

Supporting Information for

**Betaine–ZnO hybrid catalyst: A sustainable bifunctional system for
solvent-free Knoevenagel condensation**

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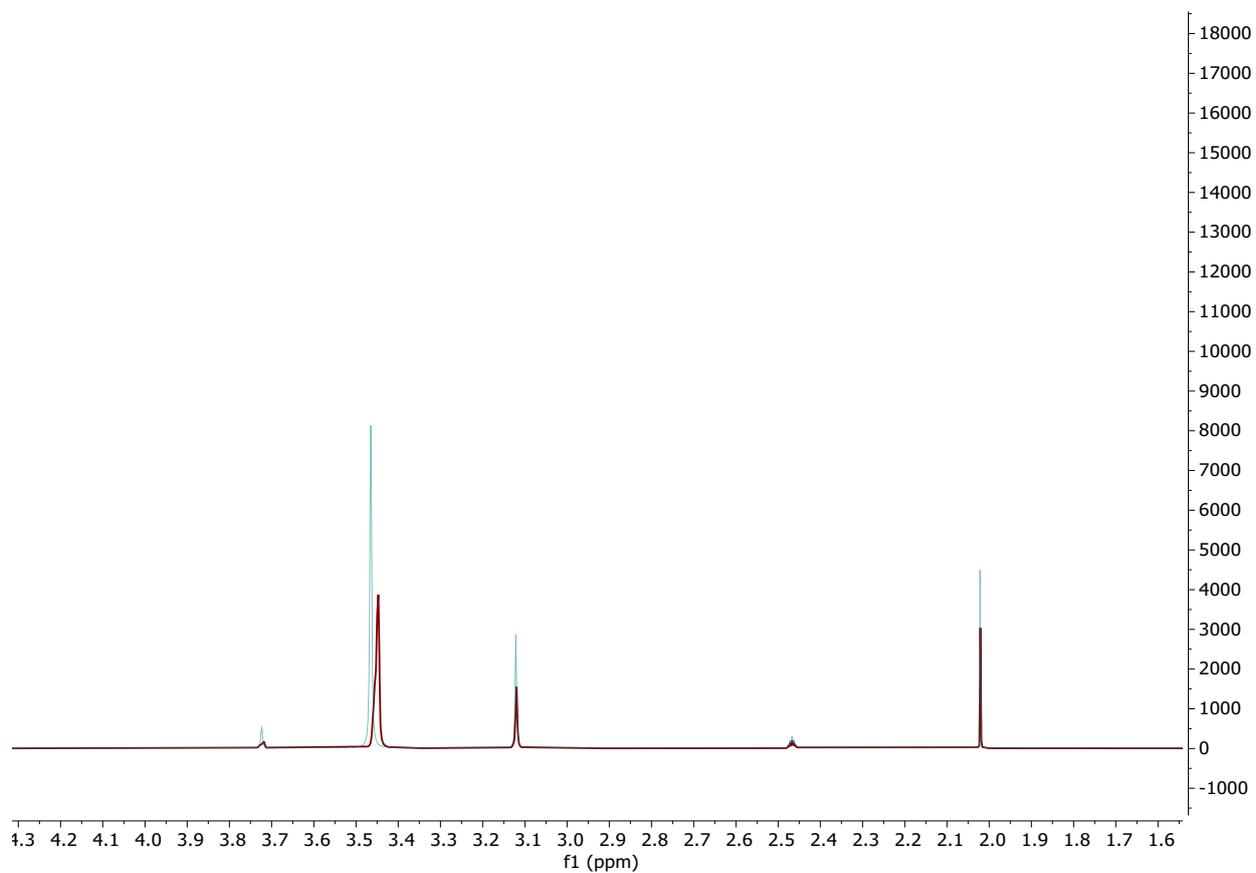


Fig. S1. ^1H NMR analysis of BetCl-ZnO before reaction (red) and after reaction (green).

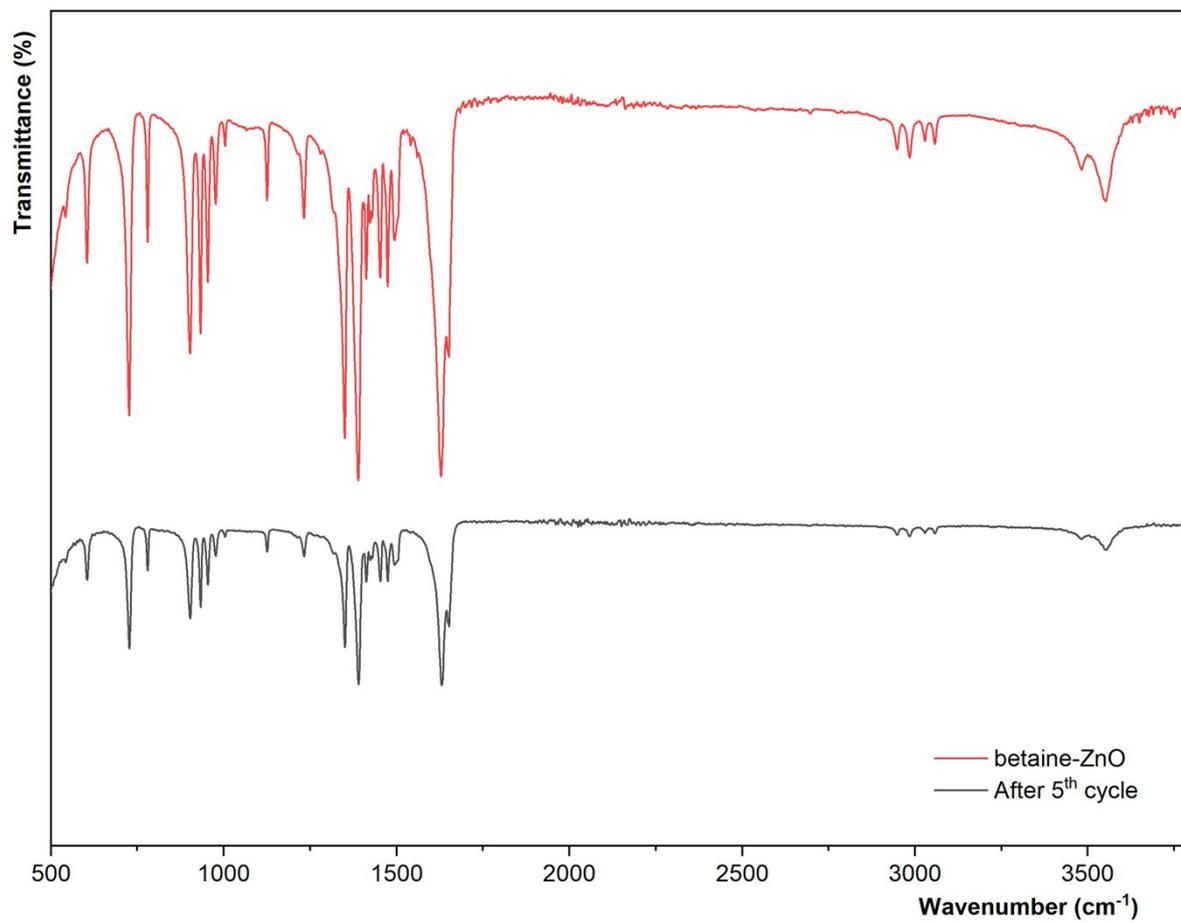


Fig. S2. FTIR analysis of fresh BetCl-ZnO and after 5th cycle.

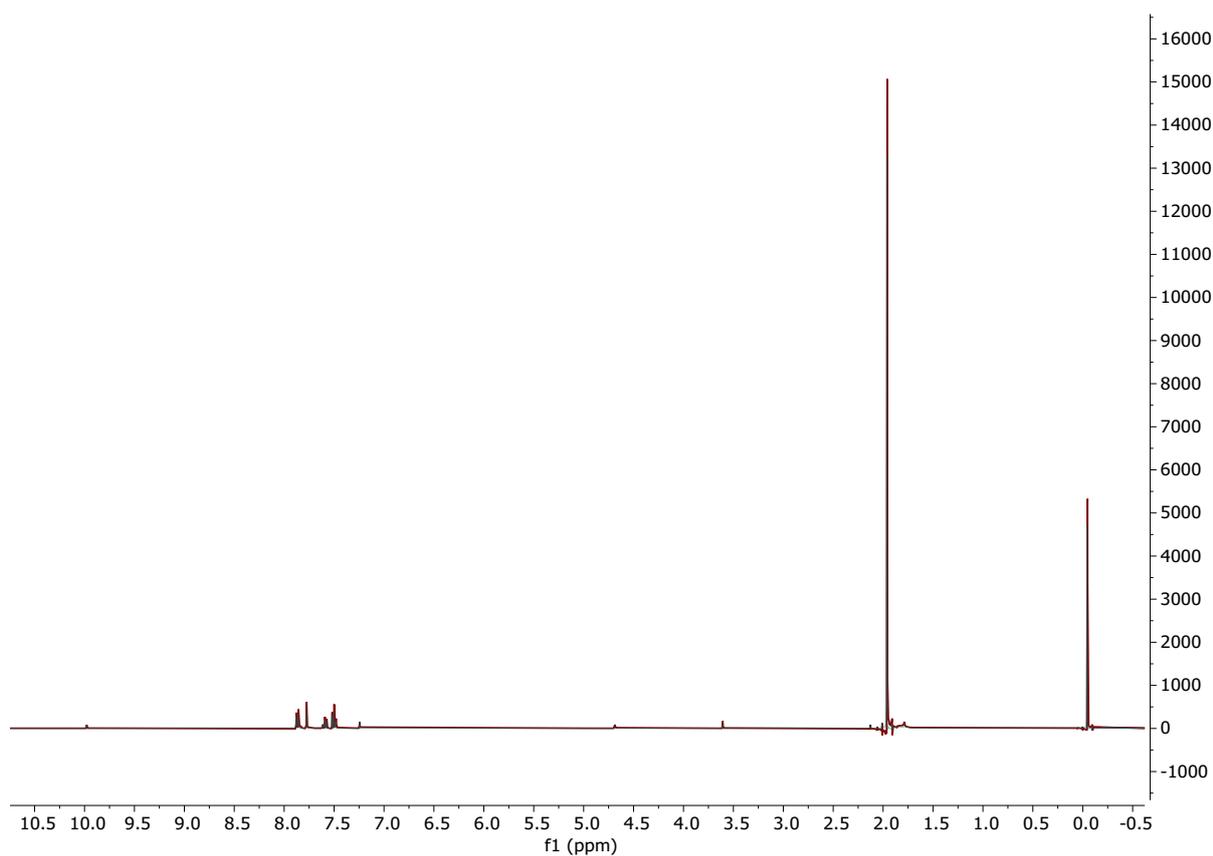


Fig. S3. ^1H NMR analysis of product after 1st cycle (red) and 6th cycle (green).

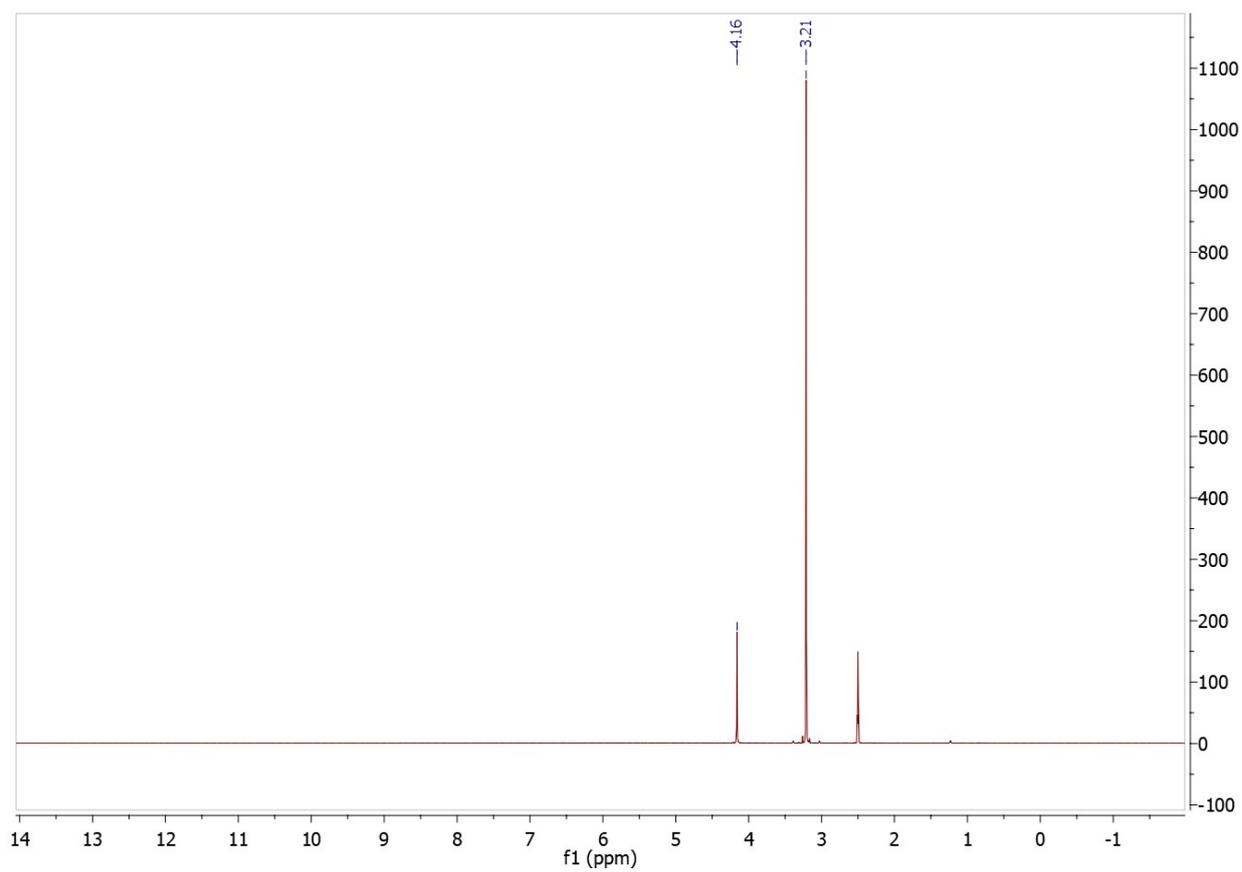


Fig. S4. ¹H NMR analysis of BetCl-ZnO after 4 hr.

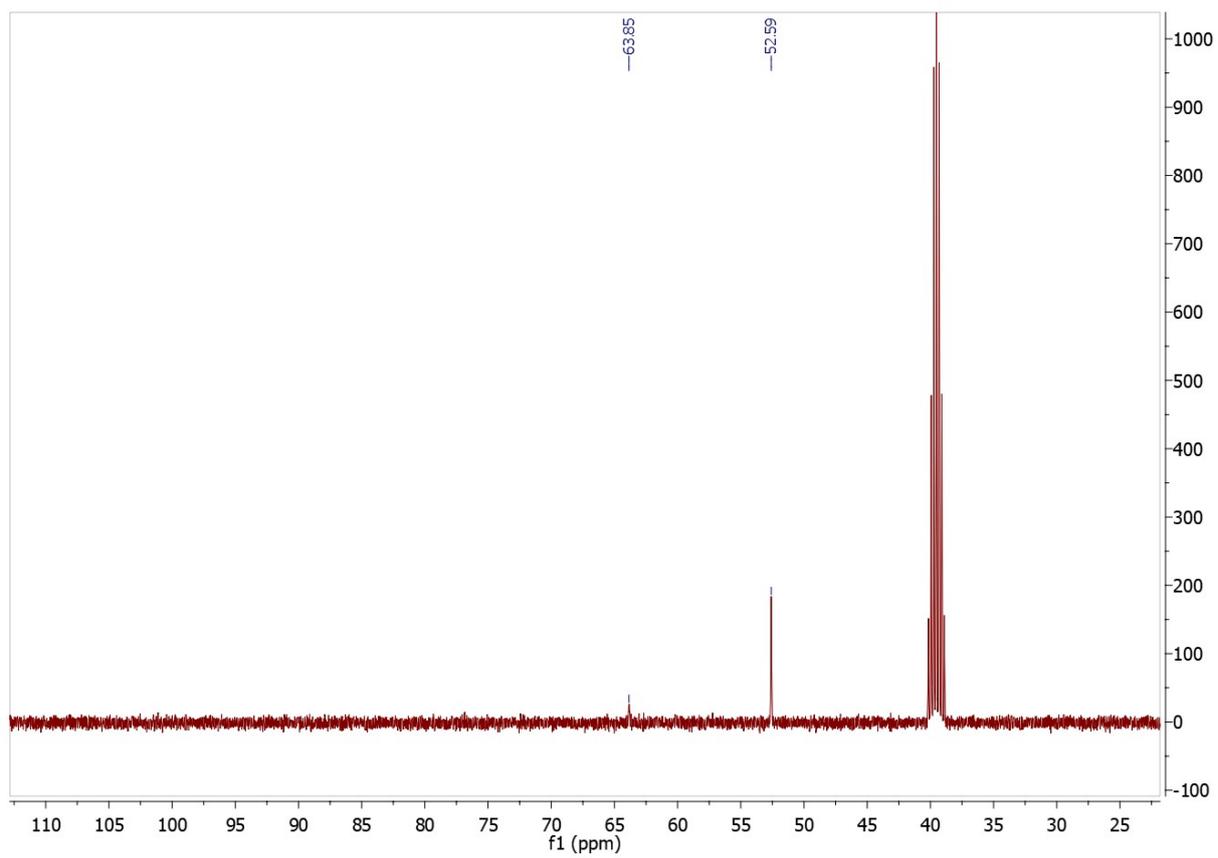


Fig. S5. ^{13}C NMR analysis of BetCl-ZnO after 4 hr.

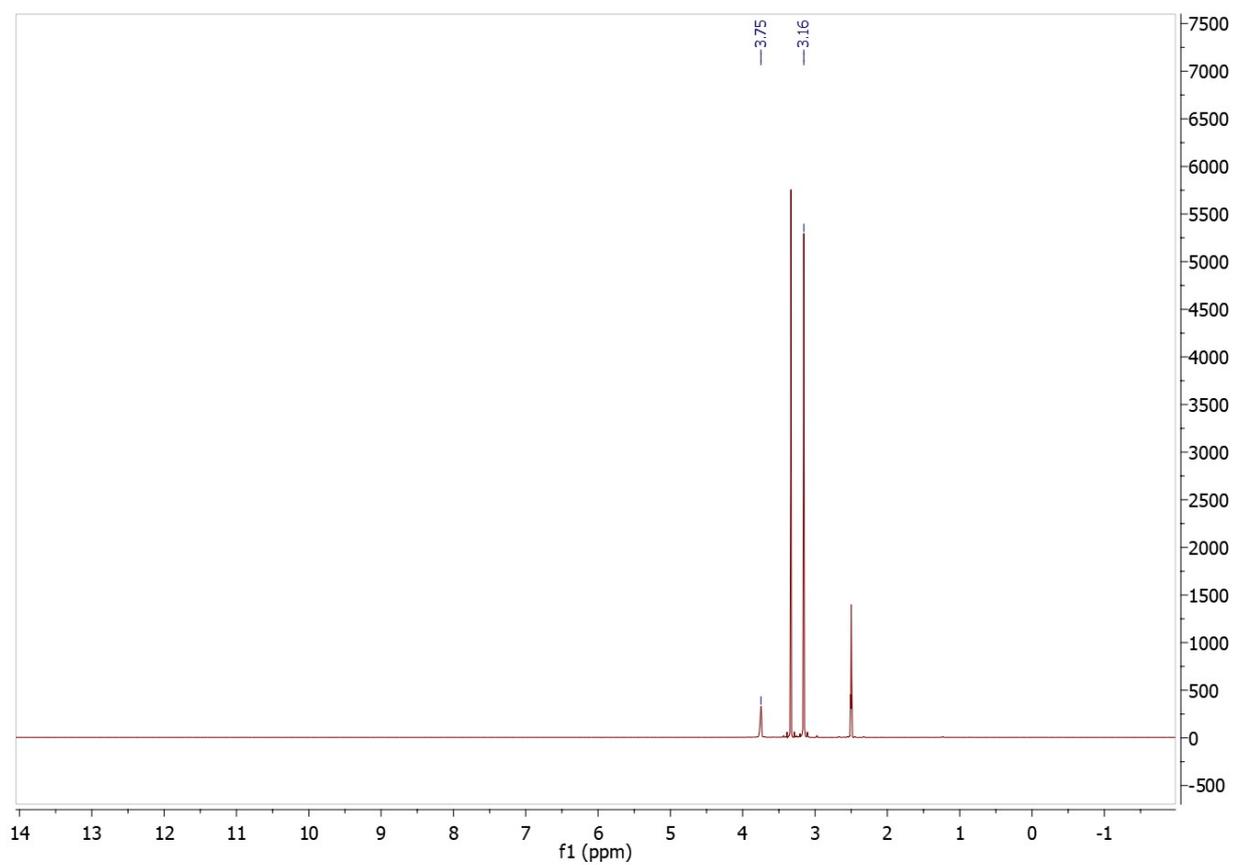


Fig. S6. ¹H NMR analysis of BetCl-ZnO after 1 day.

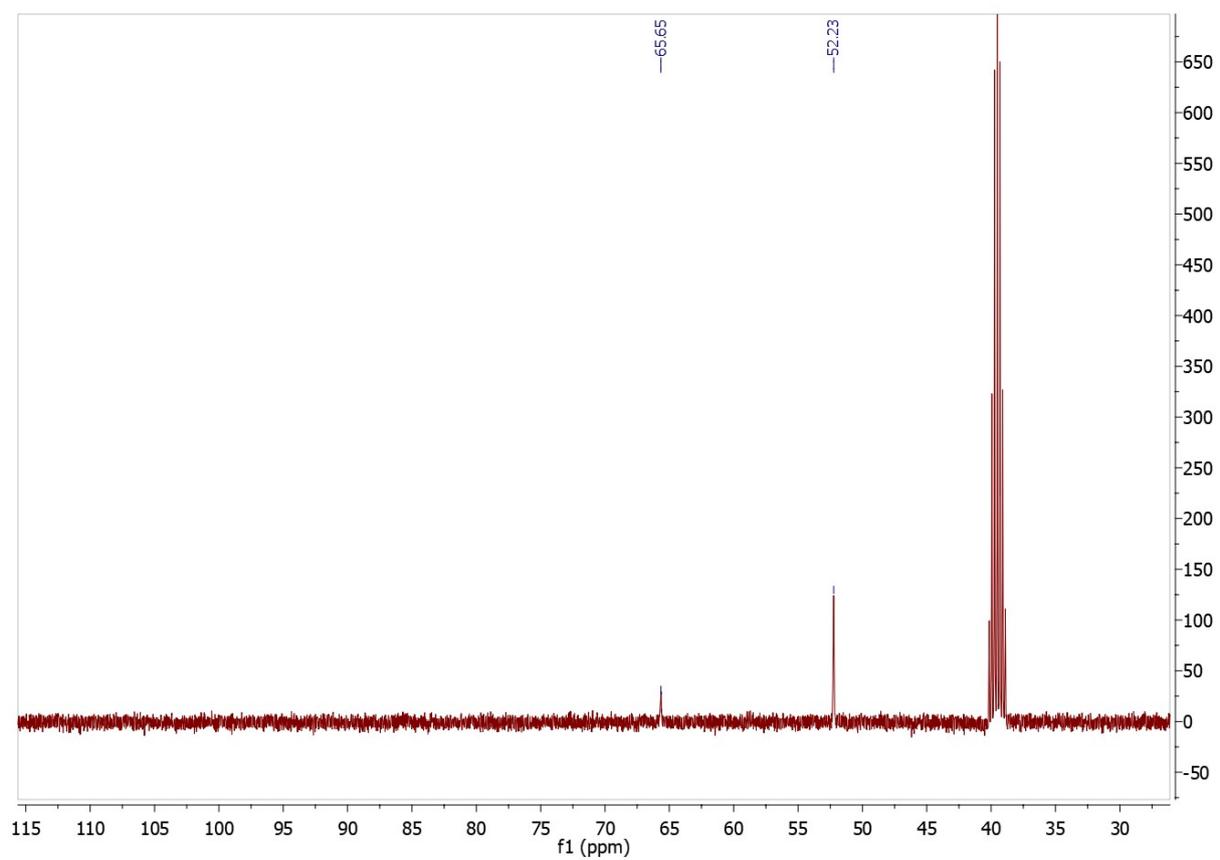


Fig. S7. ^{13}C NMR analysis of BetCl-ZnO after 1 day.

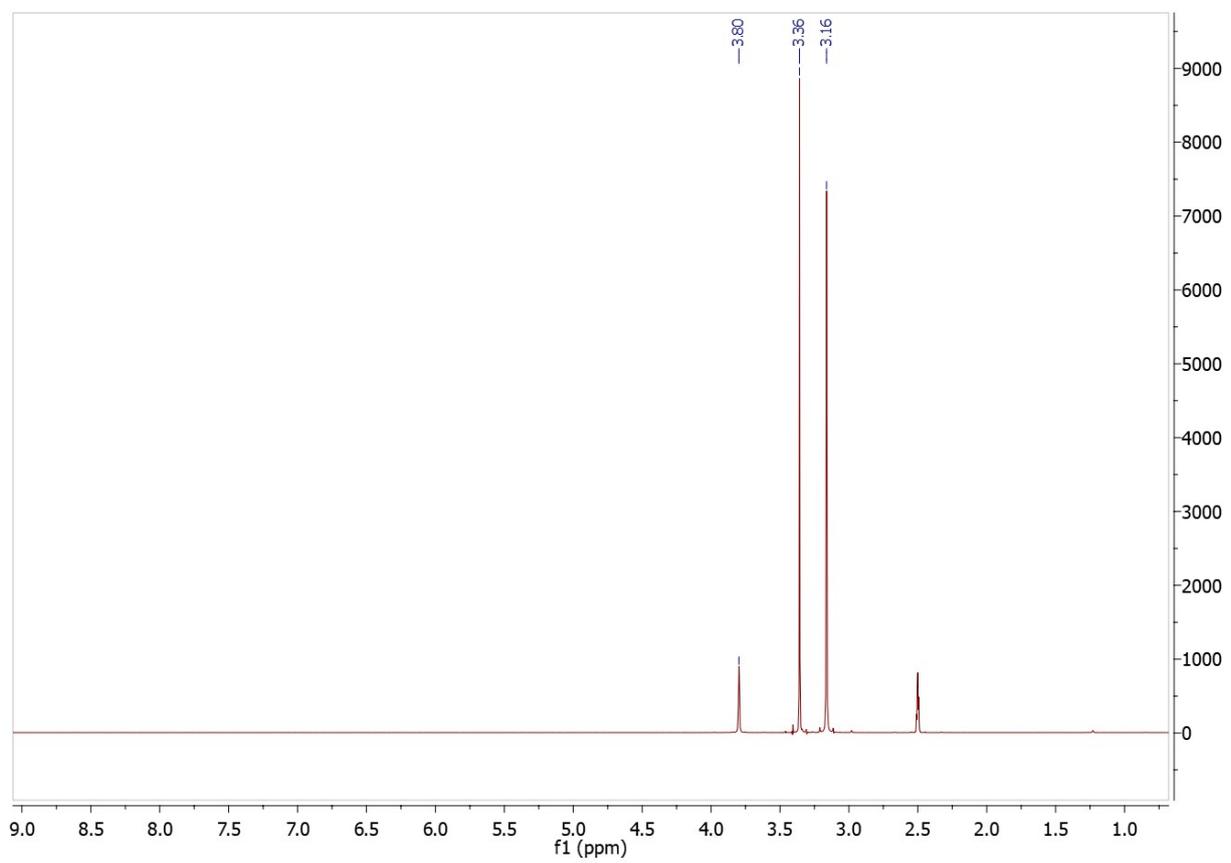


Fig. S8. ¹H NMR analysis of BetCl-ZnO after 3 days.

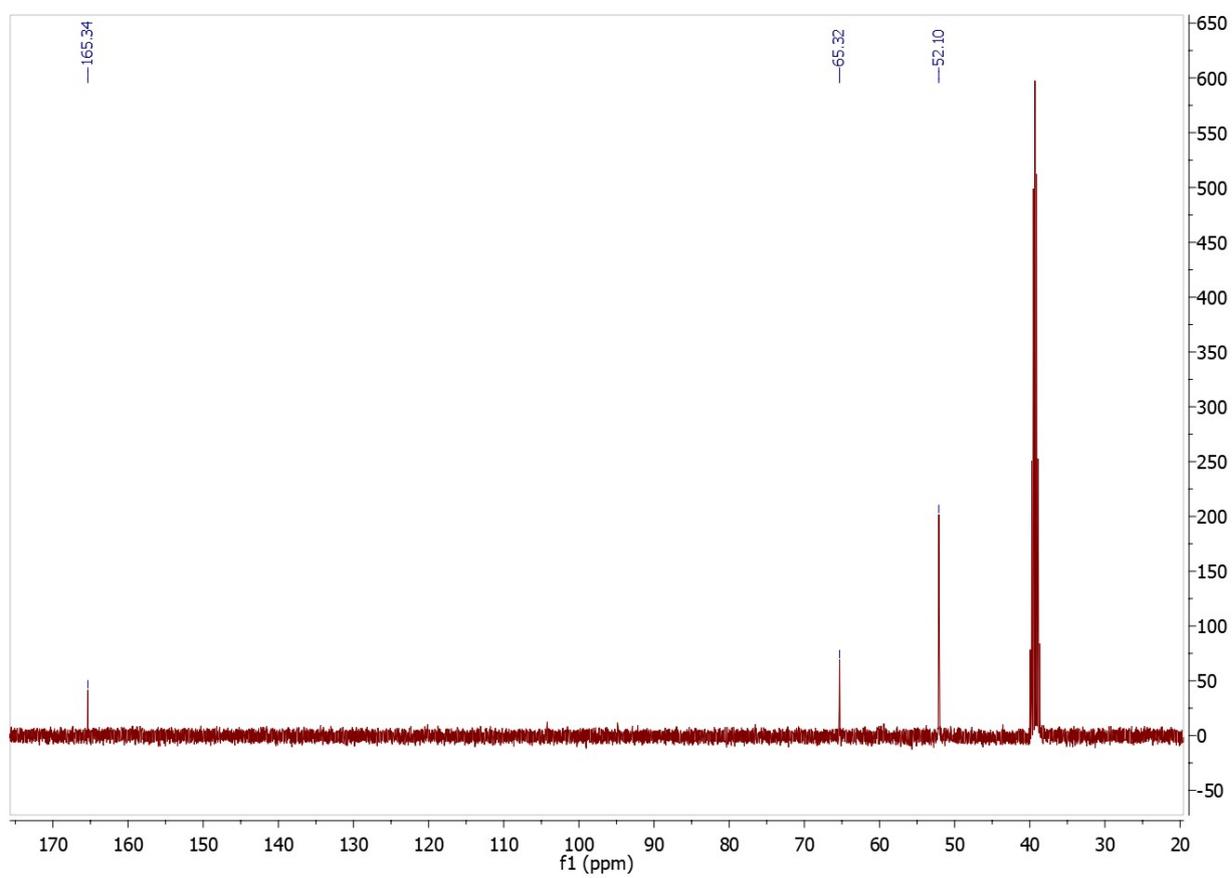


Fig. S9. ^{13}C NMR analysis of BetCl-ZnO after 3 days.

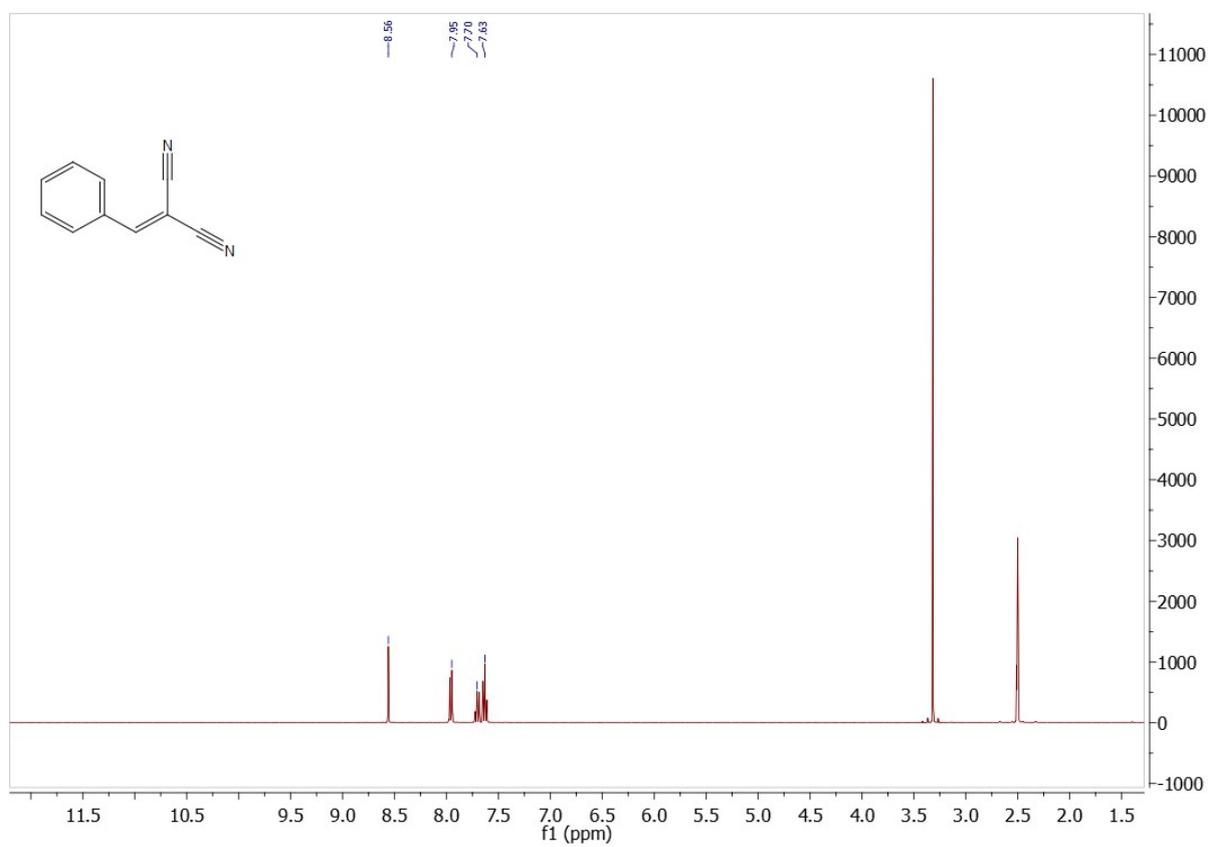


Fig. S10. ^1H NMR analysis of 2-benzylidenepropanedinitrile.

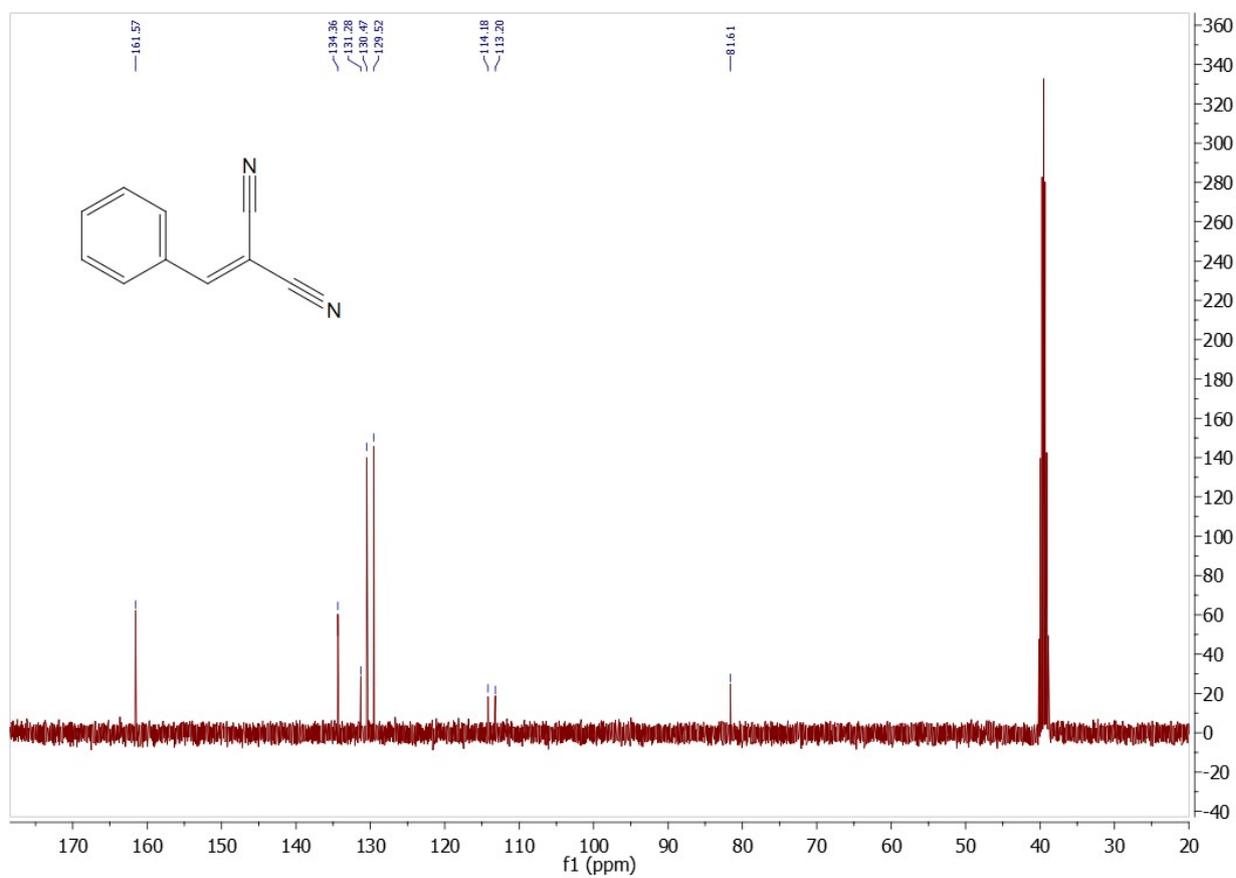


Fig. S11. ^{13}C NMR analysis of 2-benzylidenepropanedinitrile.

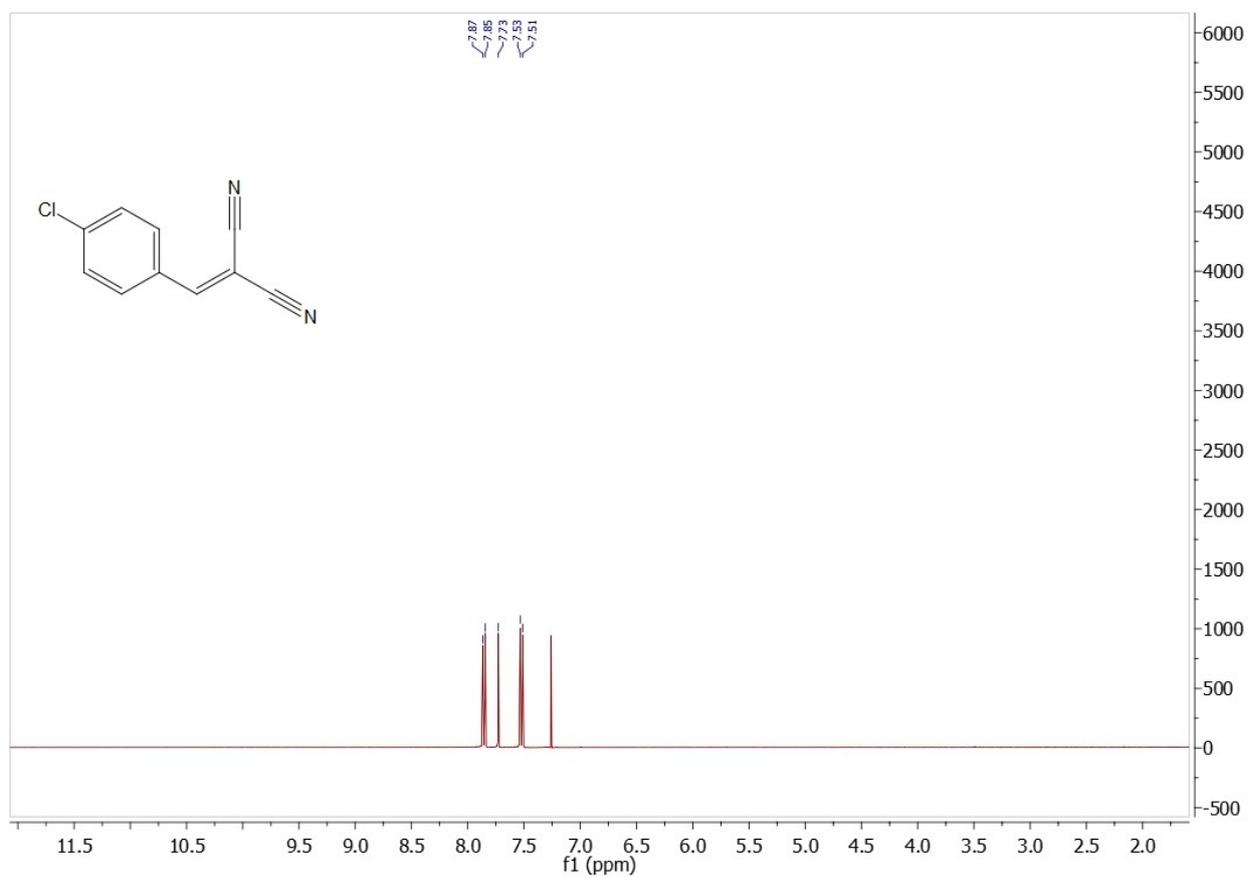


Fig. S12. ¹H NMR analysis of 2-(4-chlorobenzylidene)malononitrile.

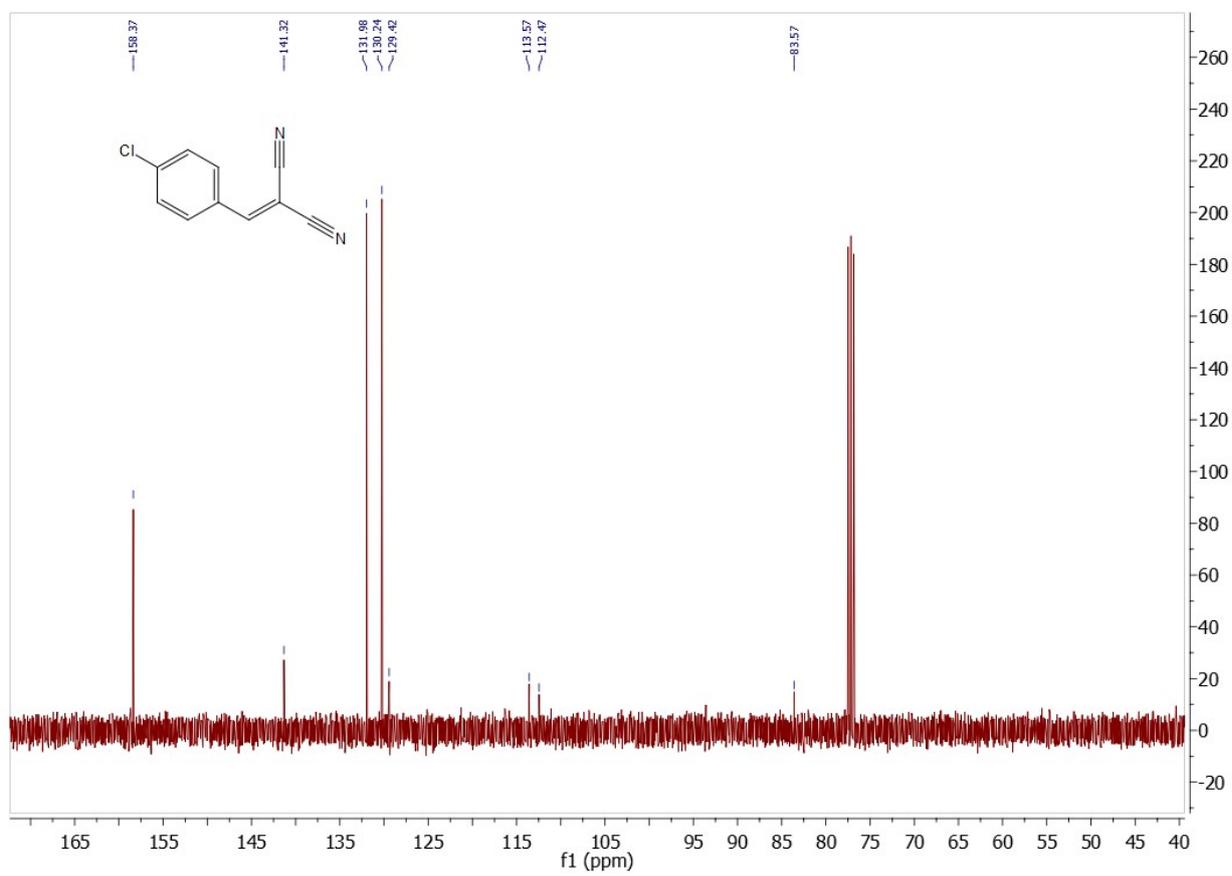


Fig. S13. ^{13}C NMR analysis of 2-(4-chlorobenzylidene)malononitrile.

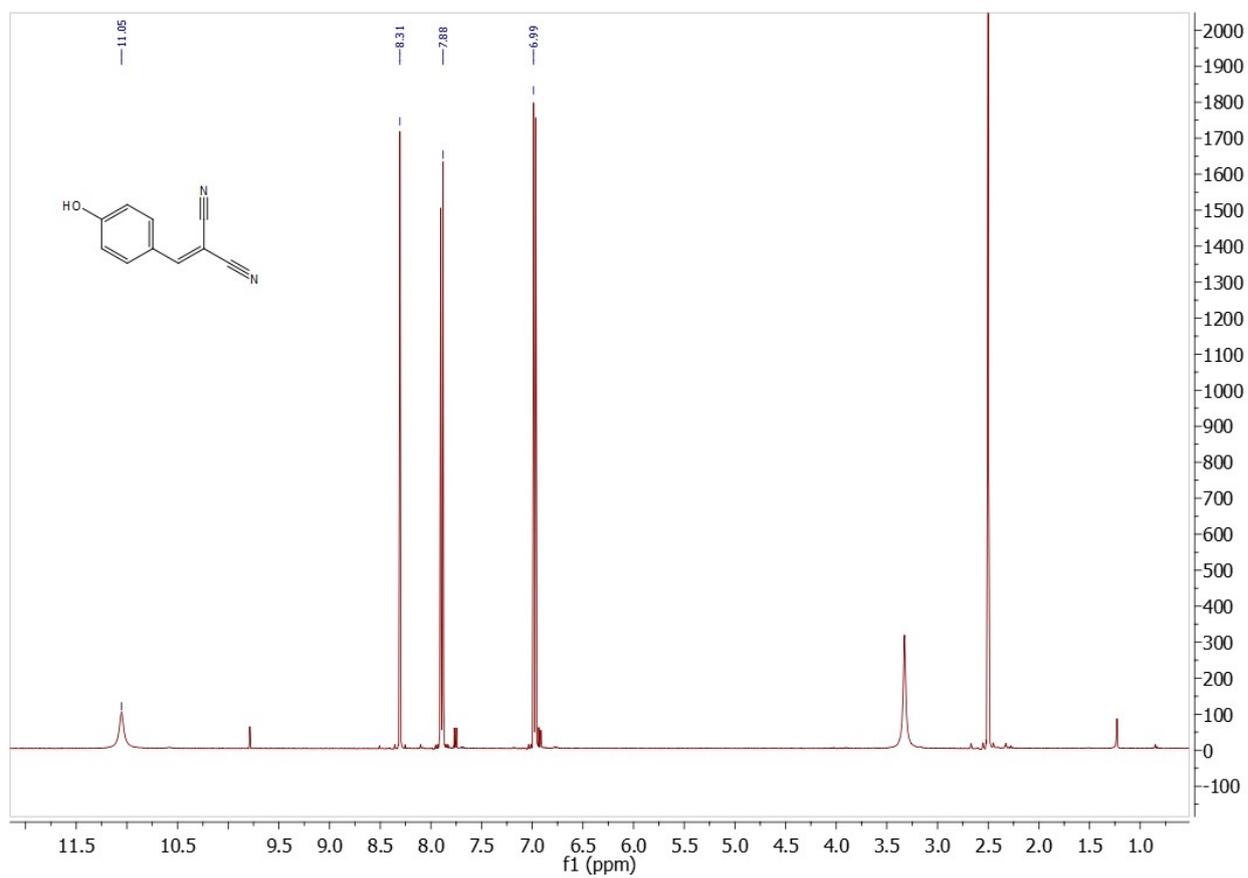


Fig. S14. ¹H NMR analysis of 2-(4-hydroxybenzylidene)malononitrile.

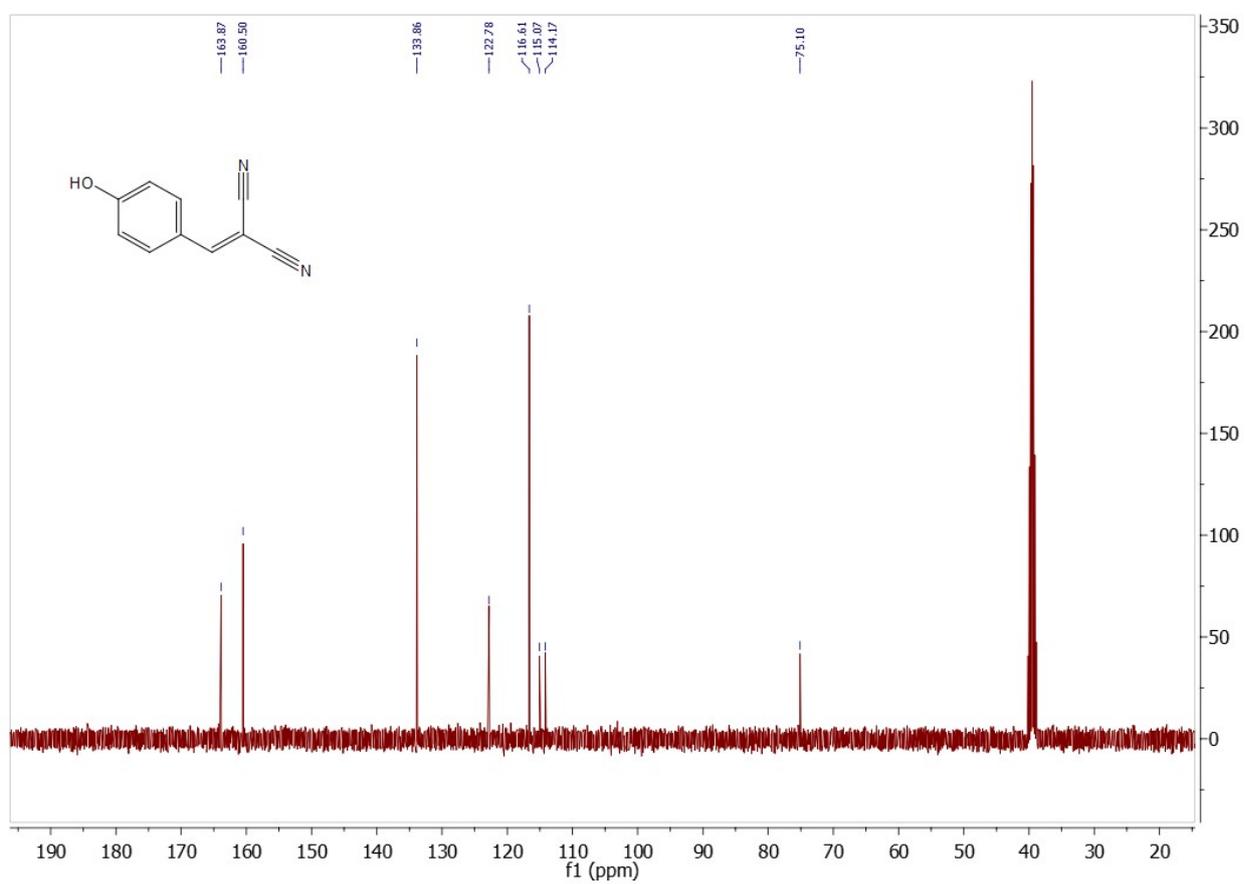


Fig. S15. ^{13}C NMR analysis of 2-(4-hydroxybenzylidene)malononitrile.

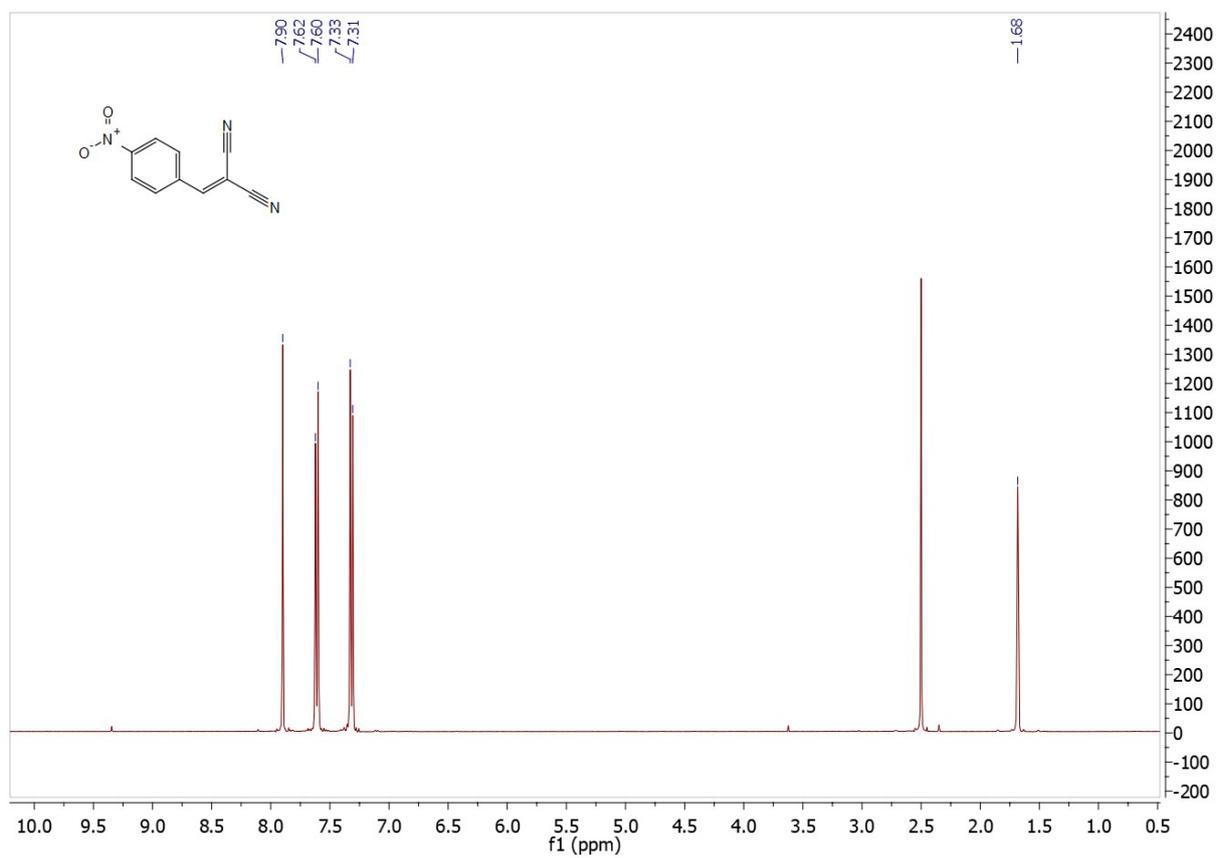


Fig. S16. ¹H NMR analysis of 2-(4-nitrobenzylidene)malononitrile.

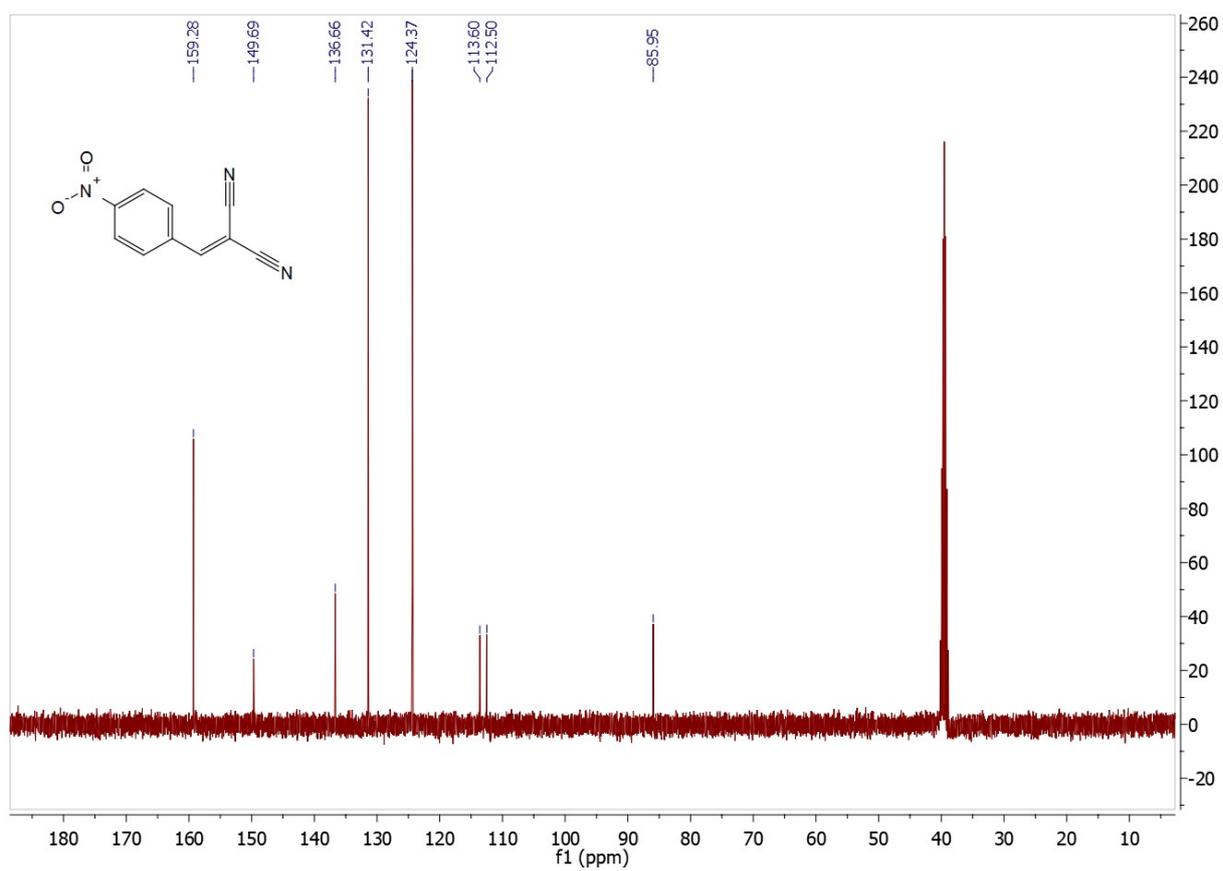


Fig. S17. ^{13}C NMR analysis of 2-(4-nitrobenzylidene)malononitrile.

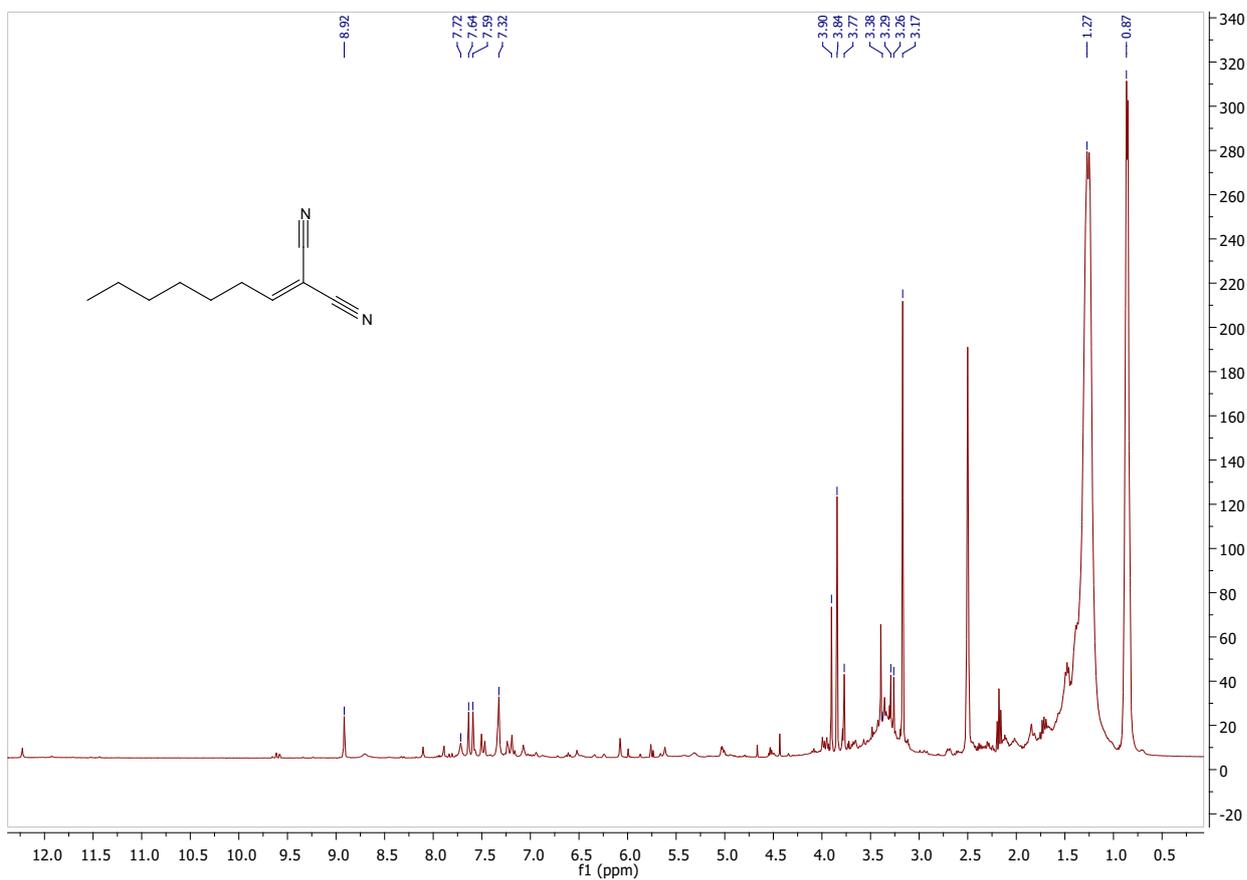


Fig. S18. ^1H NMR analysis of 2-(heptan-1-ylidene)malonitrile.

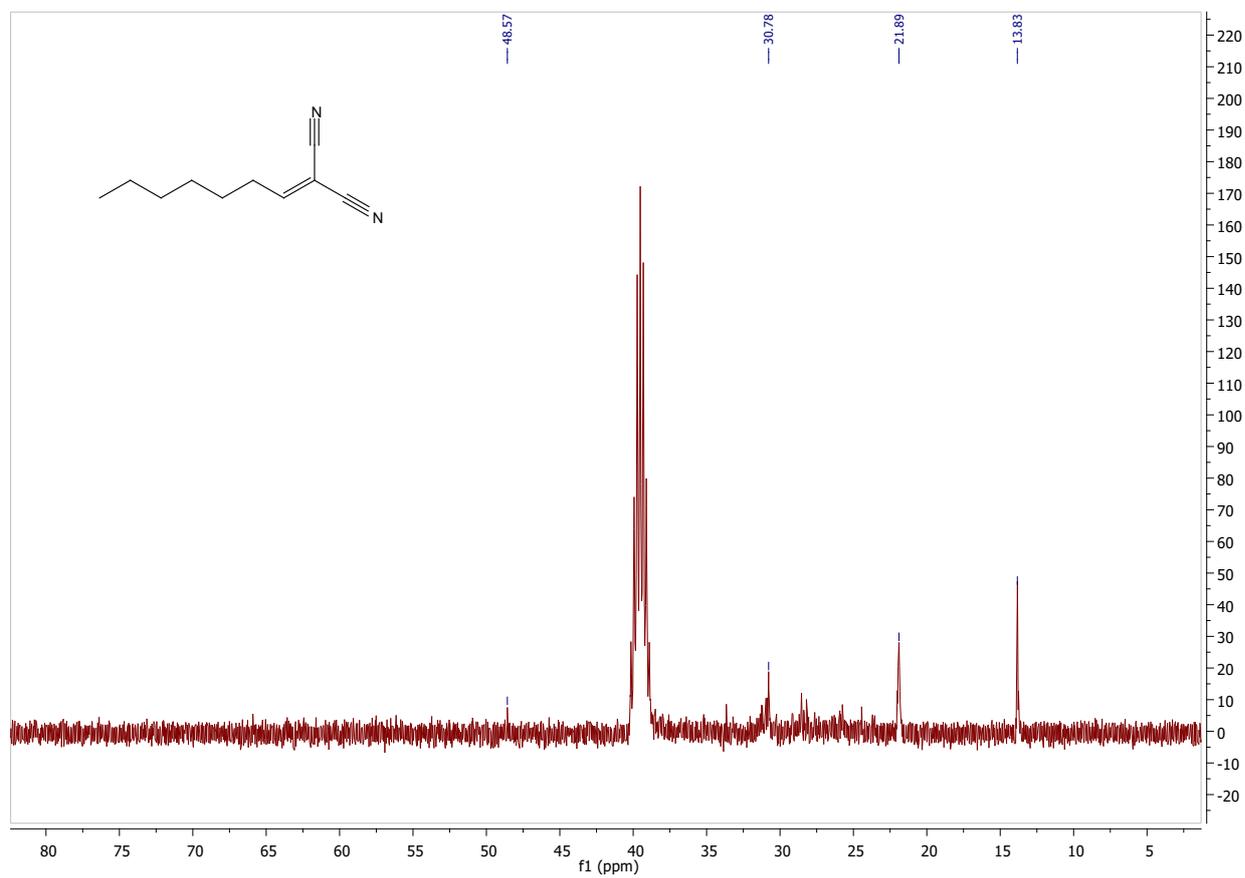


Fig. S19. ^{13}C NMR analysis of 2-(heptan-1-ylidene)malononitrile.

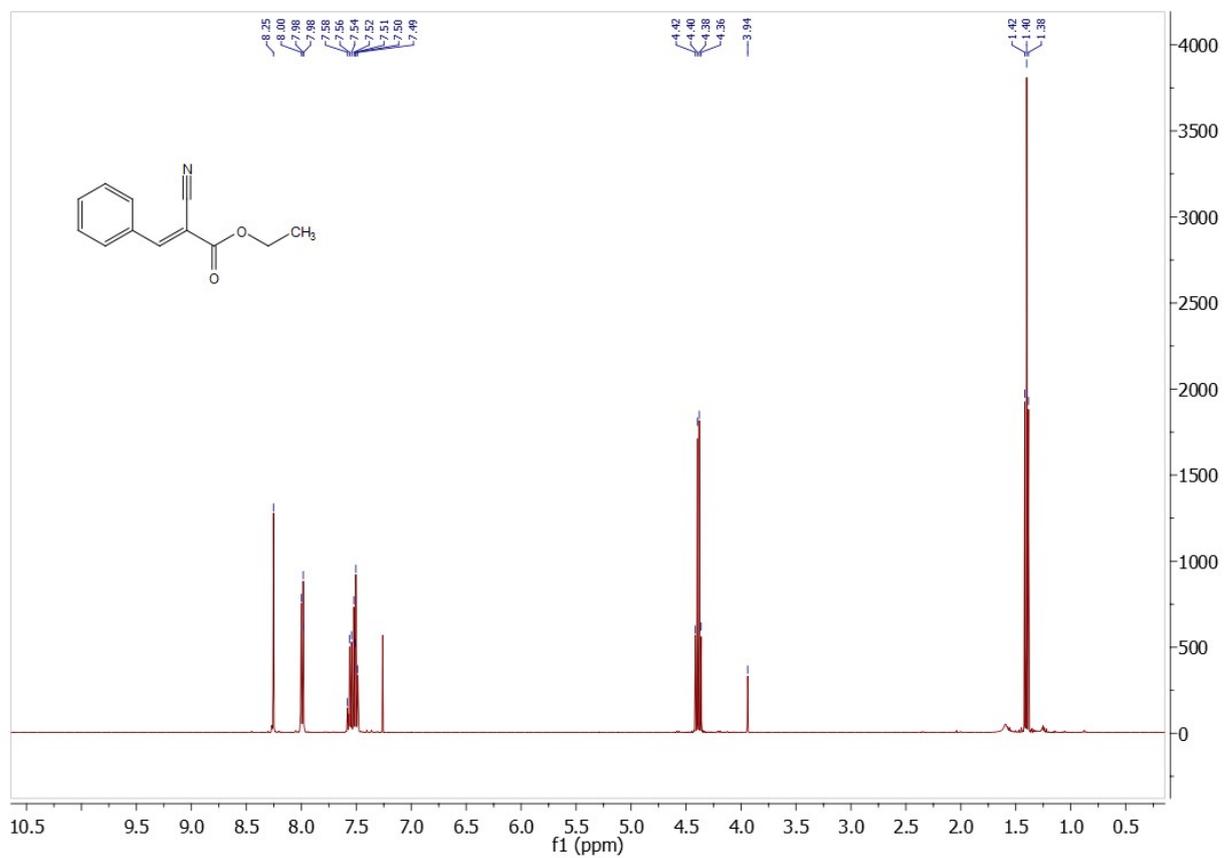


Fig. S20. ^1H NMR analysis of ethyl 2-cyano-3-phenylacrylate.

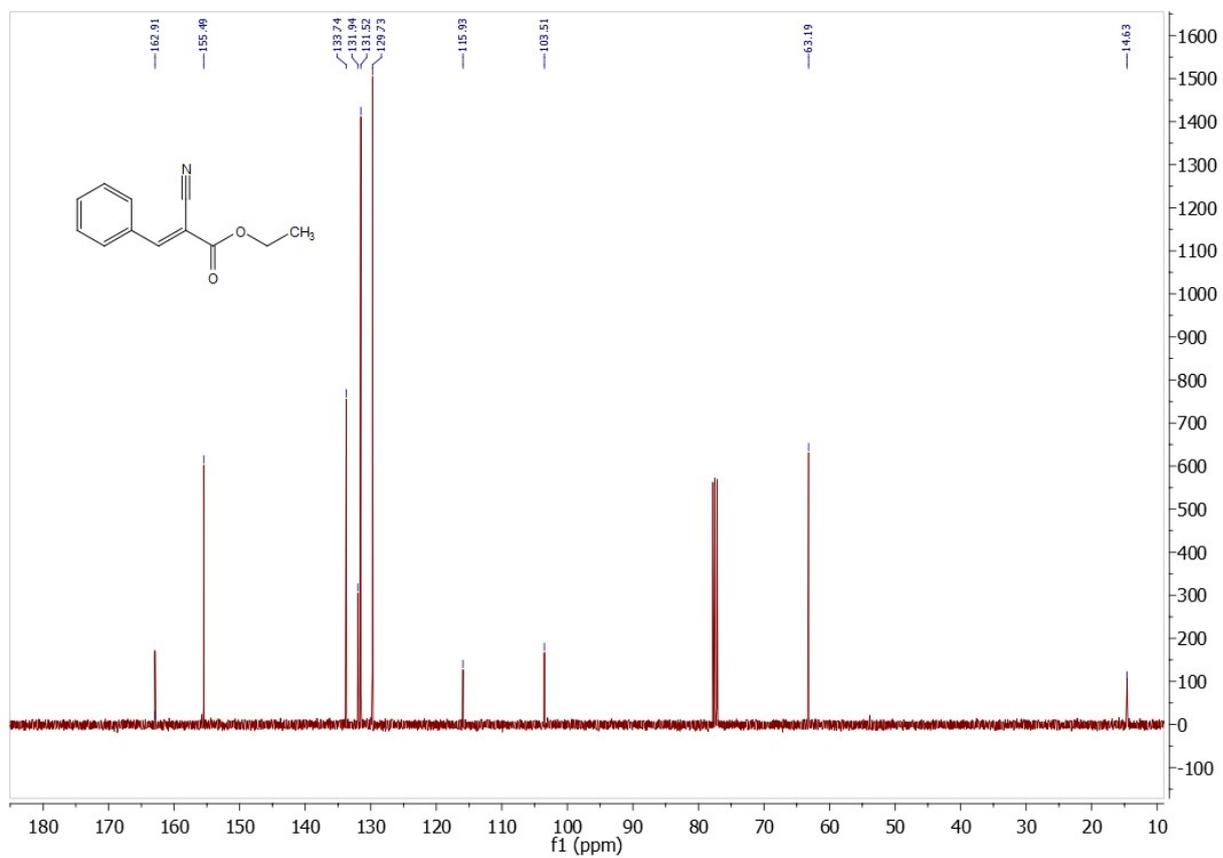


Fig. S21. ^{13}C NMR analysis of ethyl 2-cyano-3-phenylacrylate.

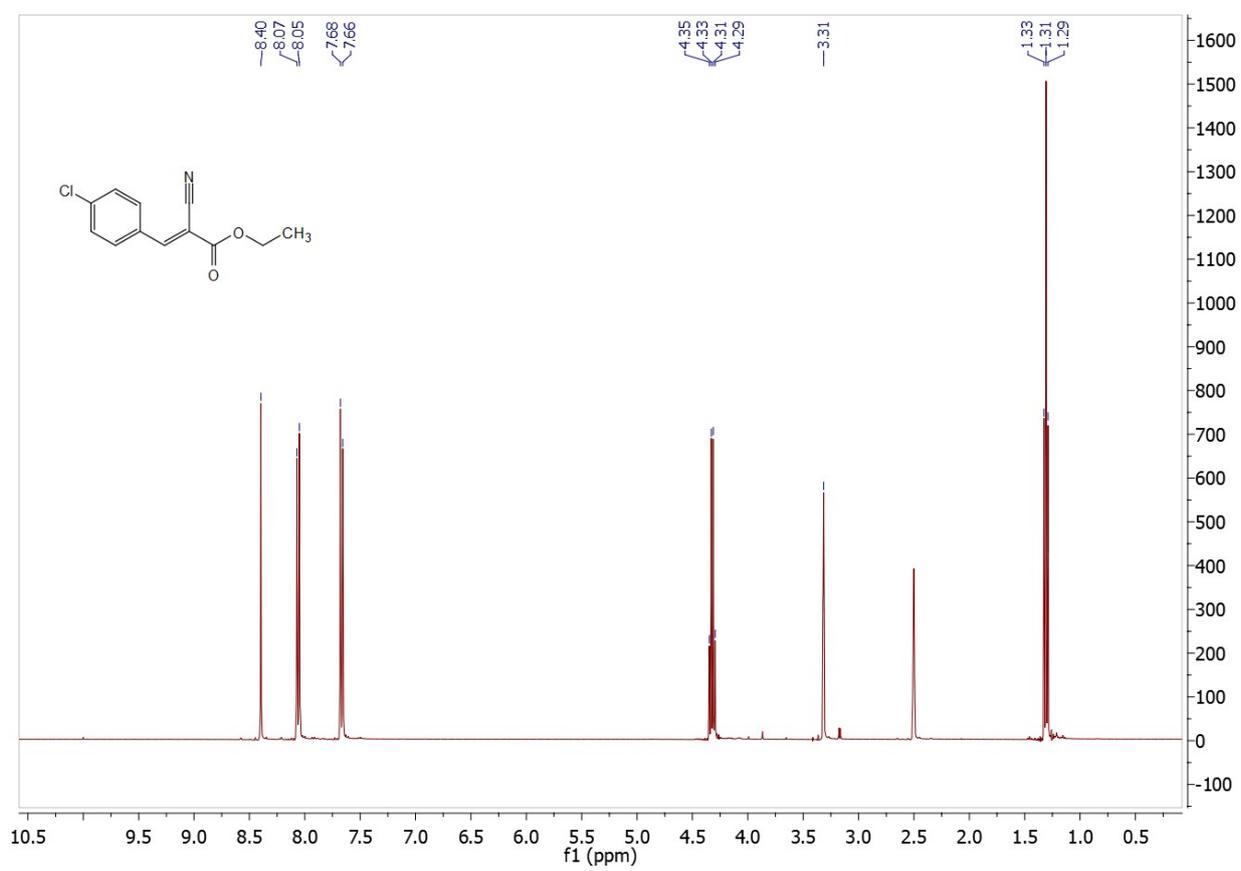


Fig. S22. ¹H NMR analysis of ethyl 2-cyano-3-(4-chlorophenyl)acrylate.

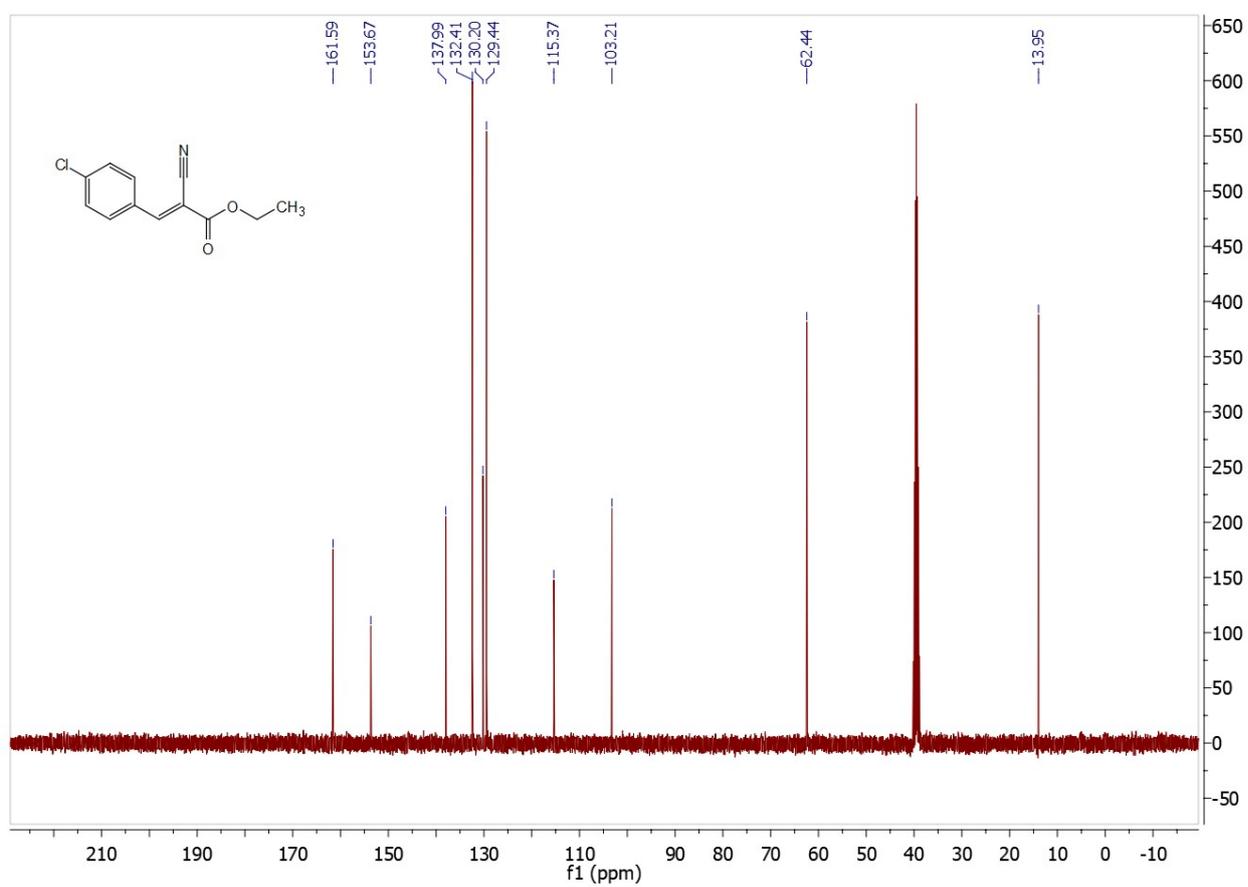


Fig. S23. ^{13}C NMR analysis of ethyl 2-cyano-3-(4-chlorophenyl)acrylate.

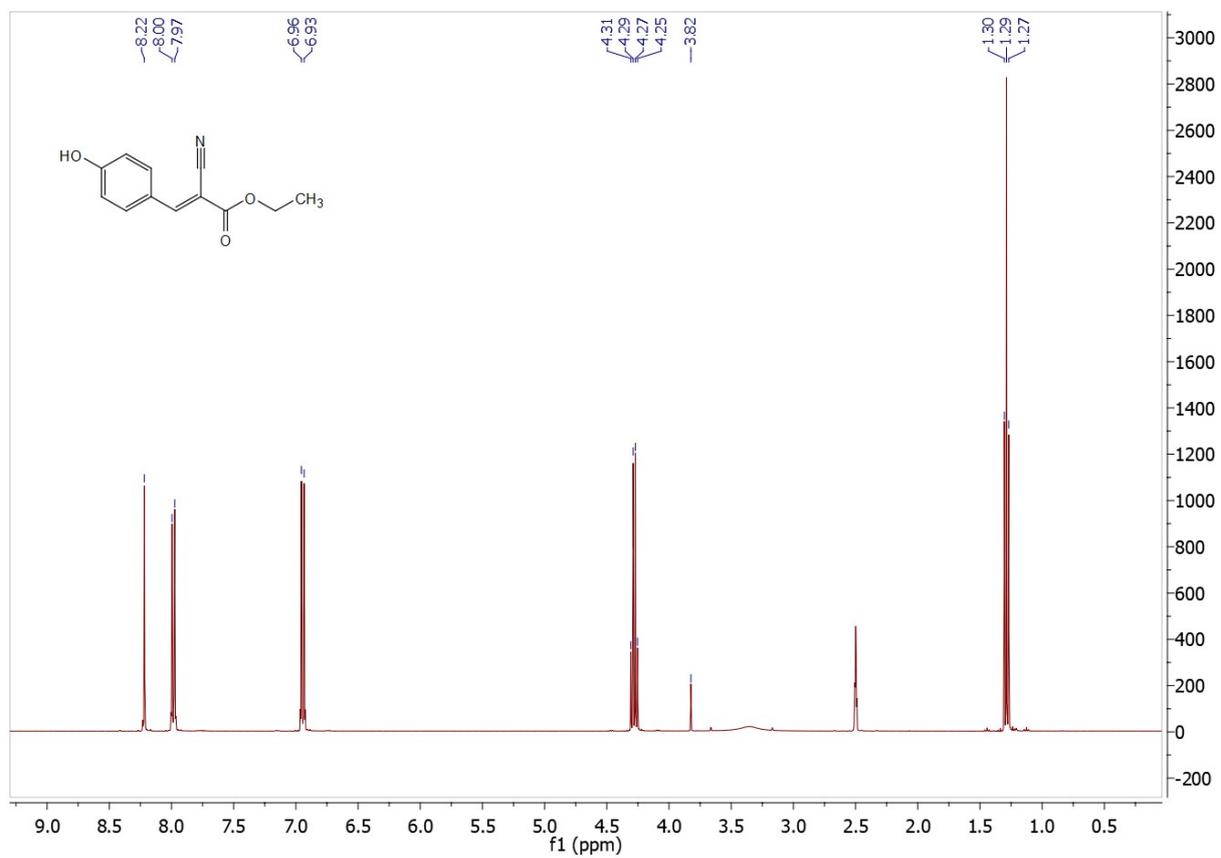


Fig. S24. ¹H NMR analysis of ethyl 2-cyano-3-(4-hydroxyphenyl)acrylate.

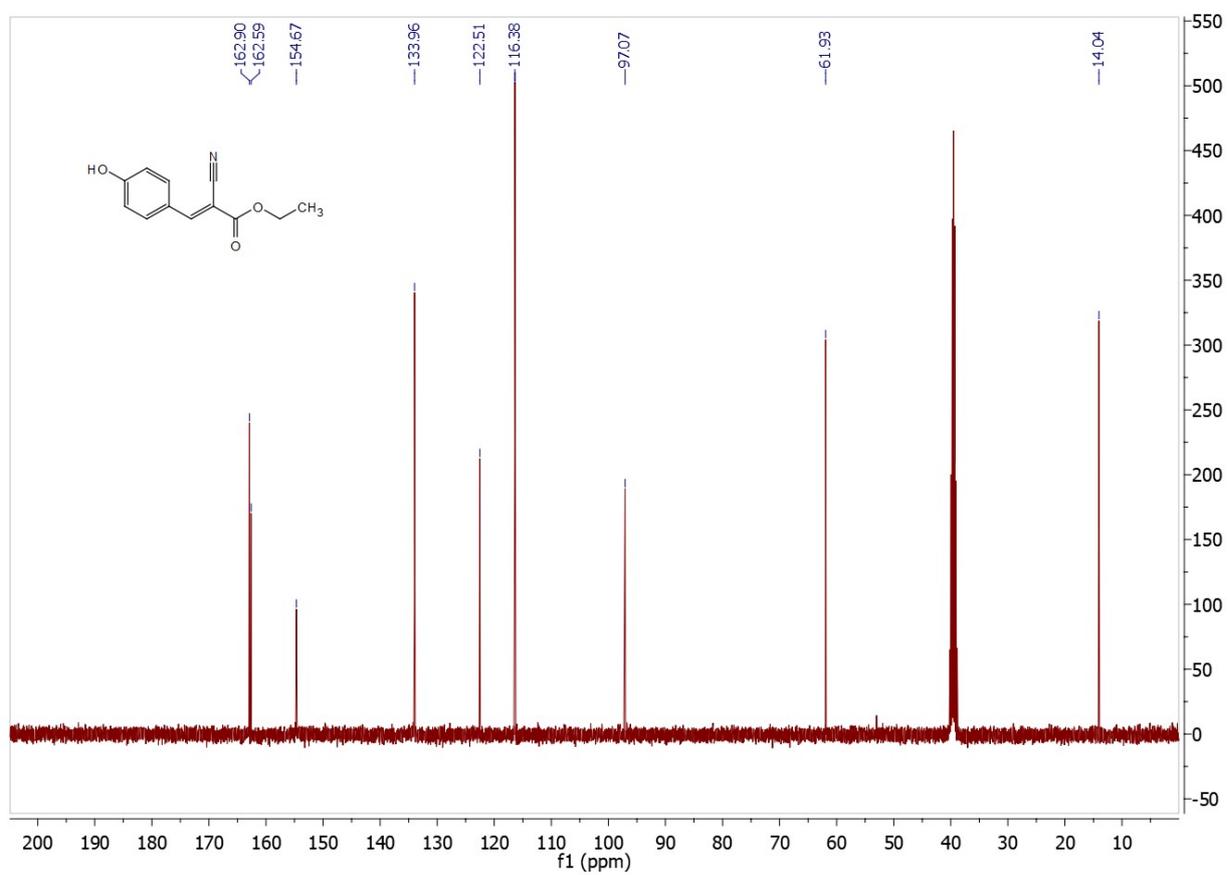


Fig. S25. ^{13}C NMR analysis of ethyl 2-cyano-3-(4-hydroxyphenyl)acrylate.

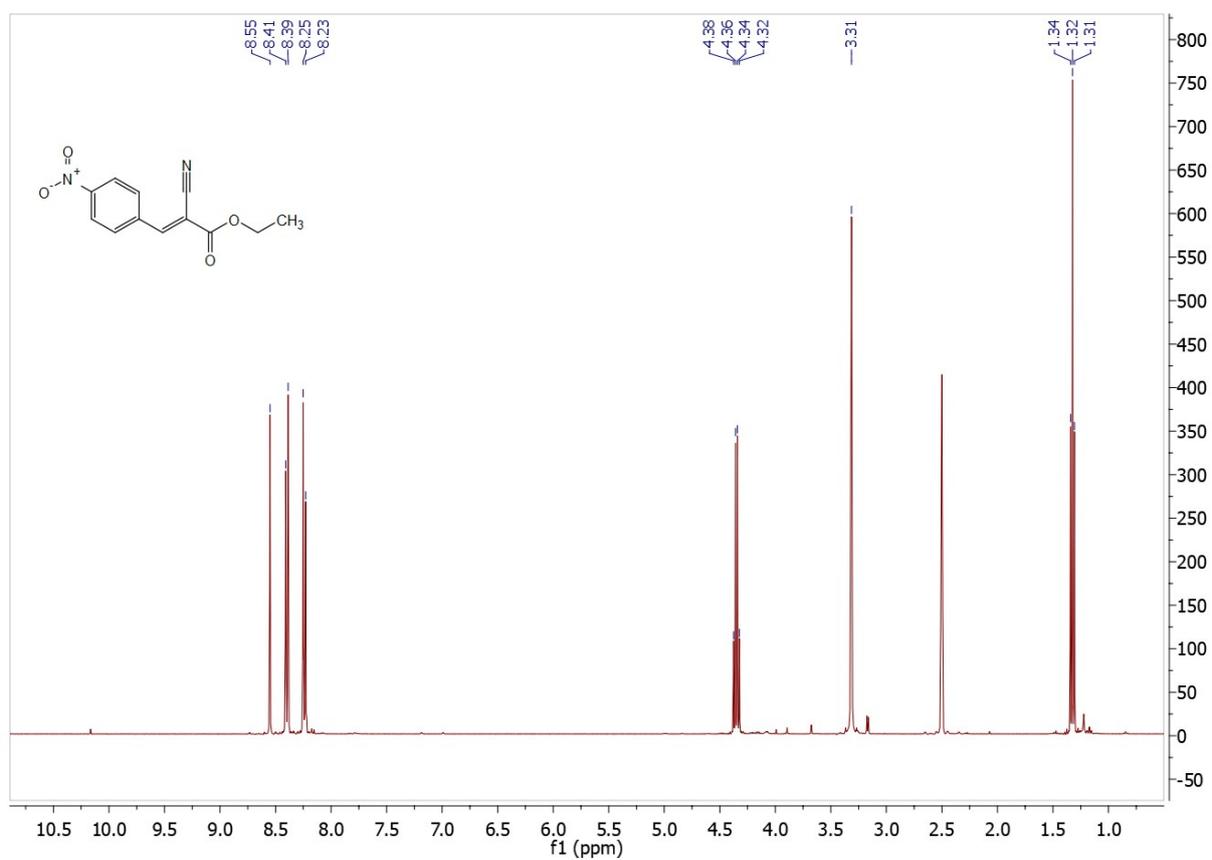


Fig. S26. ¹H NMR analysis of ethyl 2-cyano-3-(4-nitrophenyl)acrylate.

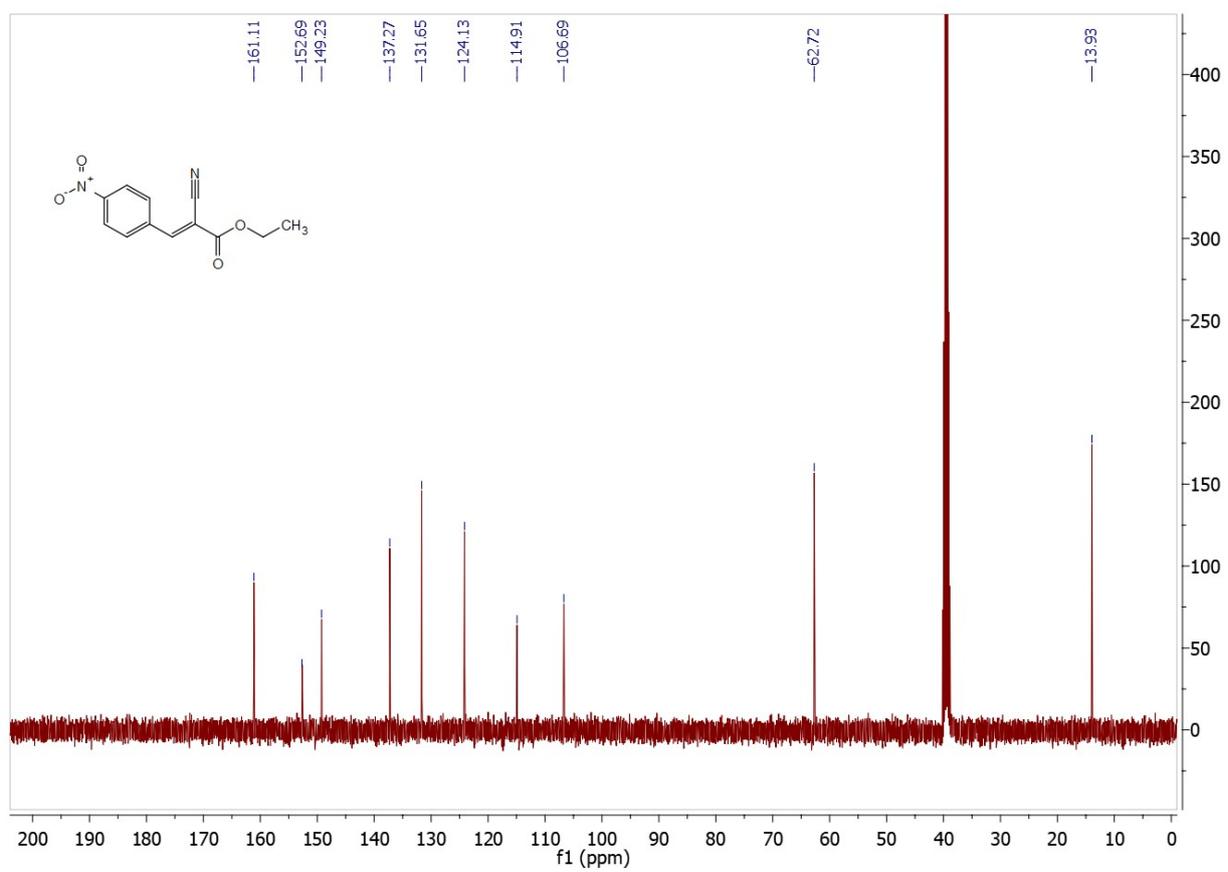


Fig. S27. ^{13}C NMR analysis of ethyl 2-cyano-3-(4-nitrophenyl)acrylate.

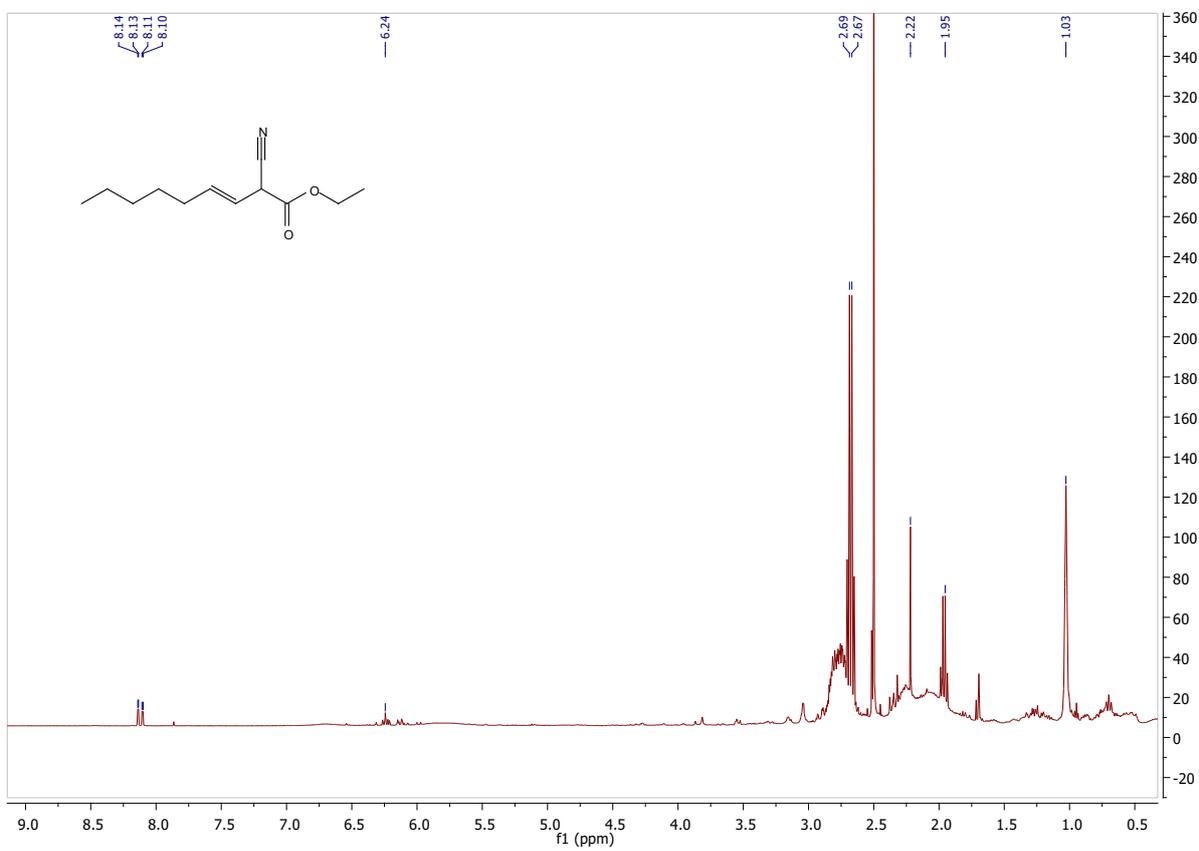


Fig. S28. ¹H NMR analysis of ethyl 2-cyano-3-nonenoate.

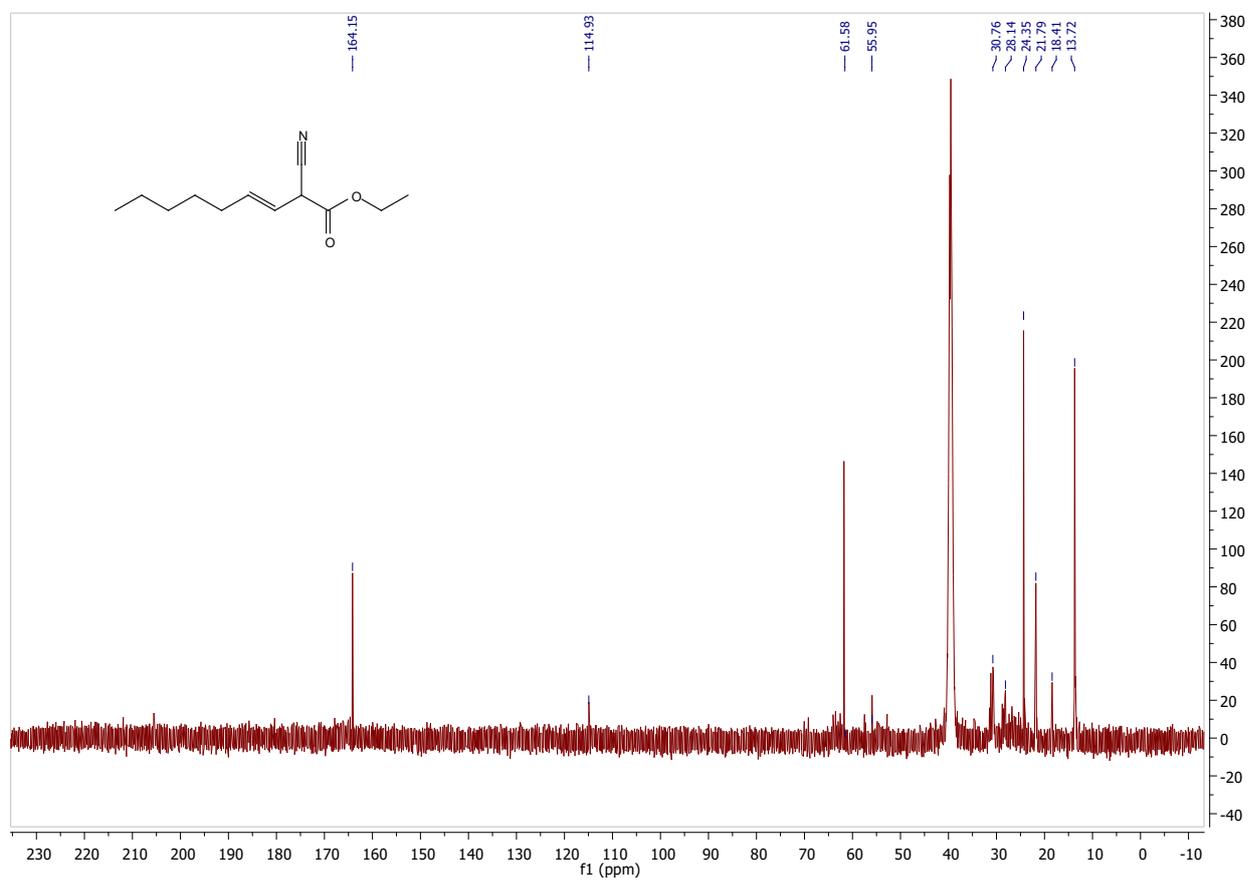


Fig. S29. ^{13}C NMR analysis of ethyl 2-cyano-3-nonenolate.

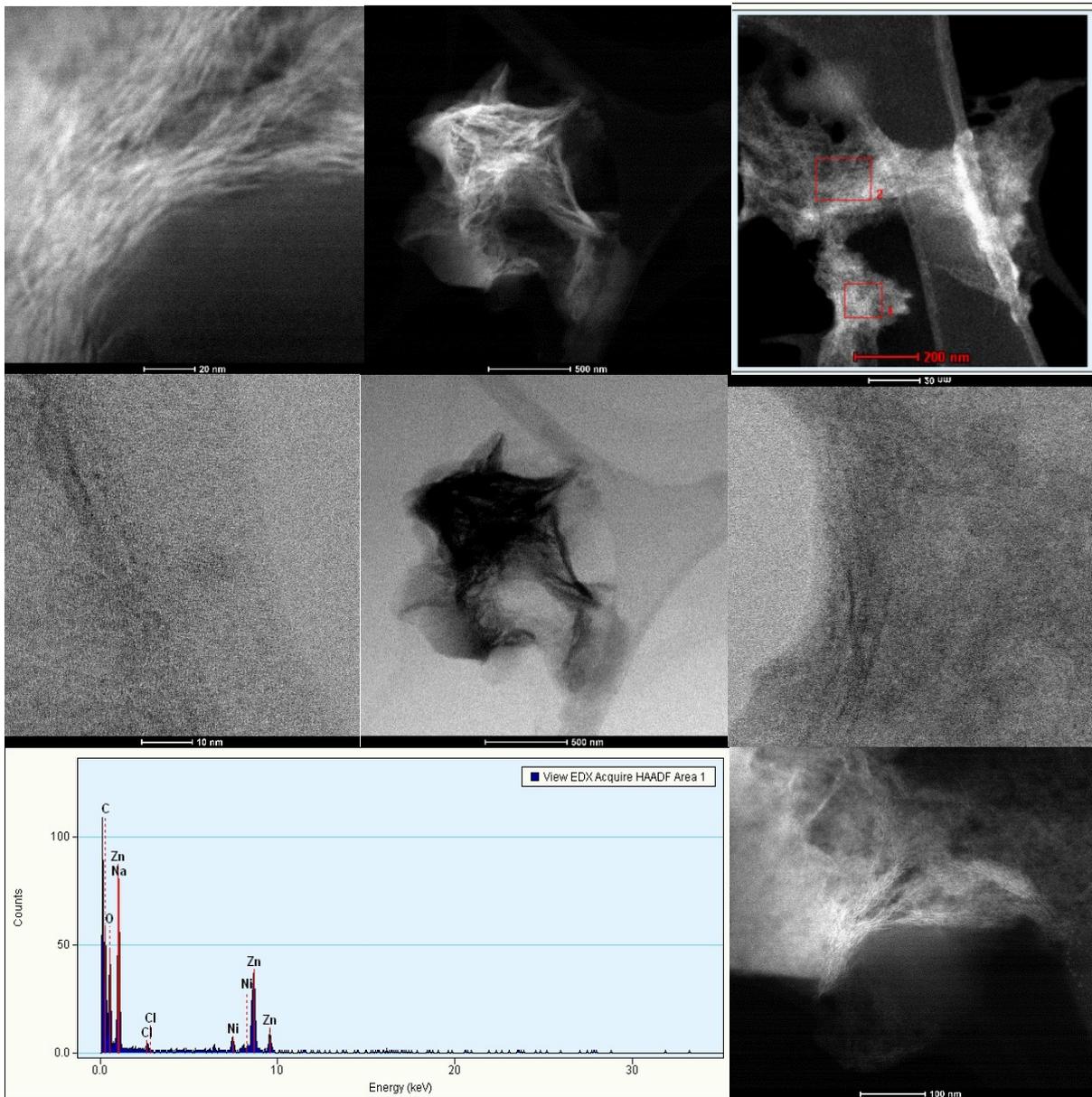


Fig. S26. TEM image of BetCl-ZnO hybrid material.

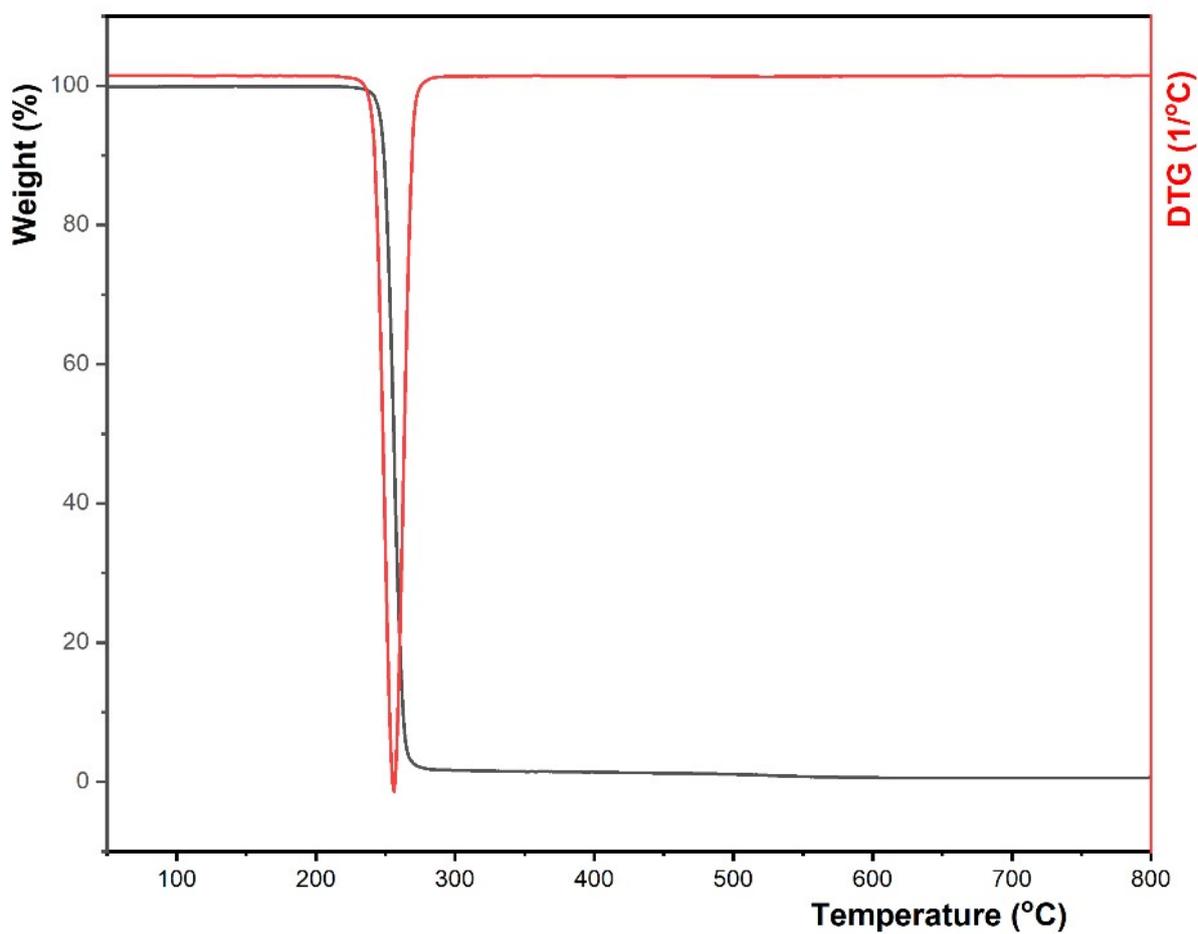


Fig. S27. Thermogravimetric analysis of BetCl-ZnO hybrid material after 4 hrs.

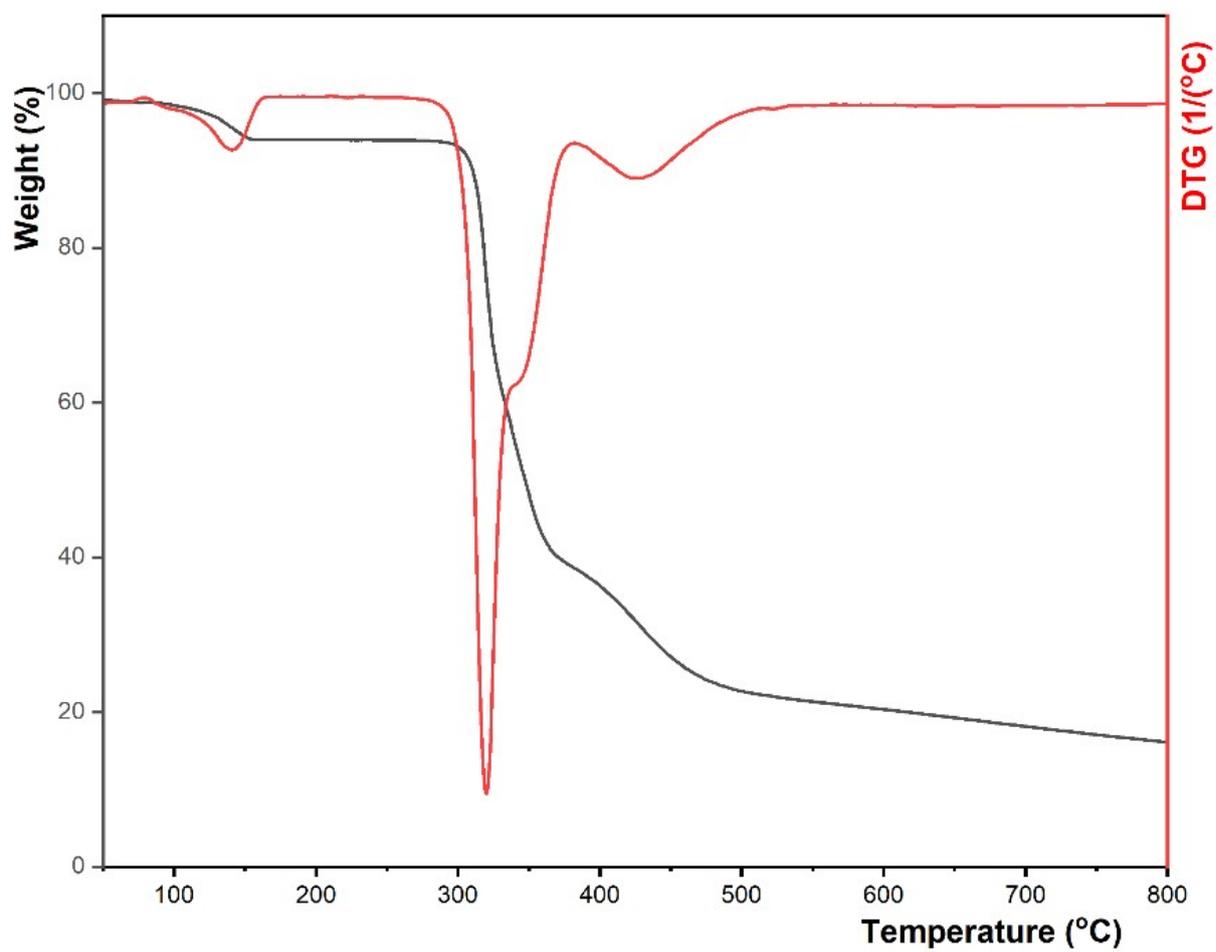


Fig. S28. Thermogravimetric analysis of BetCl-ZnO hybrid material after 1 day.

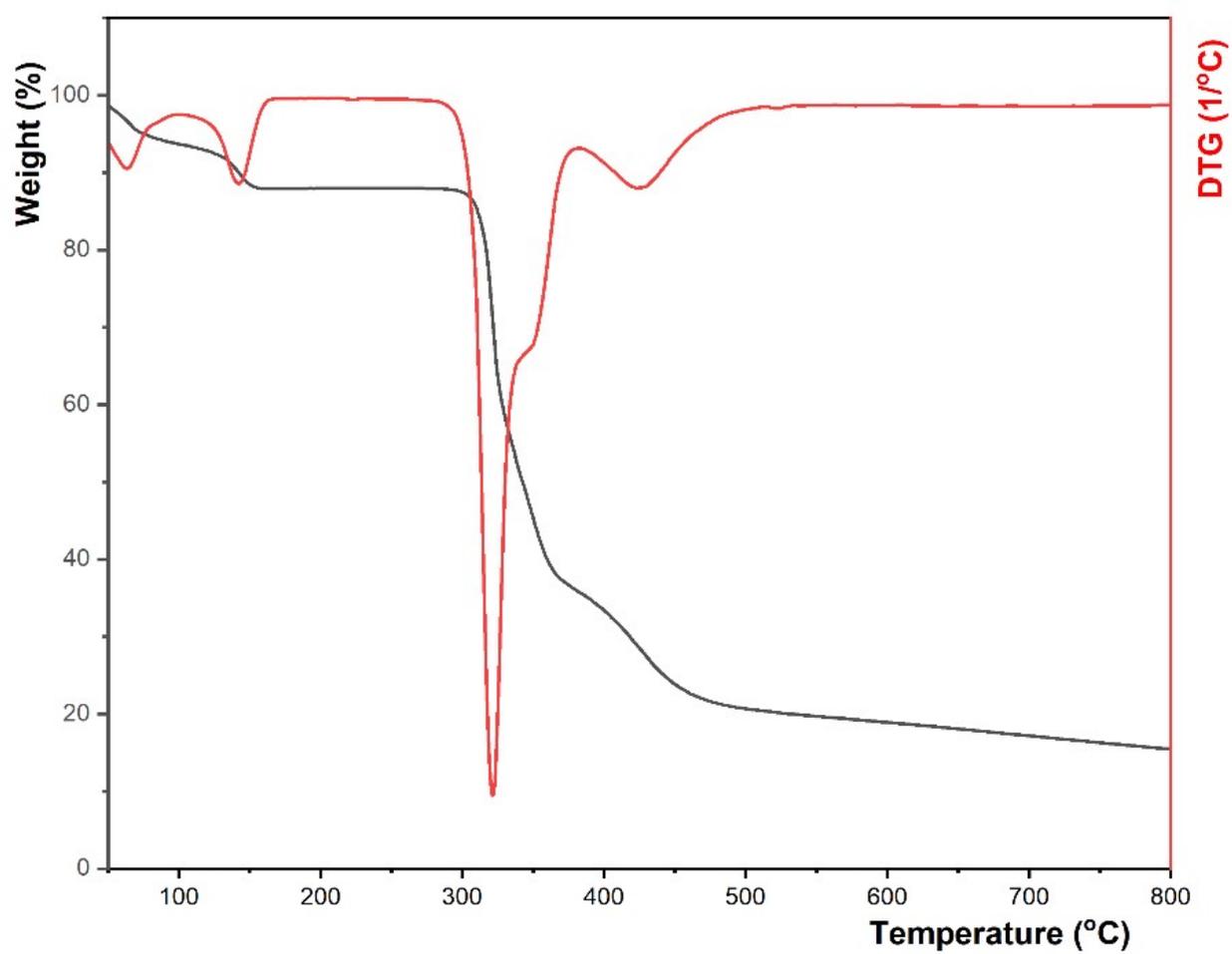


Fig. S29. Thermogravimetric analysis of BetCl-ZnO in 3 days.

Literature

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