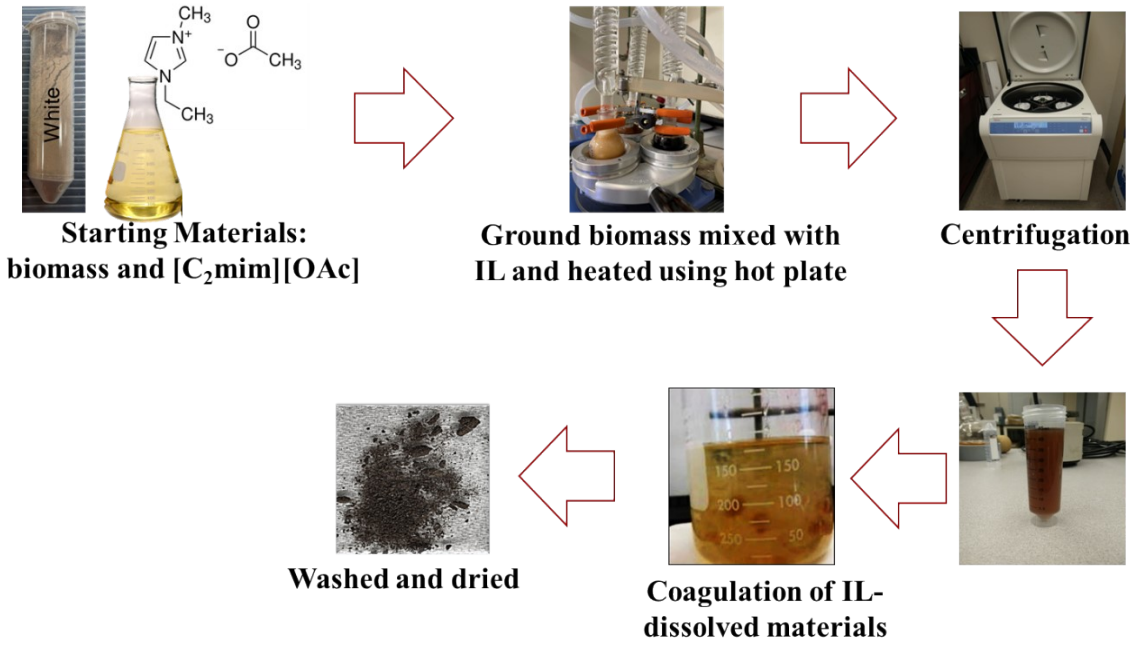


Figure S3. Process flow of extraction using the [C_2mim][OAc] thermal method.

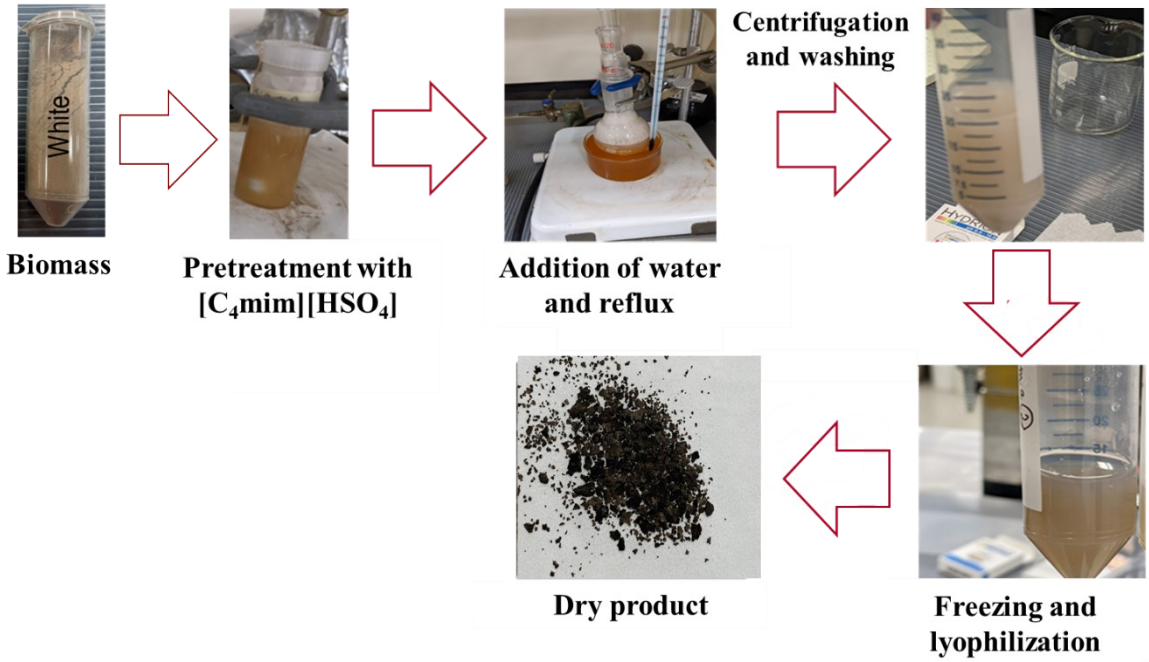


Figure S4. Process flow of pulping method using [C_4mim][HSO_4].

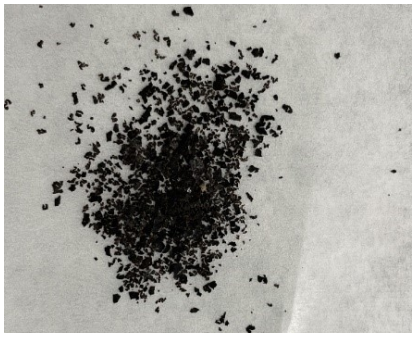
Mushroom Biomass (White)

Wh/Chitin$_{NaOH-2}$

Wh/Chitin$_{NaOH-24}$

Wh/Chitin$_{[C2mim][OAc]\ Microwave}$

Wh/Chitin$_{[C2mim][OAc]\ Thermal}$



Wh/Chitin$_{DES}$

Wh/Chitin$_{[C4mim][HSO4]}$

Figure S5. Appearance of biomass and isolates.

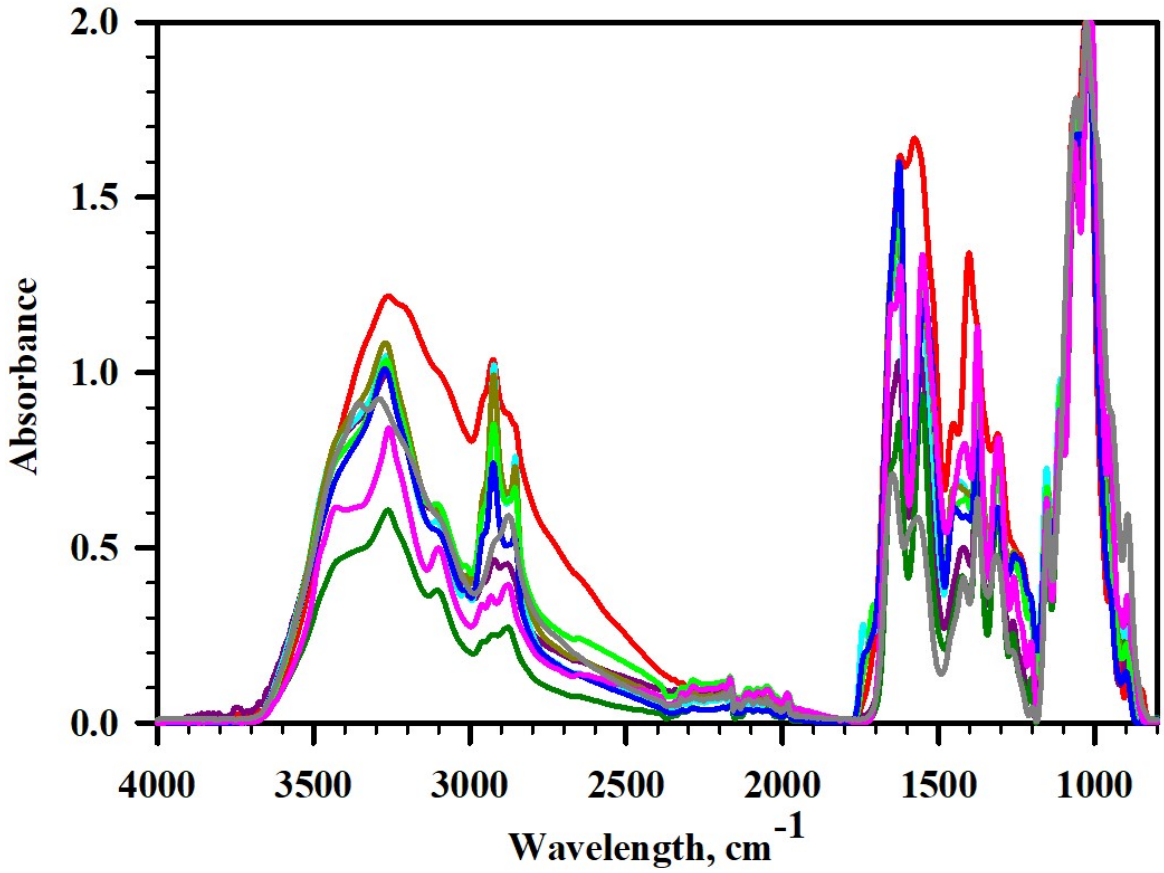


Figure S6. FTIR spectra (4000 – 600 cm^{-1}) of biomass (red), commercial chitin (pink), commercial chitosan (grey), and isolated materials by four different methods: pulping with NaOH–2 h (purple), pulping with NaOH–24 h (dark green), extraction with [C_2mim][OAc]–microwave (cyan), extraction with [C_2mim][OAc]–thermal (olive line), pulping with [C_4mim][HSO_4] (light green), and pulping with 2:1 Lactic Acid:[Cho]Cl (blue).

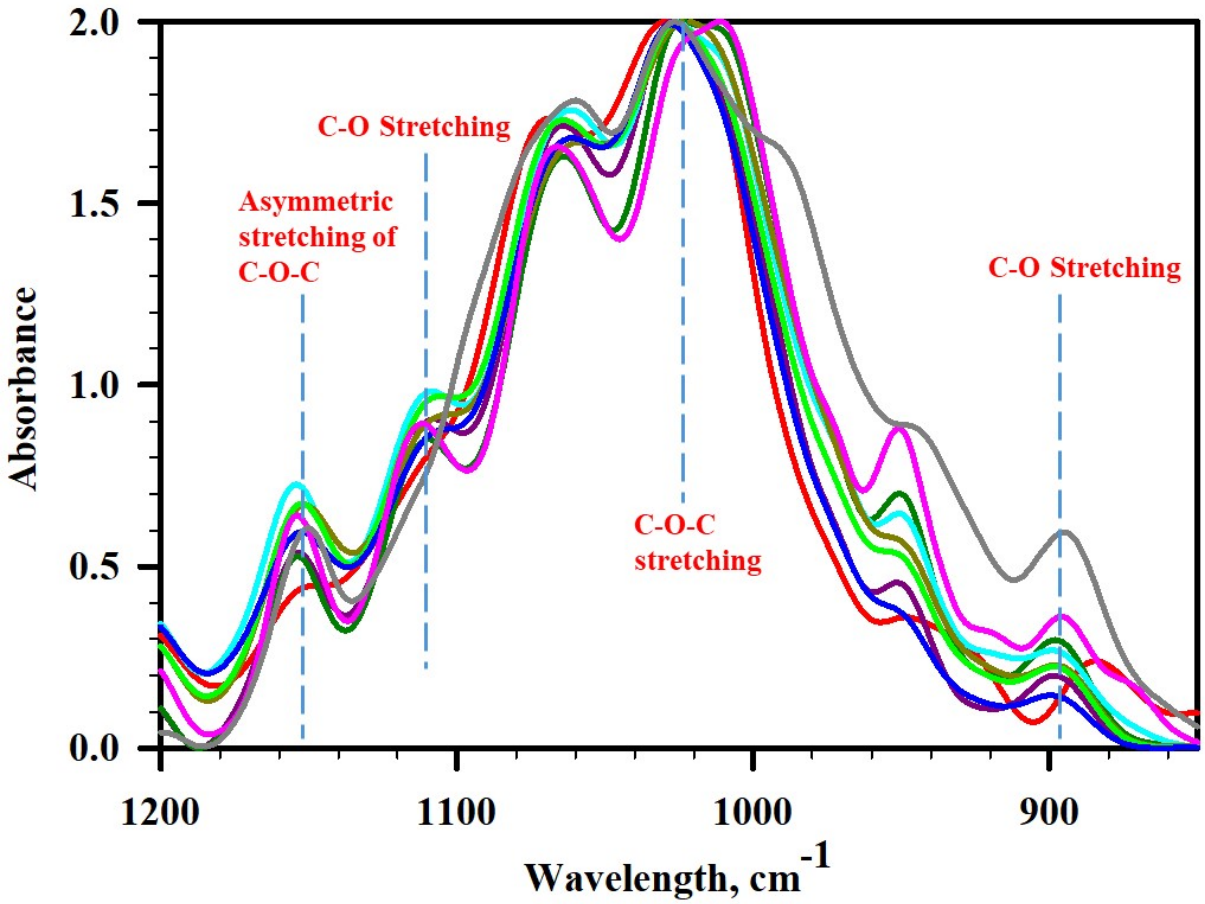


Figure S7. FTIR spectra (expanded in the region of 1200 – 850 cm^{-1}) of biomass (red), commercial chitin (pink), commercial chitosan (grey), and isolated materials by four different methods: pulping with NaOH–2 h (purple), pulping with NaOH–24 h (dark green), extraction with [C_2mim][OAc]–microwave (cyan), extraction with [C_2mim][OAc]–thermal (olive line), pulping with [C_4mim][HSO_4] (light green), and pulping with 2:1 Lactic Acid:[Cho]Cl (blue).

Table S1. Chemical Shift in the ^{13}C CP-MAS NMR spectrum of various mushroom glucans.

Source	Type of Glucans	^{13}C chemical shift (δ_C, ppm)						Ref
		C-1	C-2	C-3	C-4	C-5	C-6	
Pleurotus ostreatus	β-glucan	103.3–103.6	74.1–74.4	86.6–85.4		76.0	68.9–69.1 & 62.0–62.3[a]	1
Pleurotus ostreatus	α-1,3-glucan	100.9–101.0	71.5	84.5–82.2			60.5	1
Pleurotus ostreatus	(1→3, 1→6)-*β*-D-glucan	103.6	65–79	86.1[b]	80	65–79	62.4 and 69.3 for (1→3)- and (1→6)-linkage, respectively	2
Pleurotus tuber-regium (Fr.) Sing	β-D-glucan	102.6	72.8	85.9	68.1	75.6	69.4, & 60.3[a]	3
Penicillium chrysogenum	(1→3)-α-D-glucan	101.2	71.95	83.66	71.46	73.63	62.03	4
Aspergillus fumigatus	(1→3)-*α*-glucan	101.0	71.9	84.6	69.5	71.7	60.5	5
Aspergillus fumigatus	(1→3)-*β*-glucan	103.6	74.4	86.4	68.7	77.1	61.2	5
Aspergillus niger	(1→3)-α-D-glucan	100.0	72.7	73.9	79.8	71.4	60.9	6
Aspergillus niger	(1→4)-α-D-glucan	101.0	71.4	83.2	70.3	73.5	61.3	6
Flammulina velutipes	Linear (1→4)-*α*-D-glucan	102.8	74.0	76.1	79.8	73.2	63.4	7
Flammulina velutipes	Branched (1→4, 1→6)-*α*-D-glucan	102.4	74.2	76.1	79.8	73.2	72.2	7
Termitomyces eurhizus	(1→3)-*β*-D-glucan	103.3	73.9	86.3	68.7	76.2	61.1	8
Agaricus bitorquis	(1→6)-*β*-D-glucan	103.4	73.5	76.0	69.9	75.3	69.2	9
Ganoderma lucidum	Branched (1→3, 1→6)-*β*-D-glucan	103.0	73.0	85.8	68.7	75.0	68.7	10

[a] referring to *O*-substituted units and unsubstituted units, respectively.

[b] corresponding to (1→3)-linked residues of C-3

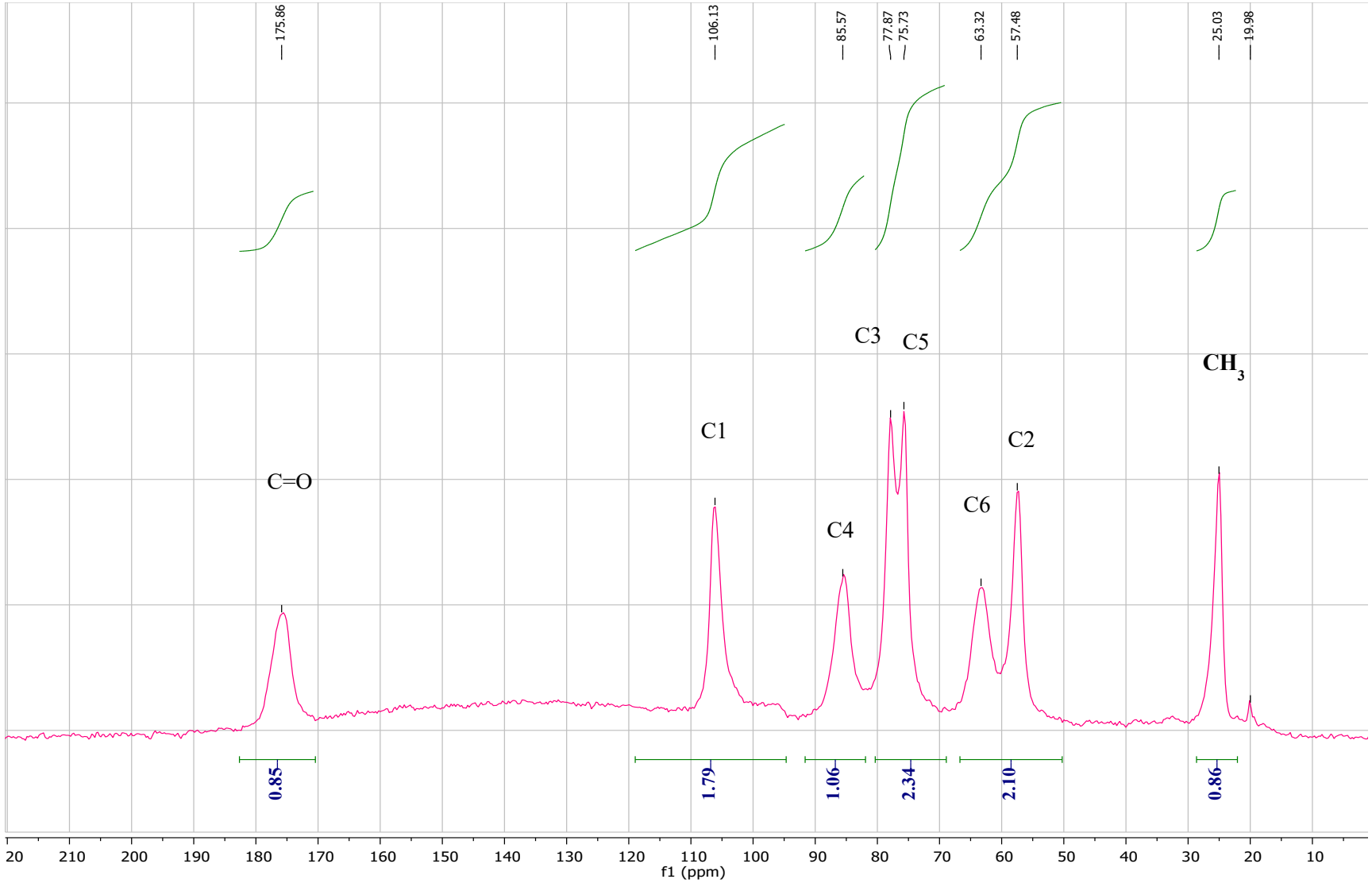


Figure S8. Solid-state ^{13}C CP-MAS NMR spectrum of crustacean chitin (extracted with [C_2mim][OAc]).

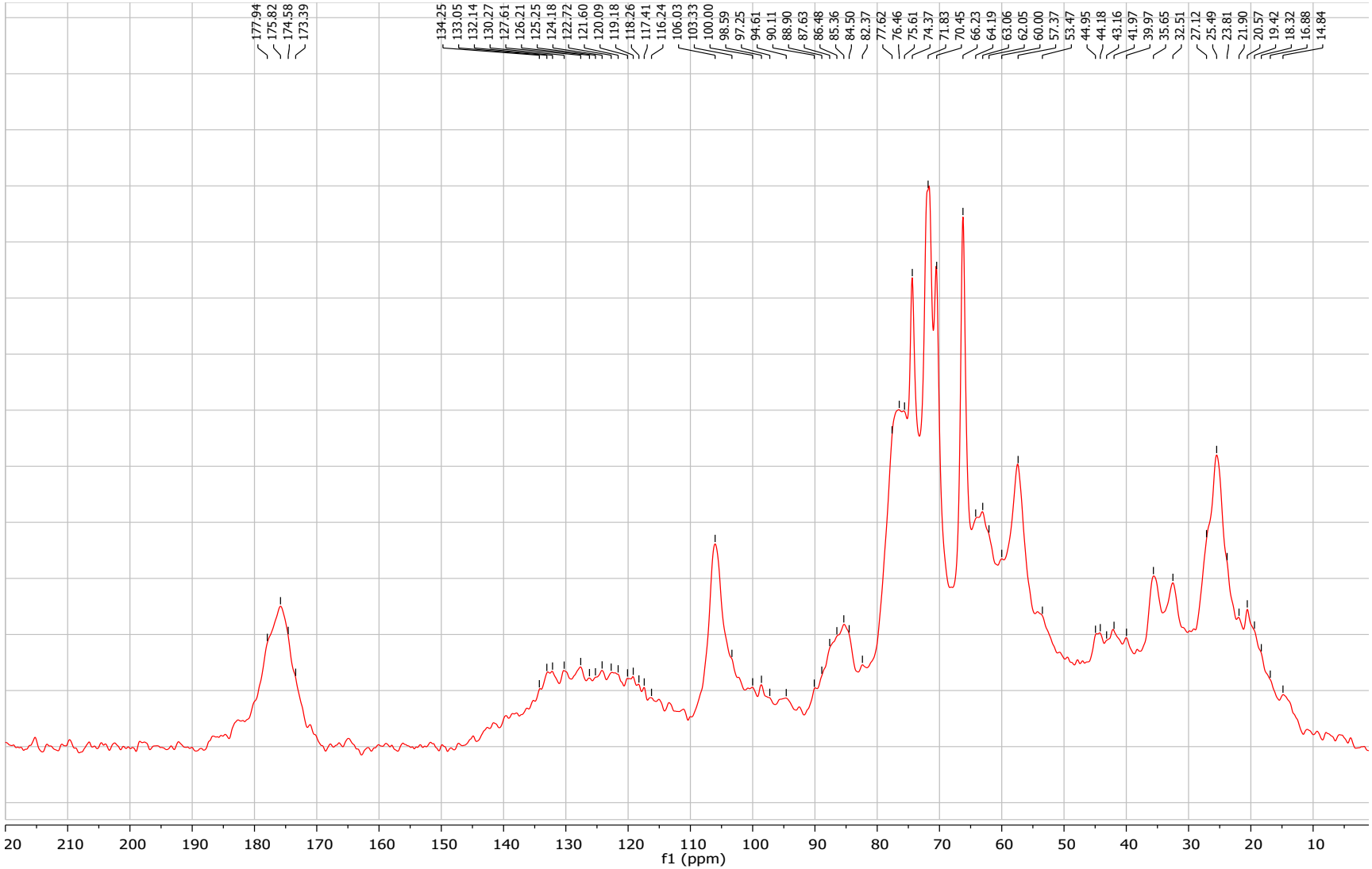


Figure S9. Solid-state ^{13}C CP-MAS NMR spectrum of White Mushroom biomass.

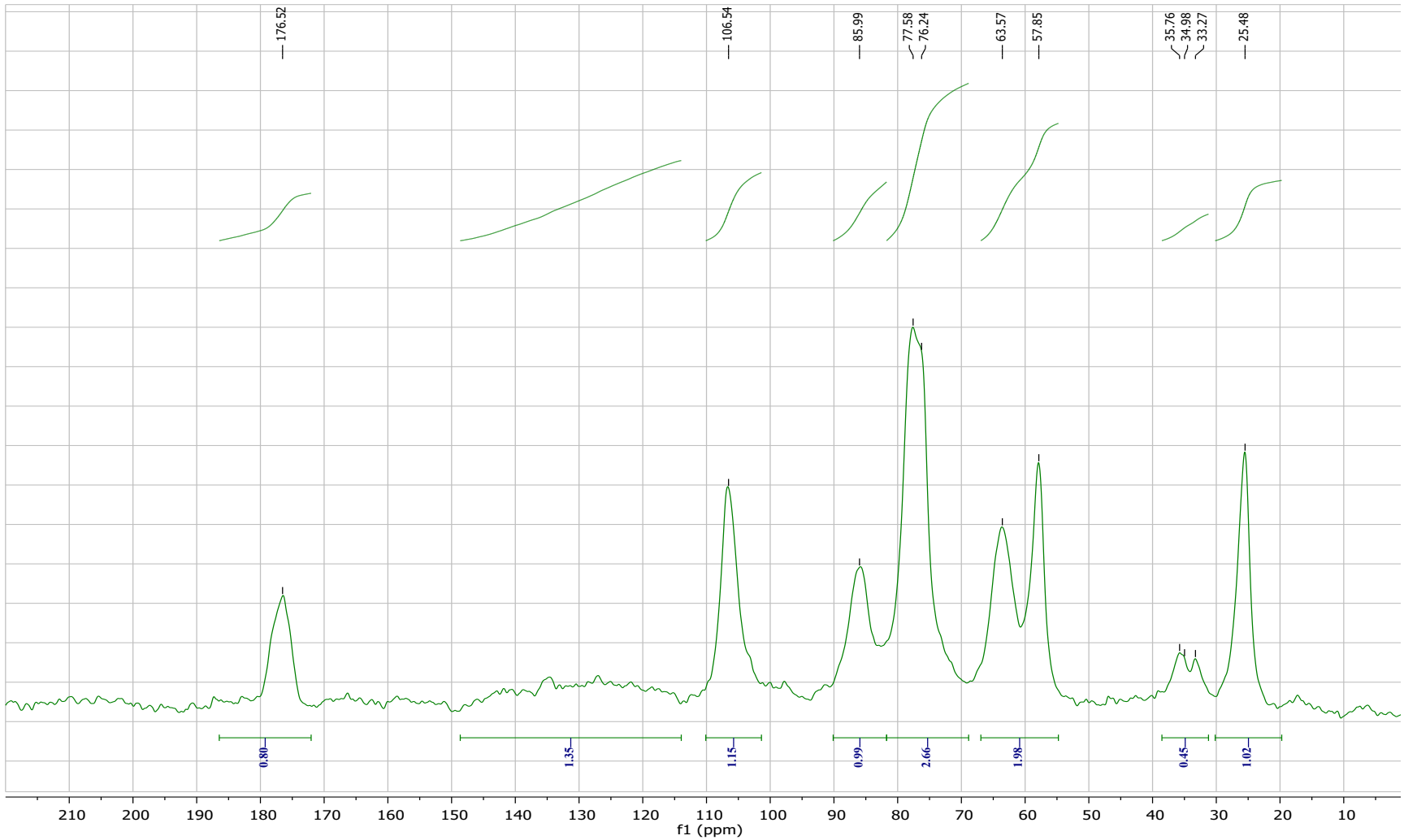


Figure S10. Solid-state ^{13}C CP-MAS NMR spectrum of Wh/Chitin$_{NaOH\text{-}24}$.

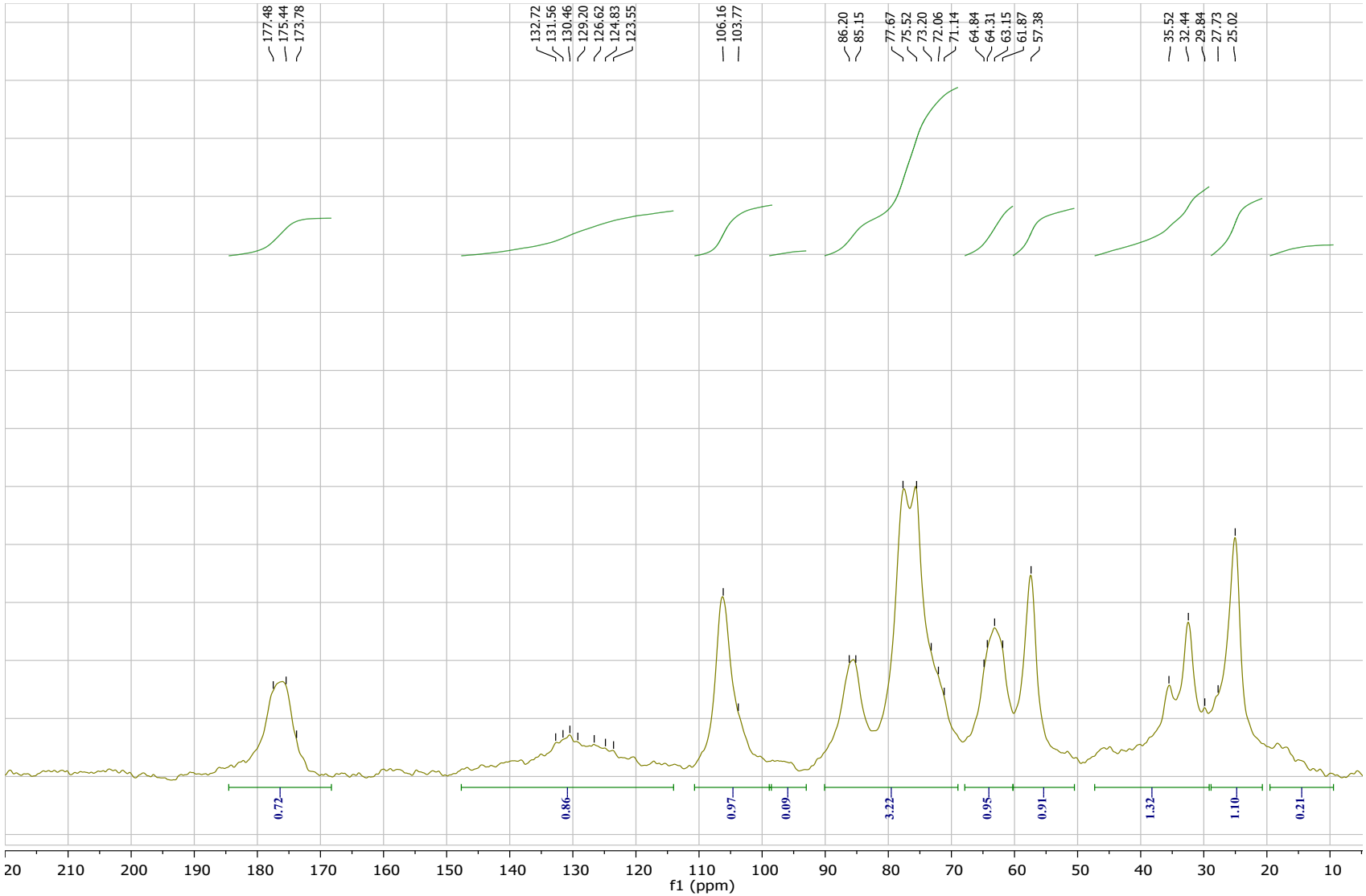


Figure S11. Solid-state ^{13}C CP-MAS NMR spectrum of Wh/Chitin$_{[C2mim][OAc]\ Thermal}$.

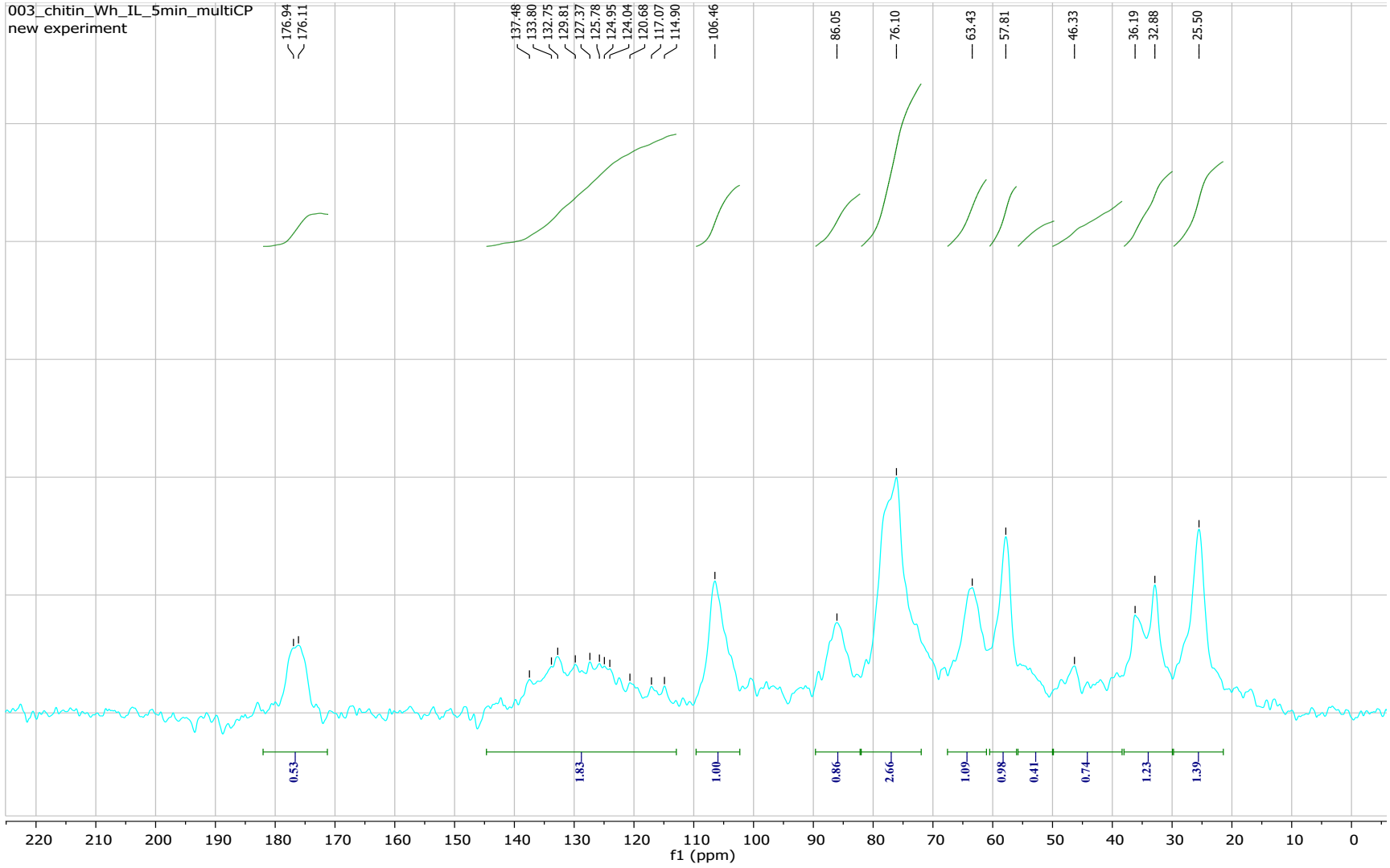


Figure S12. Solid-state ^{13}C CP-MAS NMR spectrum of Wh/Chitin$_{[C2mim][OAc]\ Microwave}$.

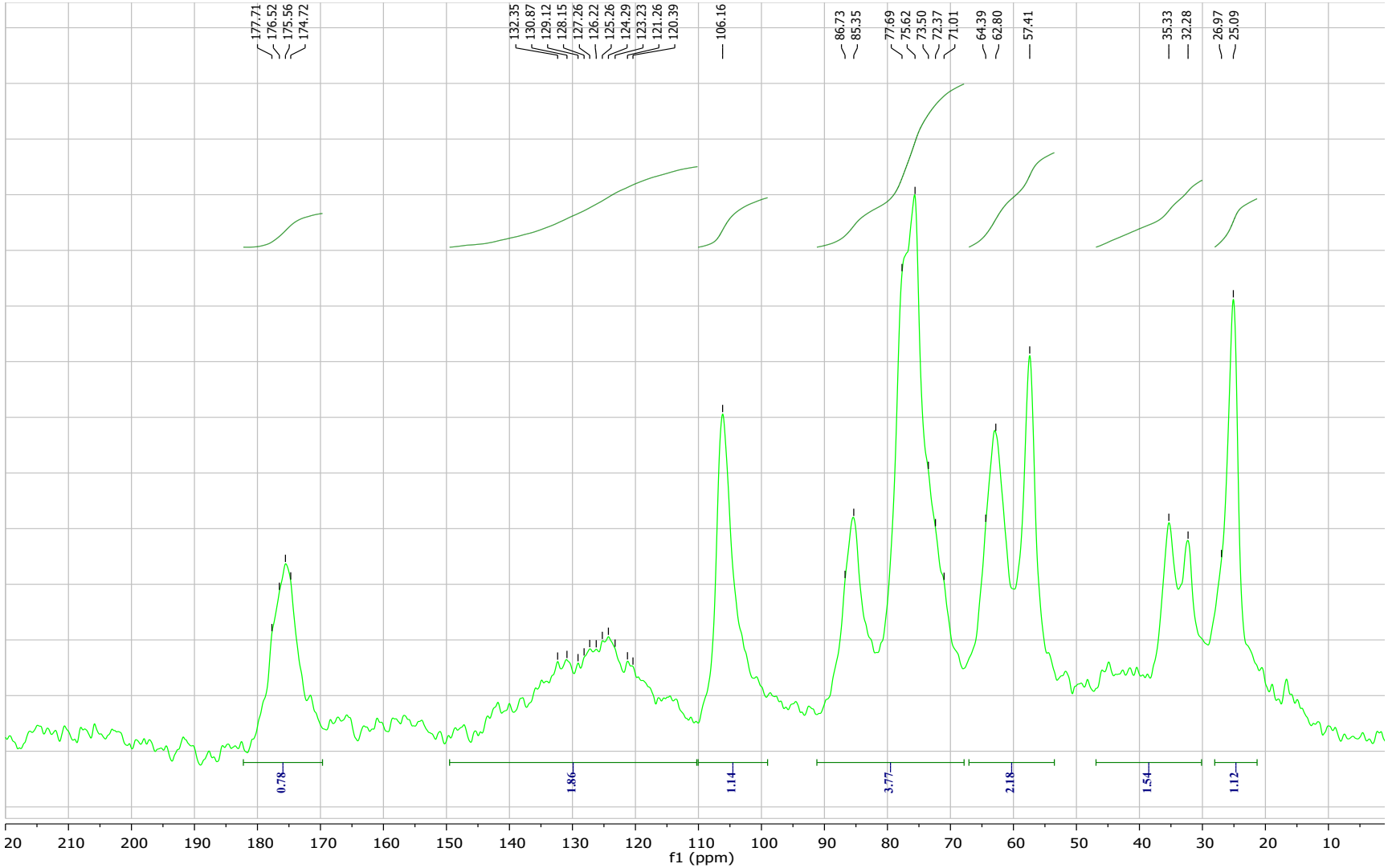


Figure S13. Solid-state ^{13}C CP-MAS NMR spectrum of Wh/Chitin$_{[C4mim][HSO4]}$.

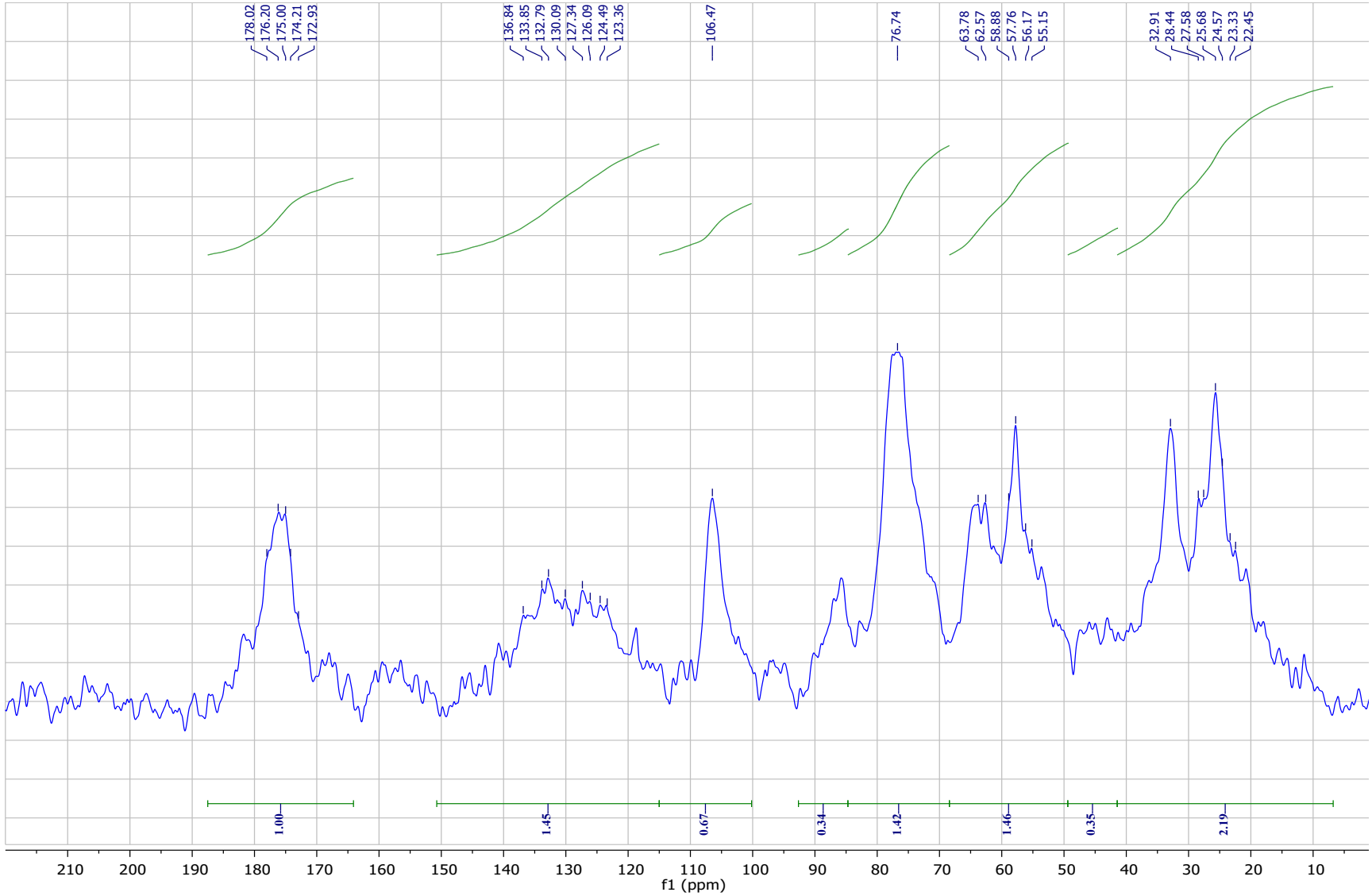


Figure S14. Solid-state ^{13}C CP-MAS NMR spectrum of Wh/Chitin$_{DES}$.

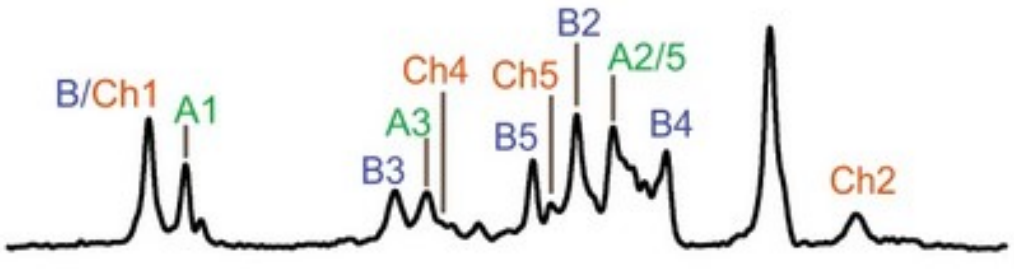


Figure S15. 1D ^{13}C−Cross Polarization NMR spectrum of rigid polysaccharides of *A. fumigatus* cell walls. Abbreviations are used for resonance assignments. For example, A1 denotes α-1,3-glucan carbon 1. Ch and B represent chitin and β-1,3-glucan, respectively. Adapted from Ref [11].

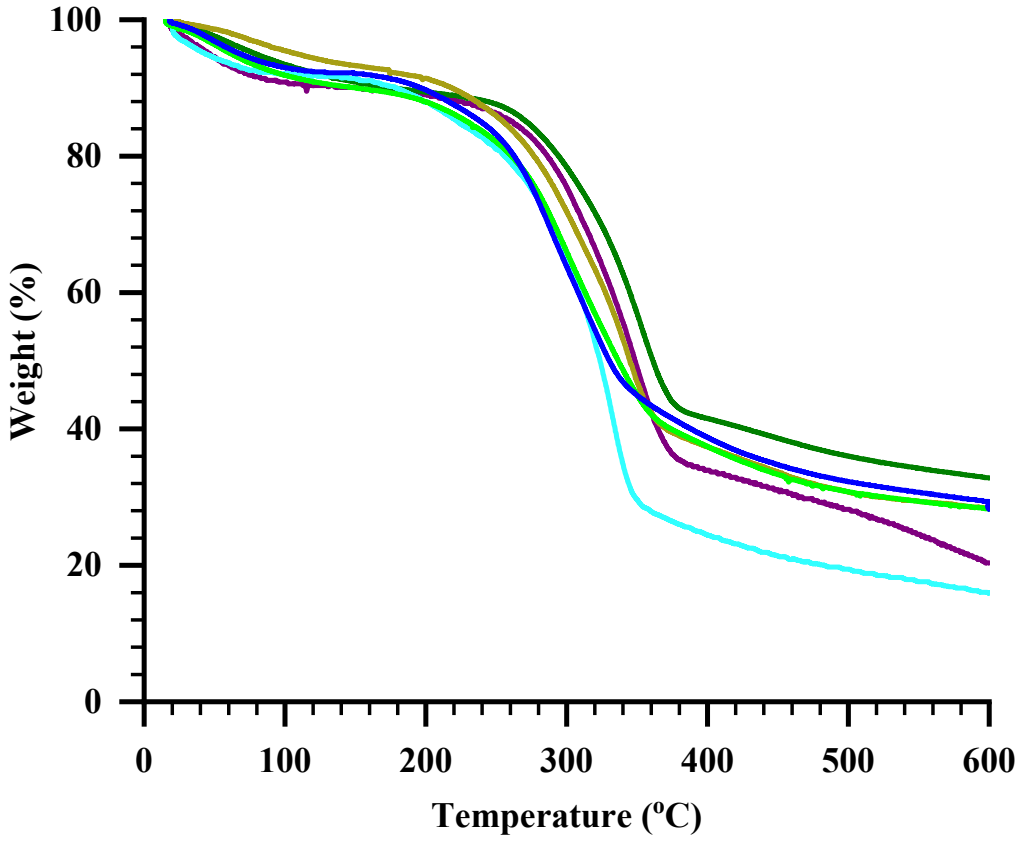


Figure S16. TGA weight loss (%) thermograms of isolated materials by different methods: pulping with NaOH–2 h (purple), pulping with NaOH–24 h (dark green), extraction with [C_2mim][OAc]–microwave (cyan), extraction with [C_2mim][OAc]–thermal (olive line), pulping with [C_4mim][HSO_4] (light green), and pulping with 2:1 Lactic Acid:[Cho]Cl (blue).

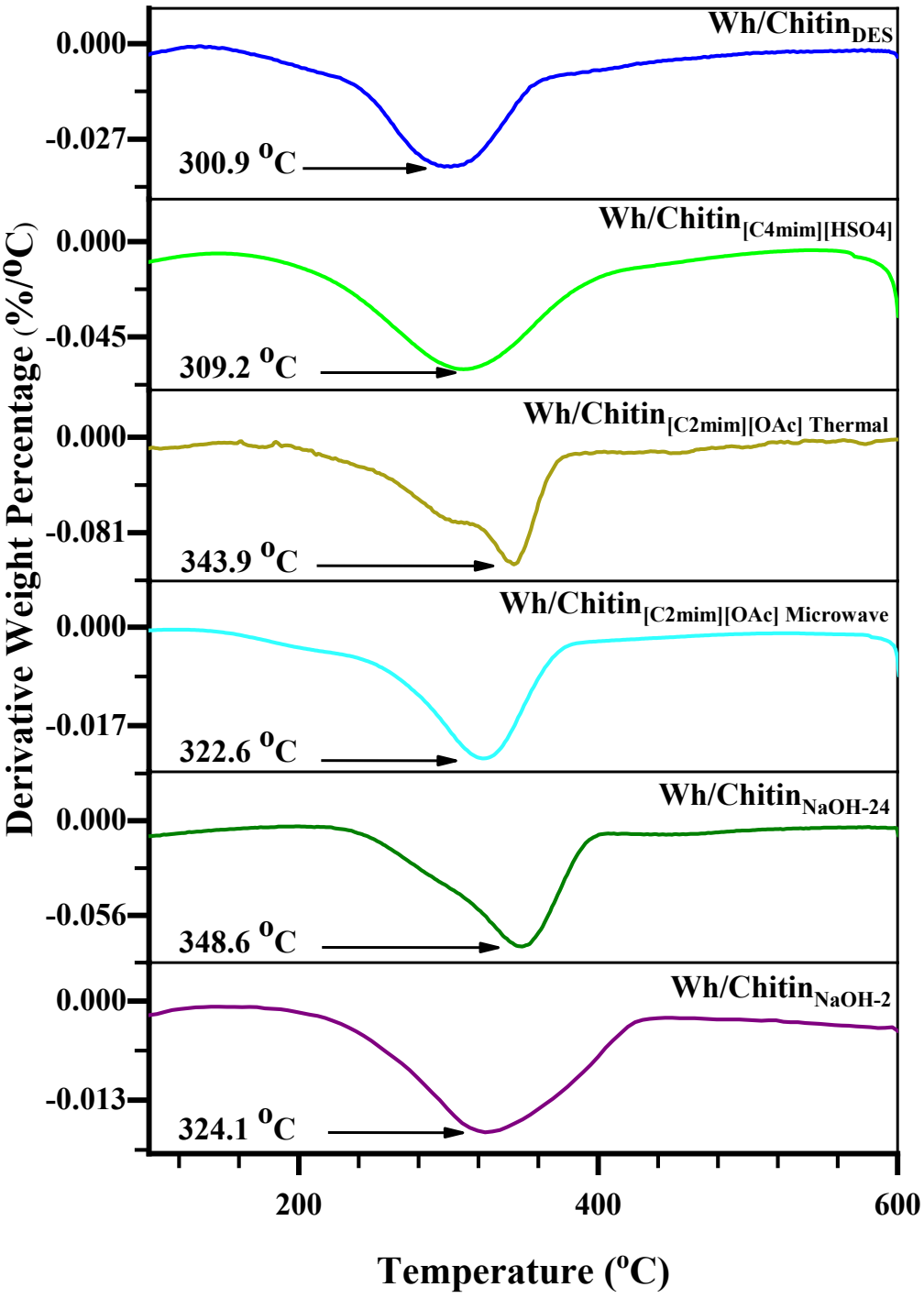


Figure S17. DTG_{max} thermograms of isolated materials by four different methods: (purple) pulping with NaOH–2 h, (dark green) pulping with NaOH–24 h, (cyan) extraction with [C_2mim][OAc]–microwave, (olive line) extraction with [C_2mim][OAc]–thermal, (light green) pulping with [C_4mim][HSO_4], and (blue) pulping with 2:1 Lactic Acid:[Cho]Cl.

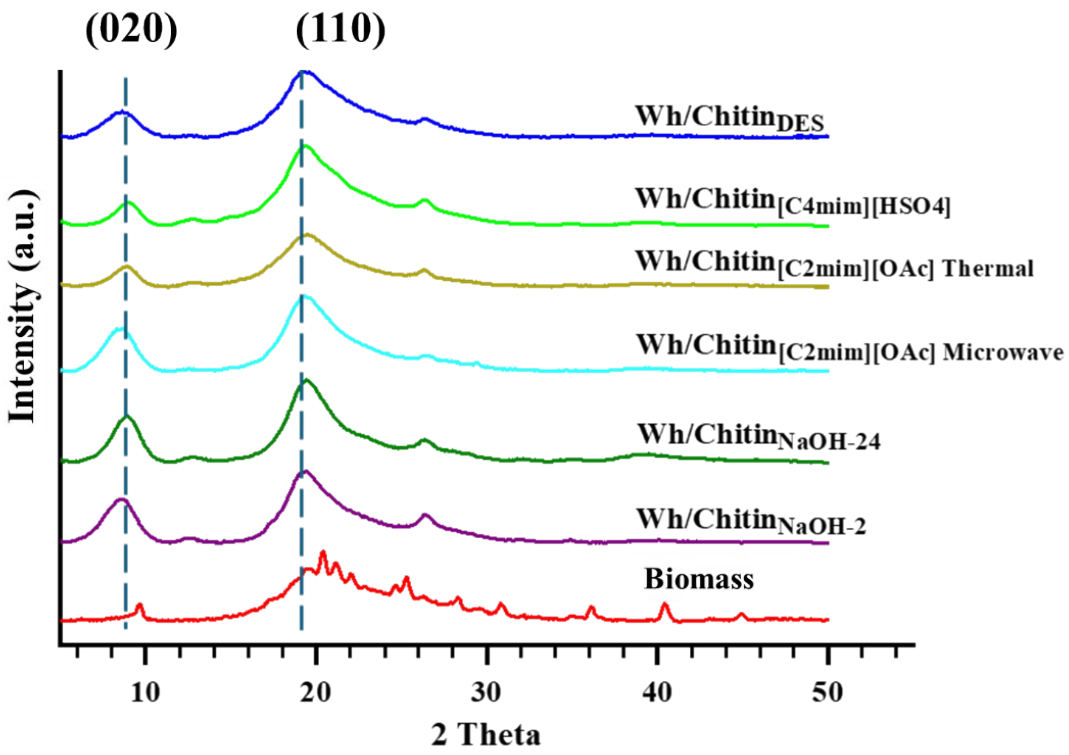


Figure S18. PXRD diffractograms of of biomass (red) and isolated materials by four different methods: pulping with NaOH–2 h(purple), pulping with NaOH–24 h (dark green), extraction with [C_2mim][OAc]–microwave (cyan), extraction with [C_2mim][OAc]–thermal (olive line), pulping with [C_4mim][HSO_4] (light green), and pulping with 2:1 Lactic Acid:[Cho]Cl (blue).

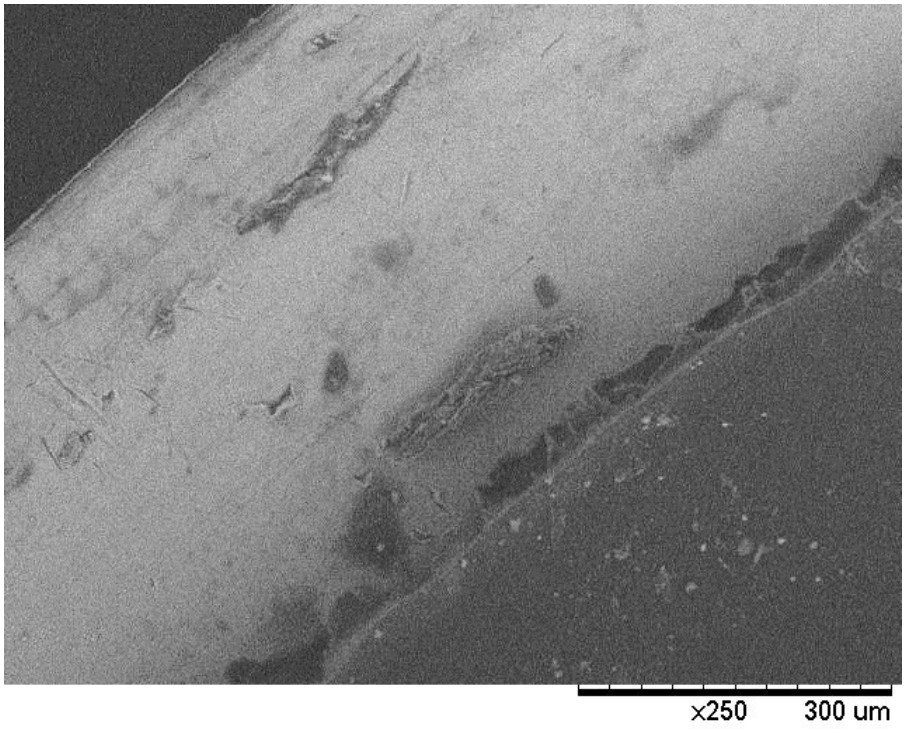


Figure S19. SEM images (x 250 magnification) of the surface of chitin fiber obtained from Wh/Chitin$_{NaOH\text{-}24}$

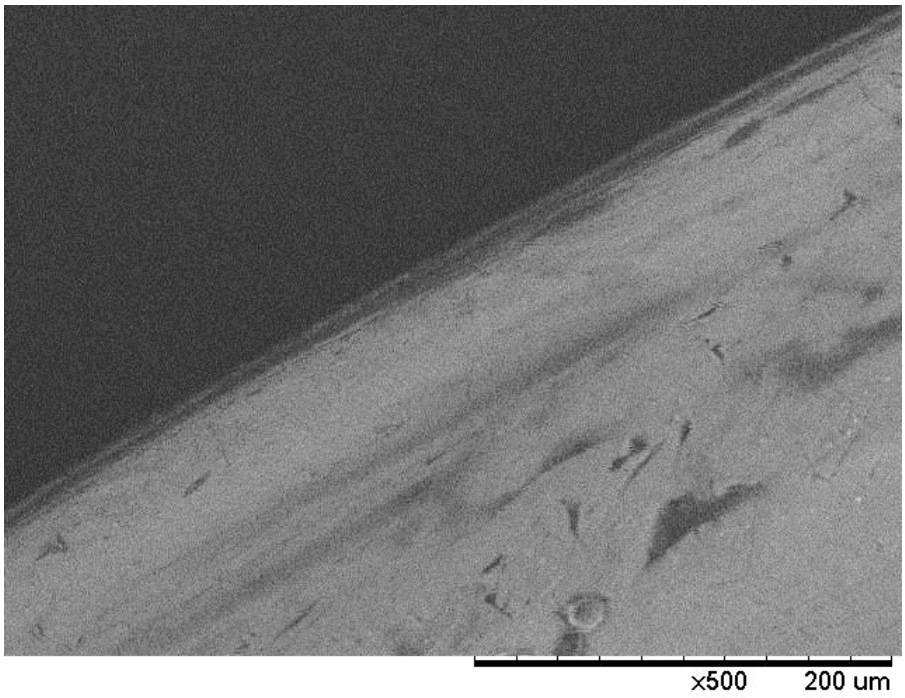


Figure S20. SEM images (x 500 magnification) of the surface of chitin fiber obtained from Wh/Chitin$_{[C2mim][OAc]}$

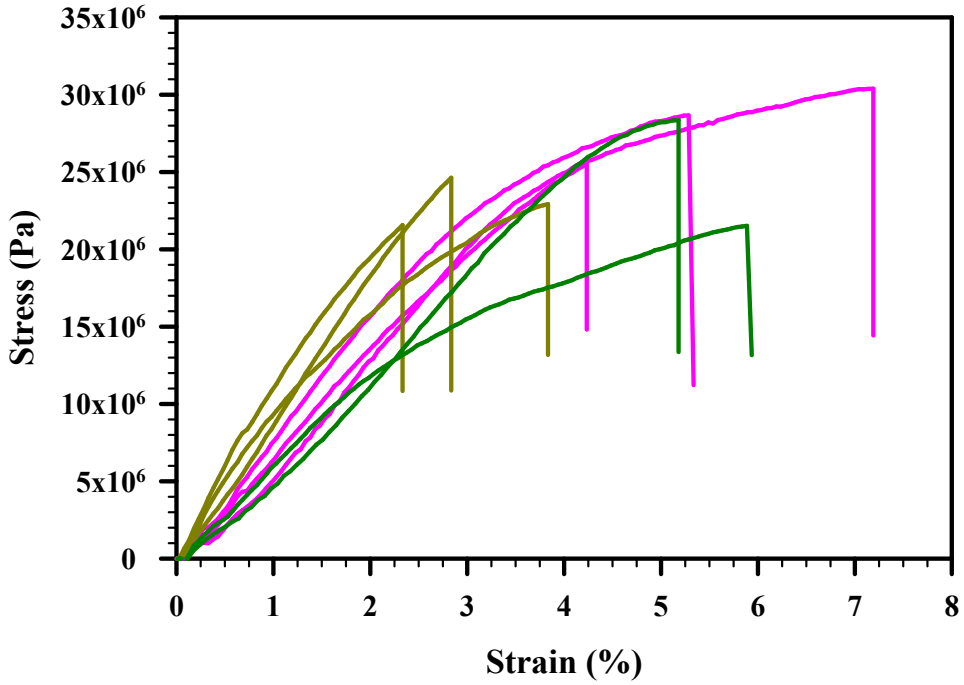


Figure S21. Stress-strain curves of chitin fibers prepared from chitin (dark green) pulped from mushroom biomass with NaOH–24 h, (olive) extracted from mushroom biomass with [C_2mim][OAc]–thermal, (pink) pulped from crustacean biomass with [C_2mim][OAc].

References

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