

Chemical characterisation, α -glucosidase, α -amylase and lipase inhibitory properties of the Australian honey bee propolis

Sabah Uddin¹, Peter R. Brooks^{1,2}, and Trong D. Tran^{1,2,*}

¹ School of Science, Technology and Engineering, University of the Sunshine Coast, Maroochydore DC, Queensland 4558, Australia; ttran1@usc.edu.au

² Centre for Bioinnovation, University of the Sunshine Coast, Maroochydore DC, Queensland 4558, Australia.

* Correspondence: ttran1@usc.edu.au; Tel: +61 7 5459 4579

Supplementary Materials

Figure S1. ¹H Spectrum of **1** in MeOH-*d*₄

Figure S2. ¹³C Spectrum of **1** in MeOH-*d*₄

Figure S3. HSQC Spectrum of **1** in MeOH-*d*₄

Figure S4. gCOSY Spectrum of **1** in MeOH-*d*₄

Figure S5. HMBC Spectrum of **1** in MeOH-*d*₄

Figure S6. ¹H Spectrum of **2** in MeOH-*d*₄

Figure S7. ¹³C Spectrum of **2** in MeOH-*d*₄

Figure S8. HSQC Spectrum of **2** in MeOH-*d*₄

Figure S9. gCOSY Spectrum of **2** in MeOH-*d*₄

Figure S10. HMBC Spectrum of **2** in MeOH-*d*₄

Figure S11. ¹H Spectrum of **3** in MeOH-*d*₄

Figure S12. ¹³C Spectrum of **3** in MeOH-*d*₄

Figure S13. HSQC Spectrum of **3** in MeOH-*d*₄

Figure S14. gCOSY Spectrum of **3** in MeOH-*d*₄

Figure S15. HMBC Spectrum of **3** in MeOH-*d*₄

Figure S16. ^1H Spectrum of **4** in $\text{MeOH-}d_4$

Figure S17. ^{13}C Spectrum of **4** in $\text{MeOH-}d_4$

Figure S18. HSQC Spectrum of **4** in $\text{MeOH-}d_4$

Figure S19. gCOSY Spectrum of **4** in $\text{MeOH-}d_4$

Figure S20. HMBC Spectrum of **4** in $\text{MeOH-}d_4$

Figure S21. ^1H Spectrum of **5** in CHCl_3-d

Figure S22. ^{13}C Spectrum of **5** in CHCl_3-d

Figure S23. HSQC Spectrum of **5** in CHCl_3-d

Figure S24. gCOSY Spectrum of **5** in CHCl_3-d

Figure S25. HMBC Spectrum of **5** in CHCl_3-d

Figure S26. ^1H Spectrum of **6** in $\text{MeOH-}d_4$

Figure S27. ^{13}C Spectrum of **6** in $\text{MeOH-}d_4$

Figure S28. HSQC Spectrum of **6** in $\text{MeOH-}d_4$

Figure S29. gCOSY Spectrum of **6** in $\text{MeOH-}d_4$

Figure S30. HMBC Spectrum of **6** in $\text{MeOH-}d_4$

Figure S31. Two-dimensional diagrams showing non-covalent interactions of **1-9** and acarbose (**10**) with α -glucosidase (2ZQ0)

Figure S32. Two-dimensional diagrams showing non-covalent interactions of **1-9** and acarbose (**10**) with α -amylase (2QV4)

Figure S33. Two-dimensional diagrams showing non-covalent interactions of **1-9** and orlistat (**11**) with lipase (6KSM)

Figure S1. ^1H Spectrum of **1** in $\text{MeOH-}d_4$.

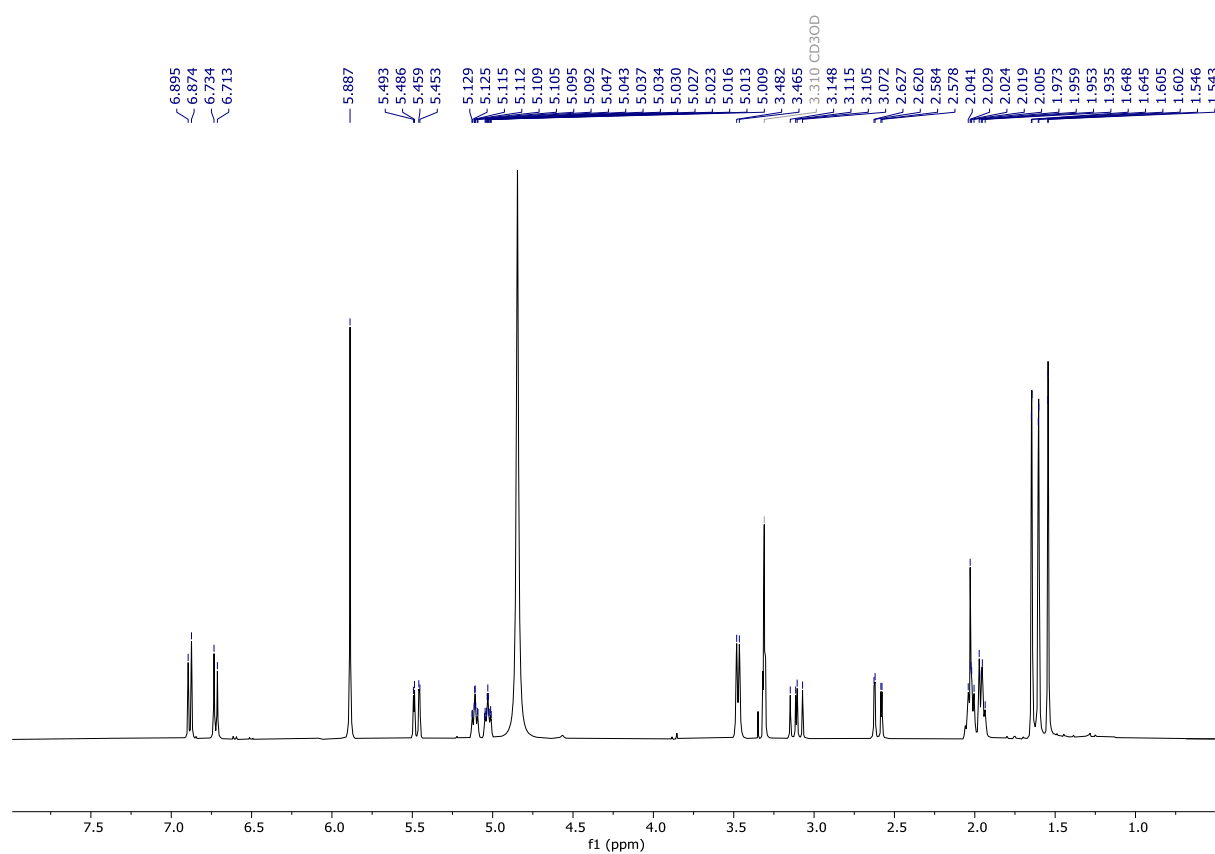


Figure S2. ^{13}C Spectrum of **1** in $\text{MeOH-}d_4$.

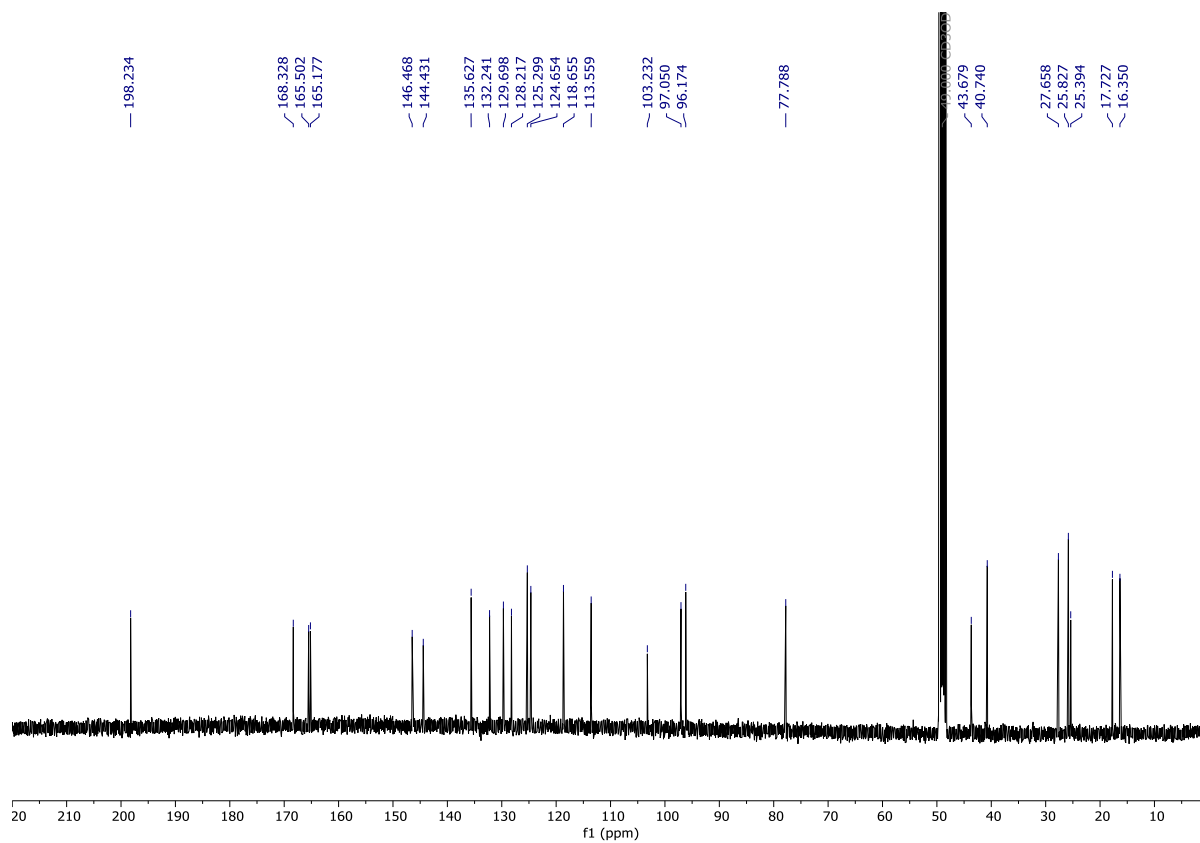


Figure S3. HSQC Spectrum of **1** in MeOH-*d*₄.

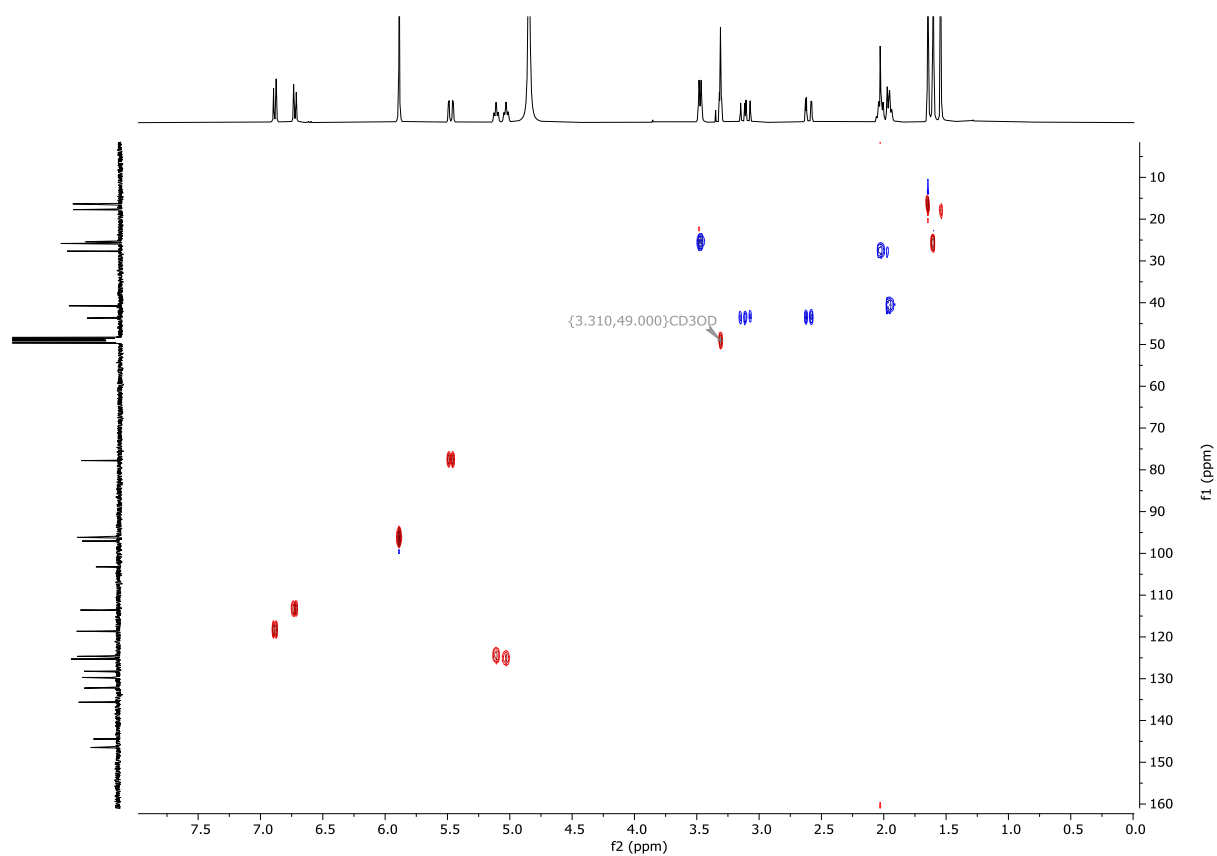


Figure S4. gCOSY Spectrum of **1** in MeOH-*d*₄.

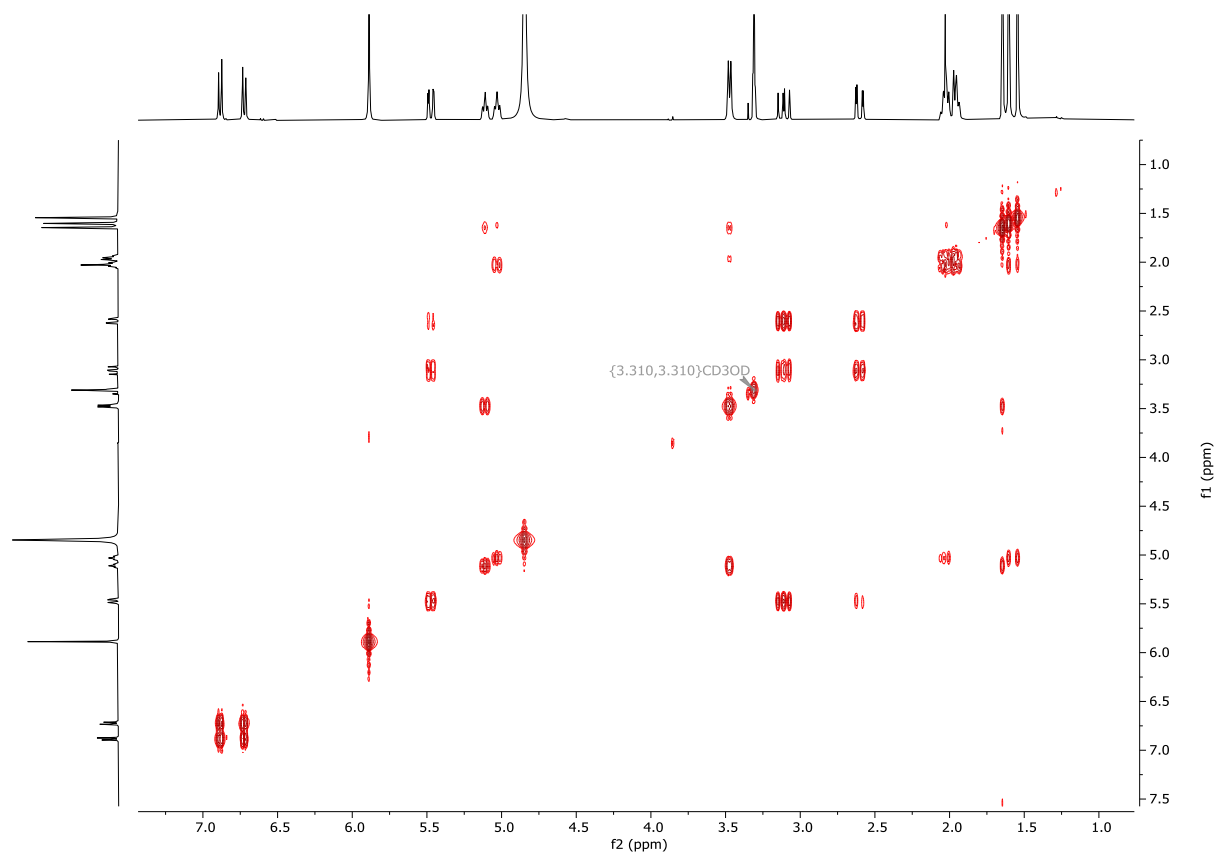


Figure S5. HMBC Spectrum of **1** in MeOH- d_4 .

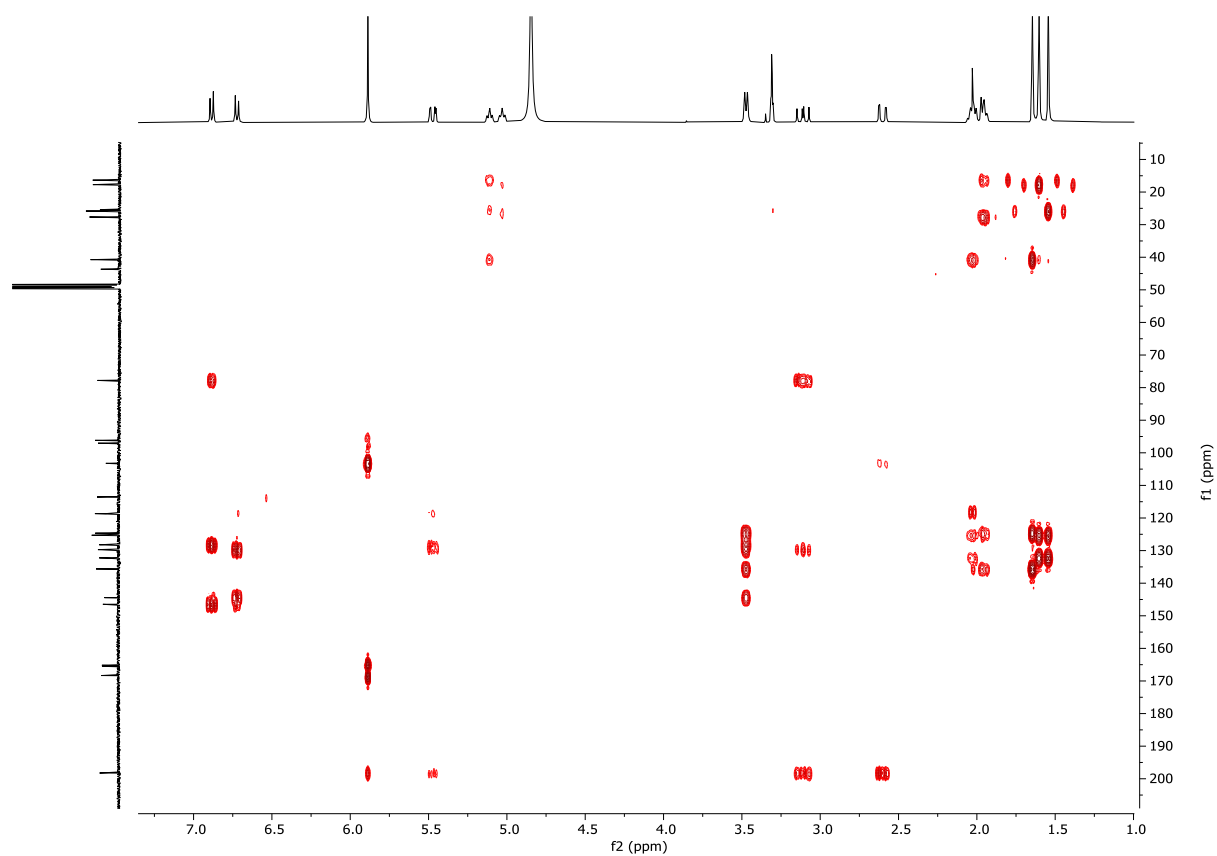


Figure S6. ^1H Spectrum of **2** in MeOH- d_4 .

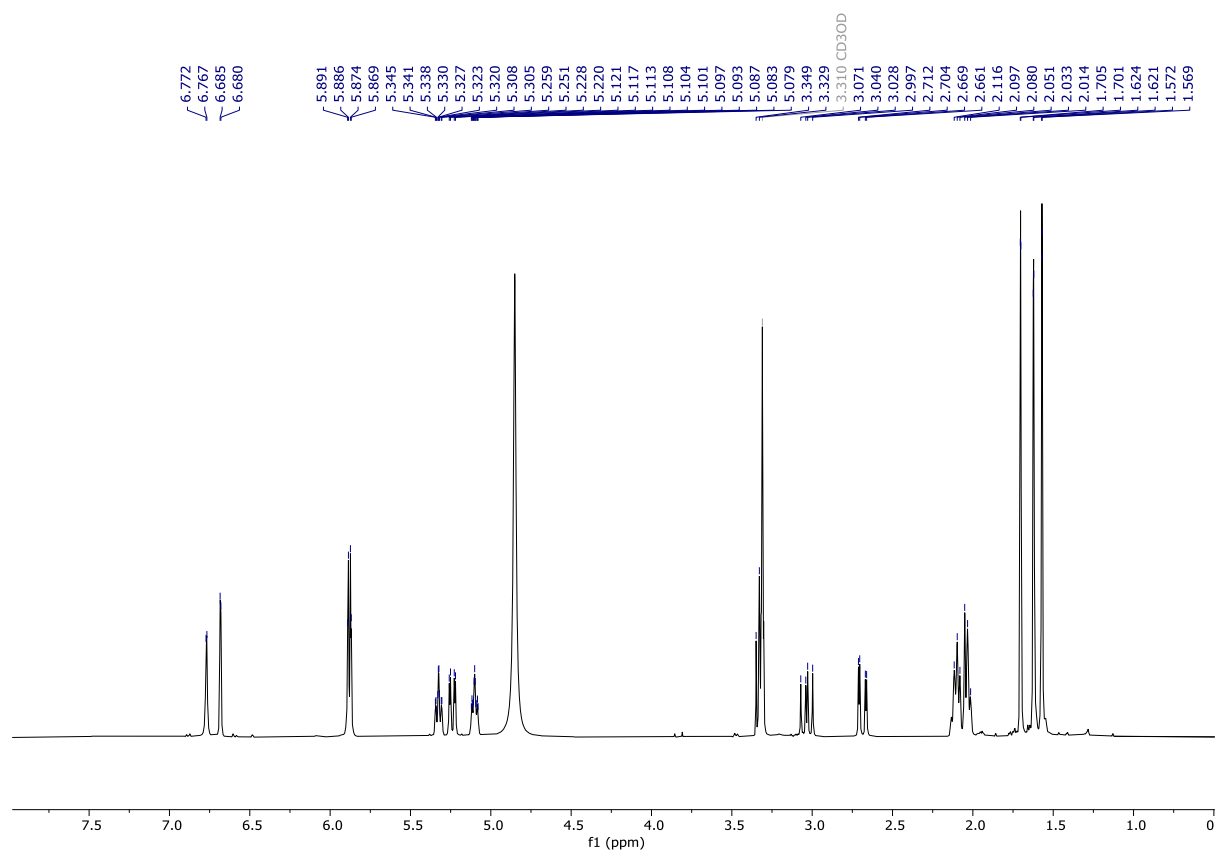


Figure S7. ^{13}C Spectrum of **2** in $\text{MeOH-}d_4$.

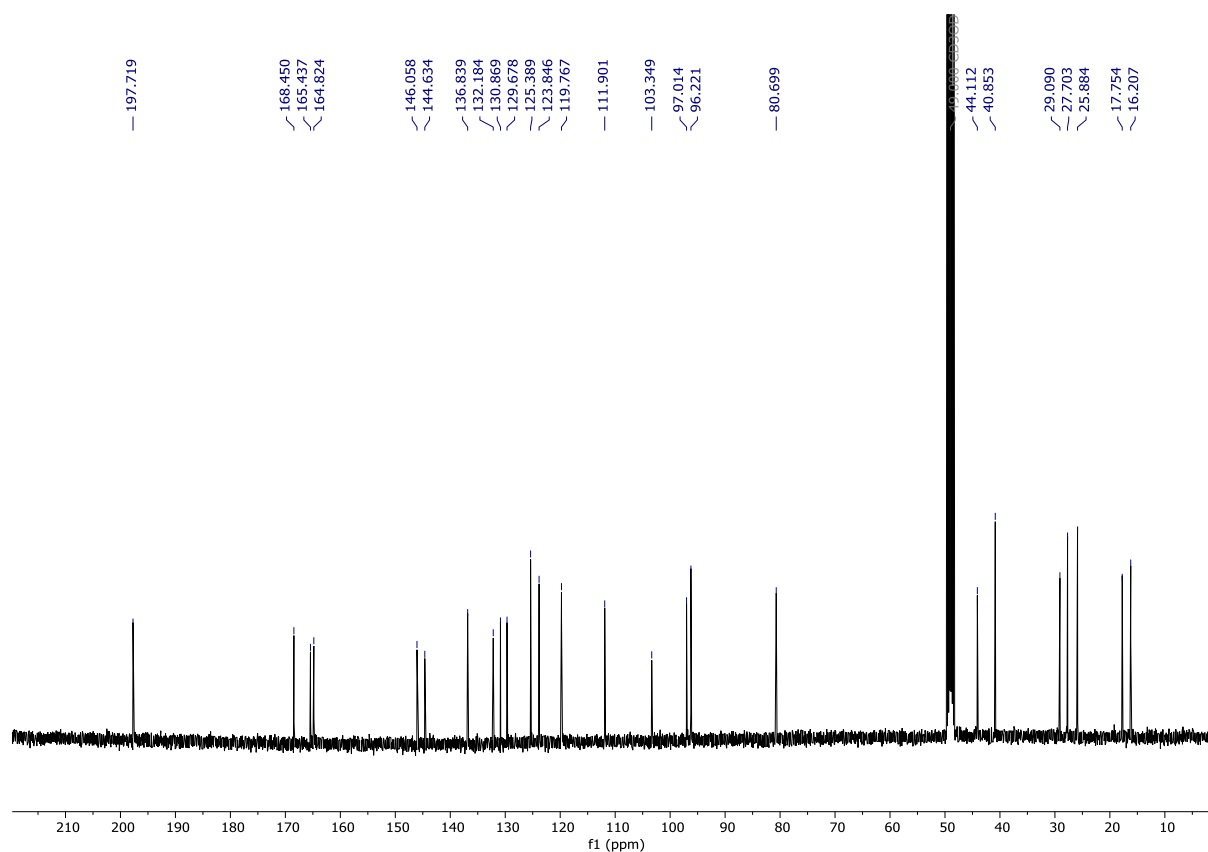


Figure S8. HSQC Spectrum of **2** in $\text{MeOH-}d_4$.

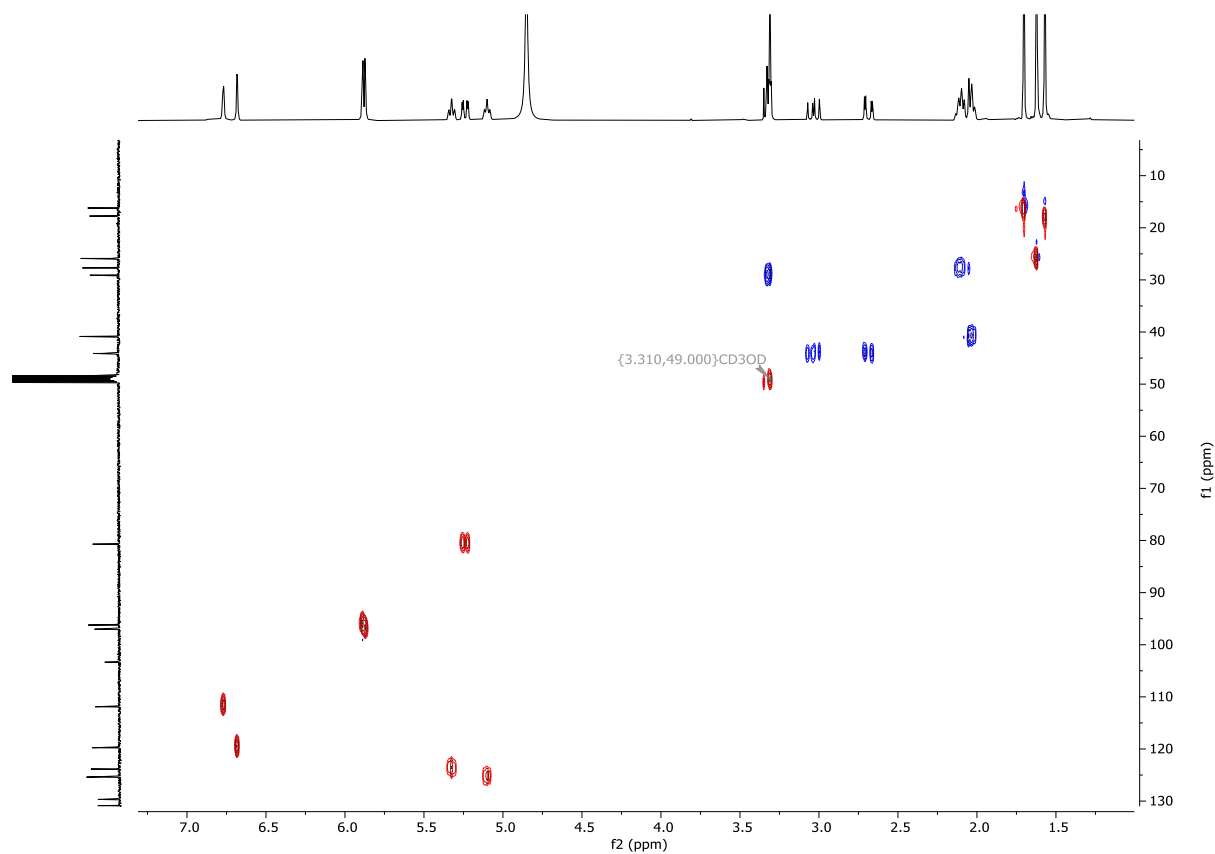


Figure S9. gCOSY Spectrum of **2** in MeOH-*d*₄.

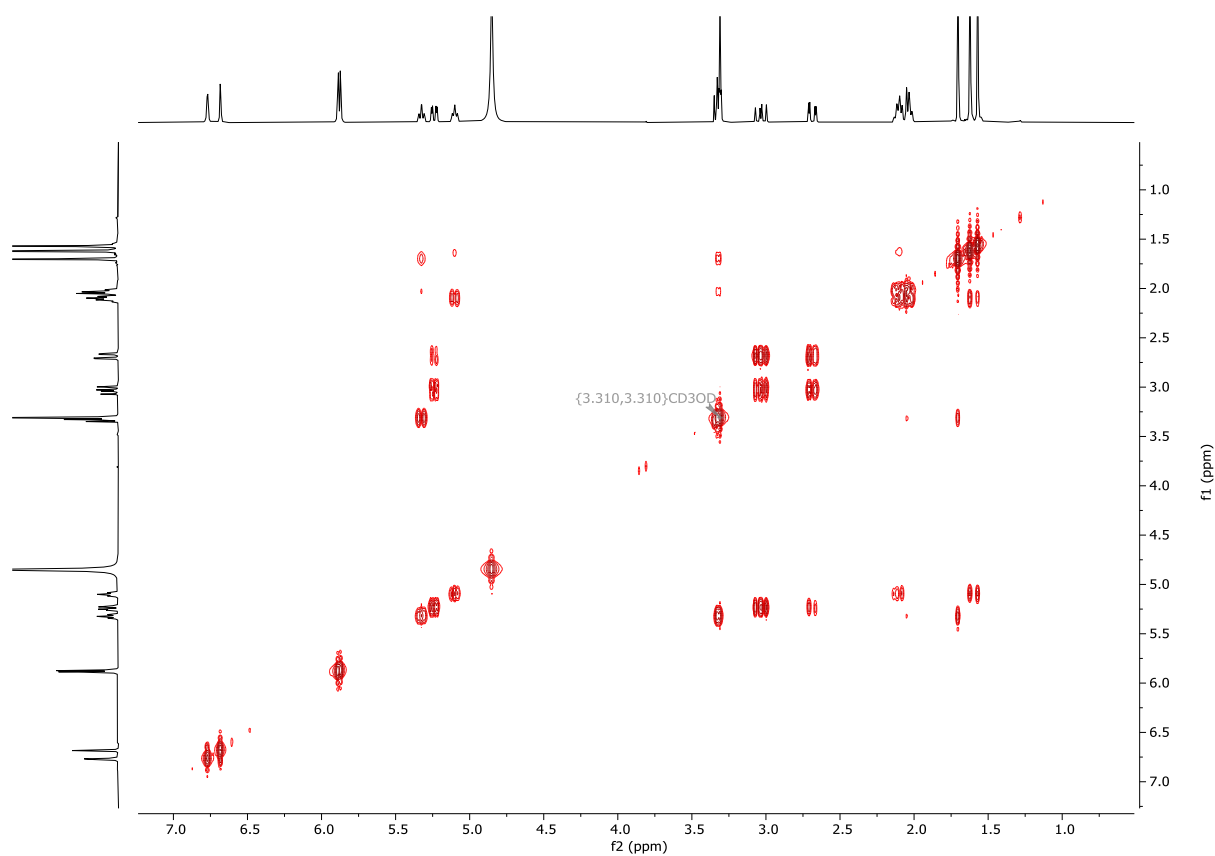


Figure S10. HMBC Spectrum of **2** in MeOH-*d*₄.

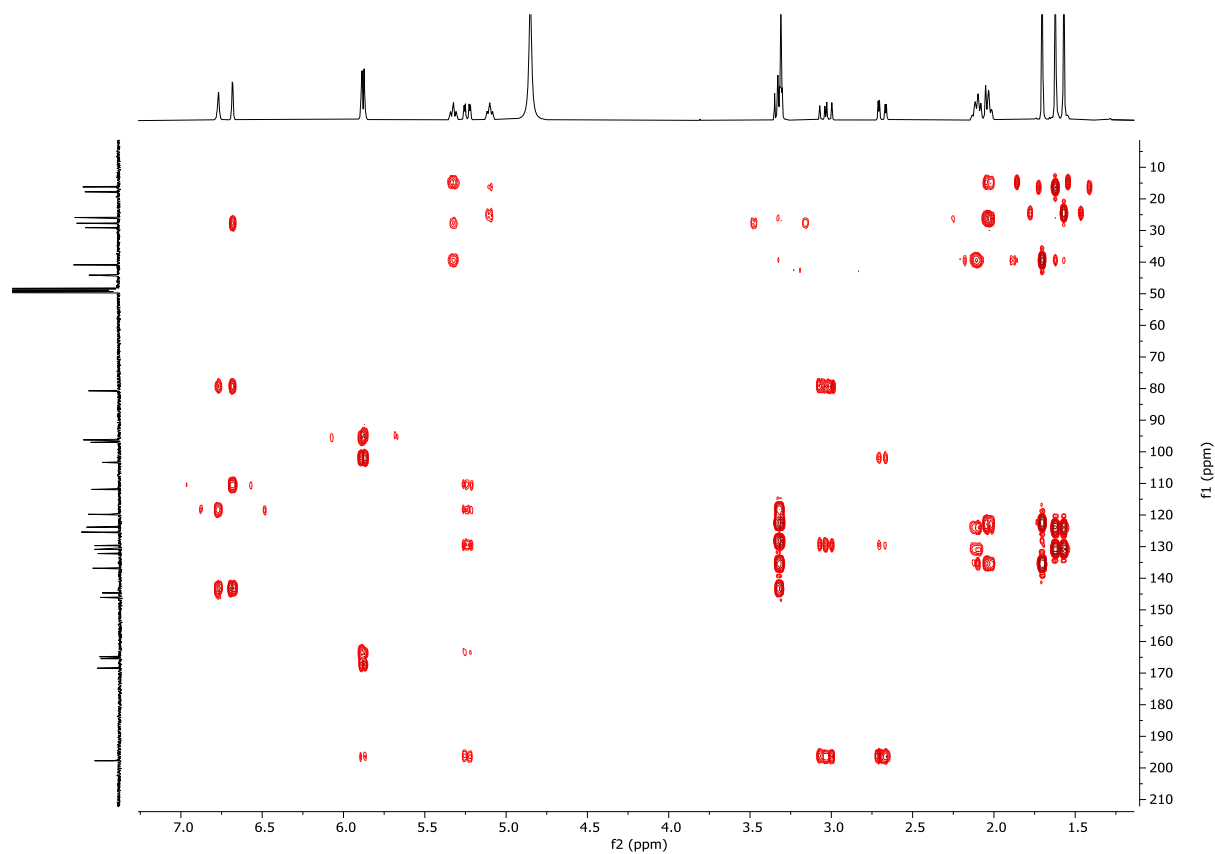


Figure S11. ^1H Spectrum of **3** in $\text{MeOH-}d_4$.

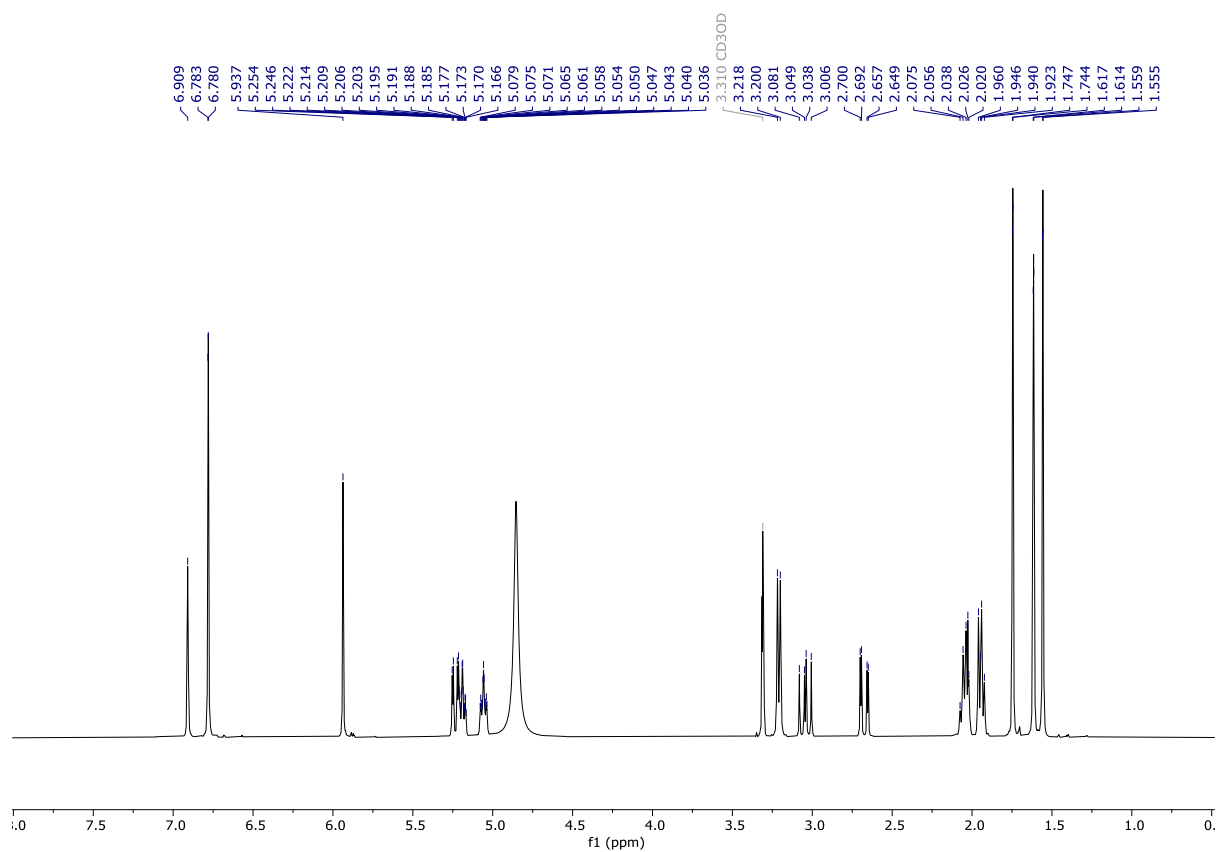


Figure S12. ^{13}C Spectrum of **3** in $\text{MeOH-}d_4$.

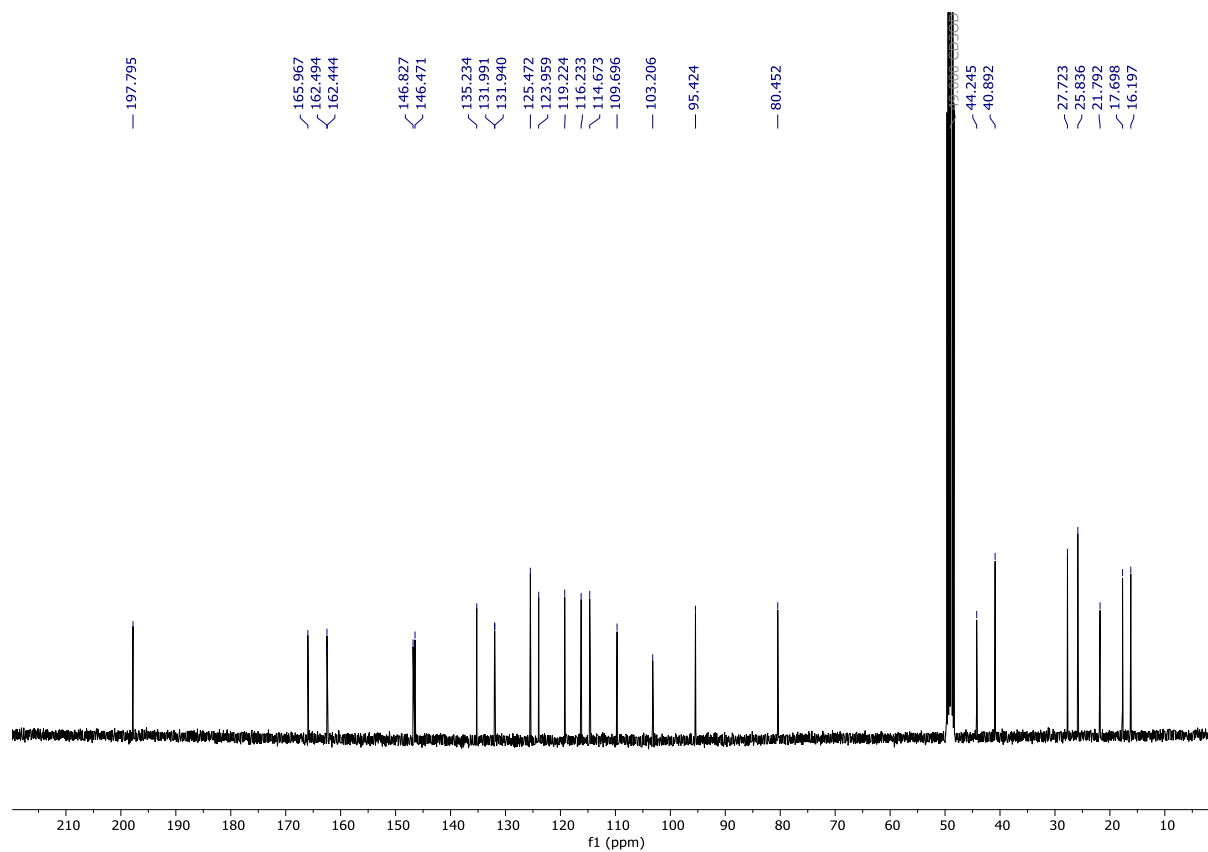


Figure S13. HSQC Spectrum of **3** in MeOH-*d*₄.

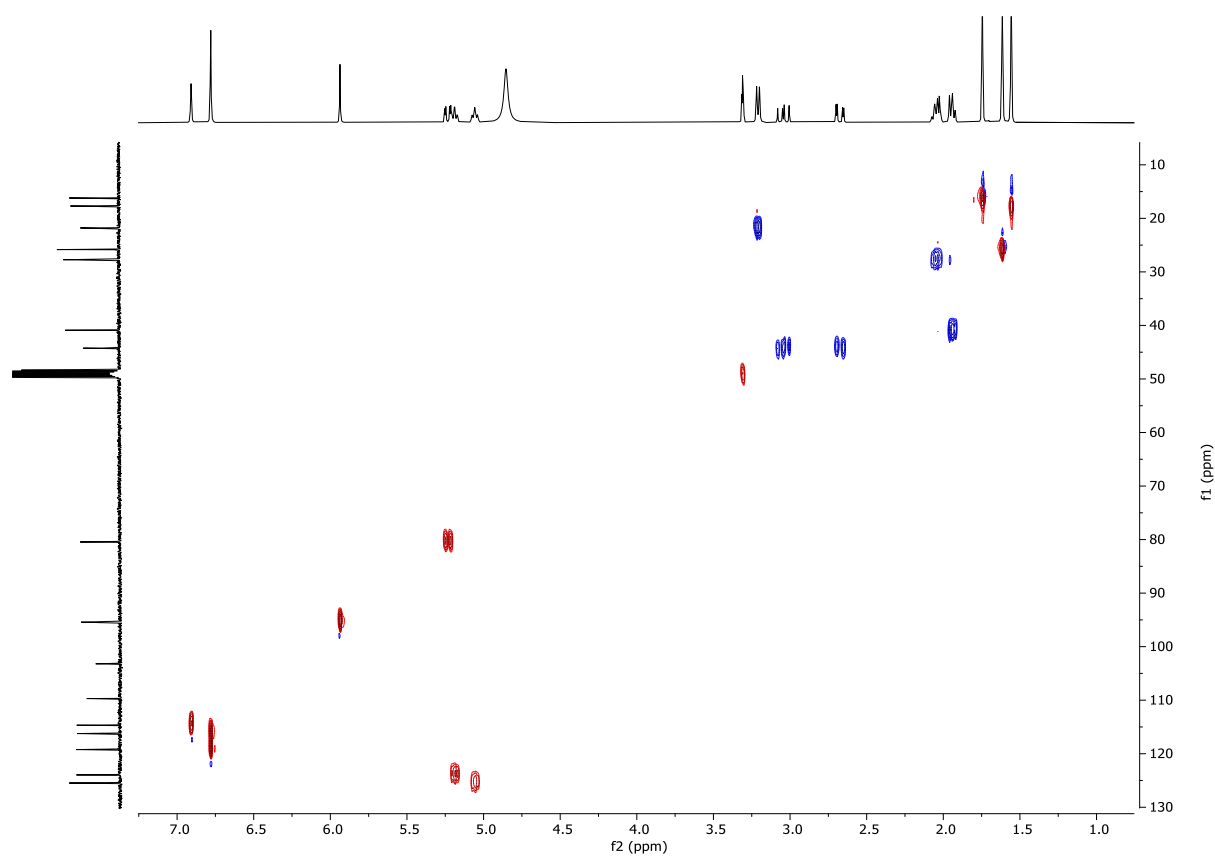


Figure S14. gCOSY Spectrum of **3** in MeOH-*d*₄.

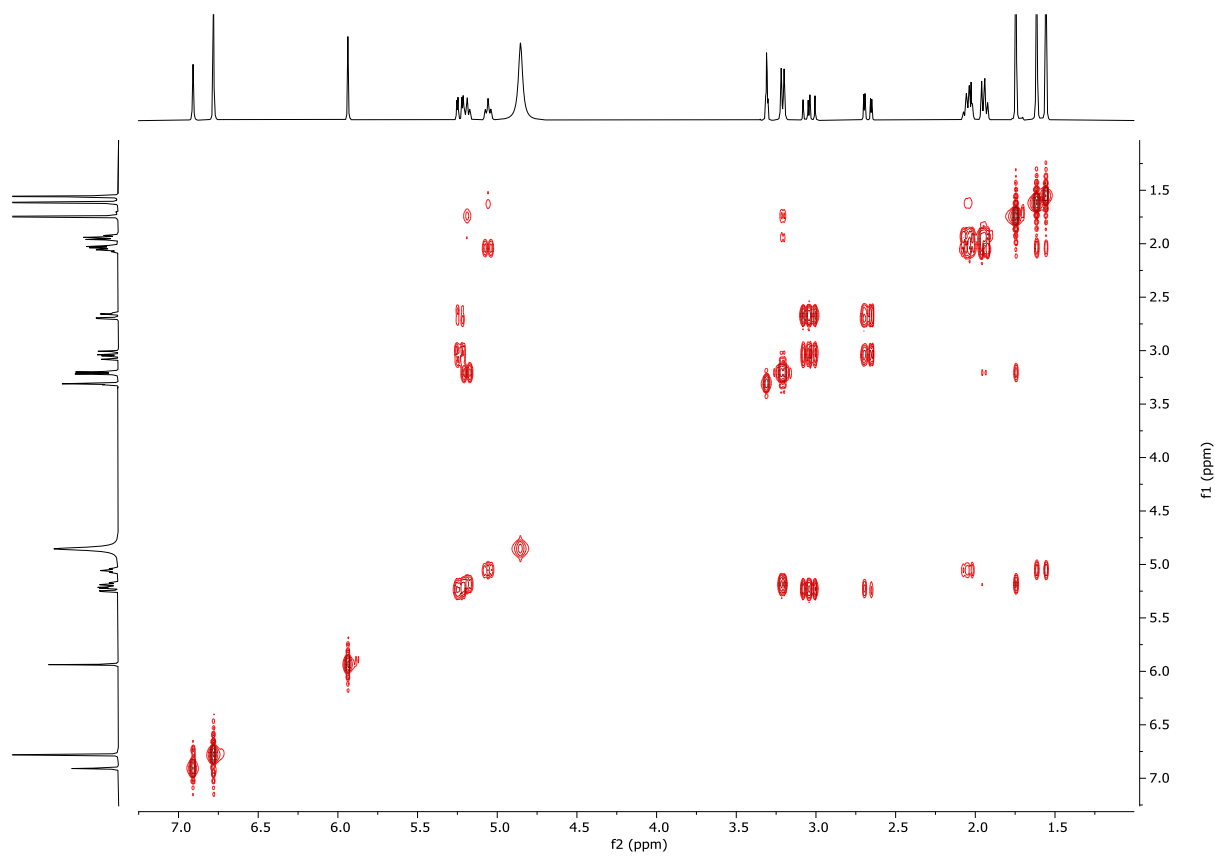


Figure S15. HMBC Spectrum of **3** in MeOH- d_4 .

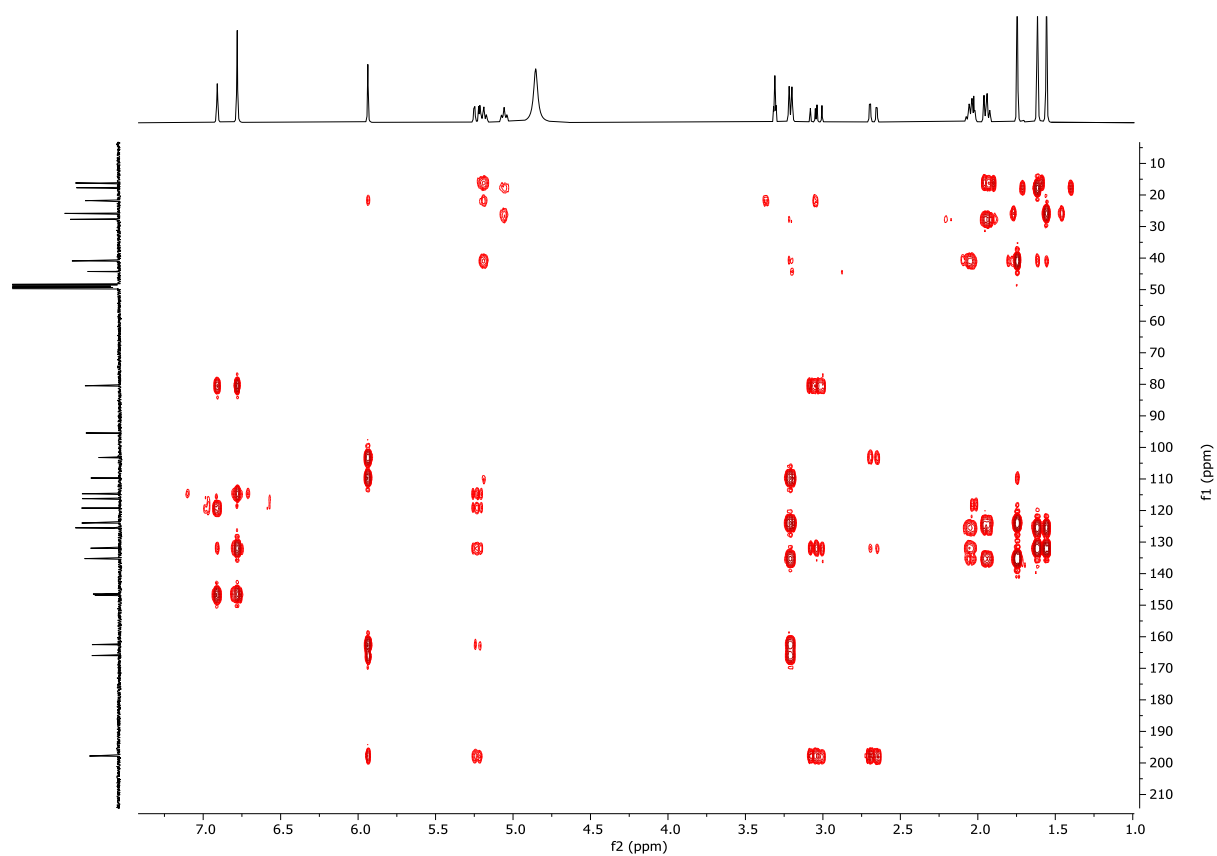


Figure S16. ^1H Spectrum of **4** in MeOH- d_4 .

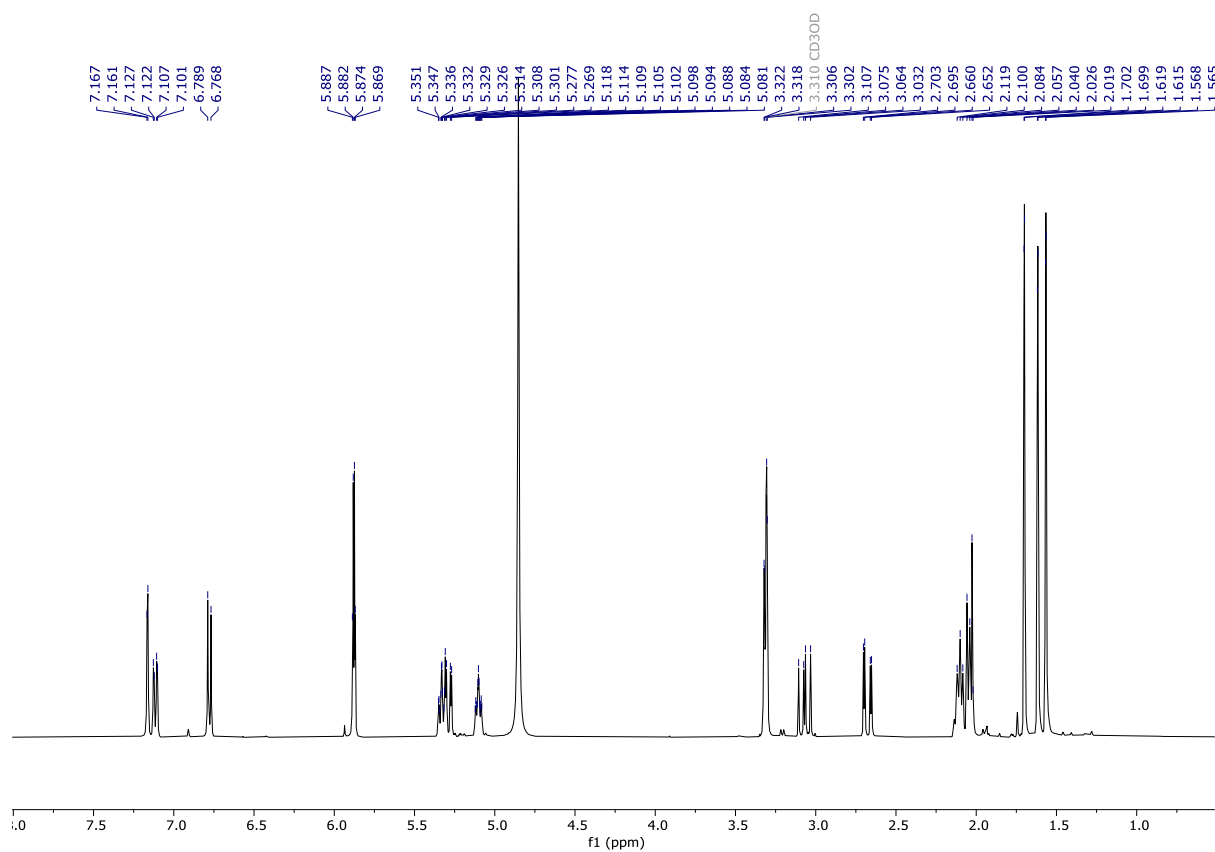


Figure S17. ^{13}C Spectrum of **4** in $\text{MeOH-}d_4$.

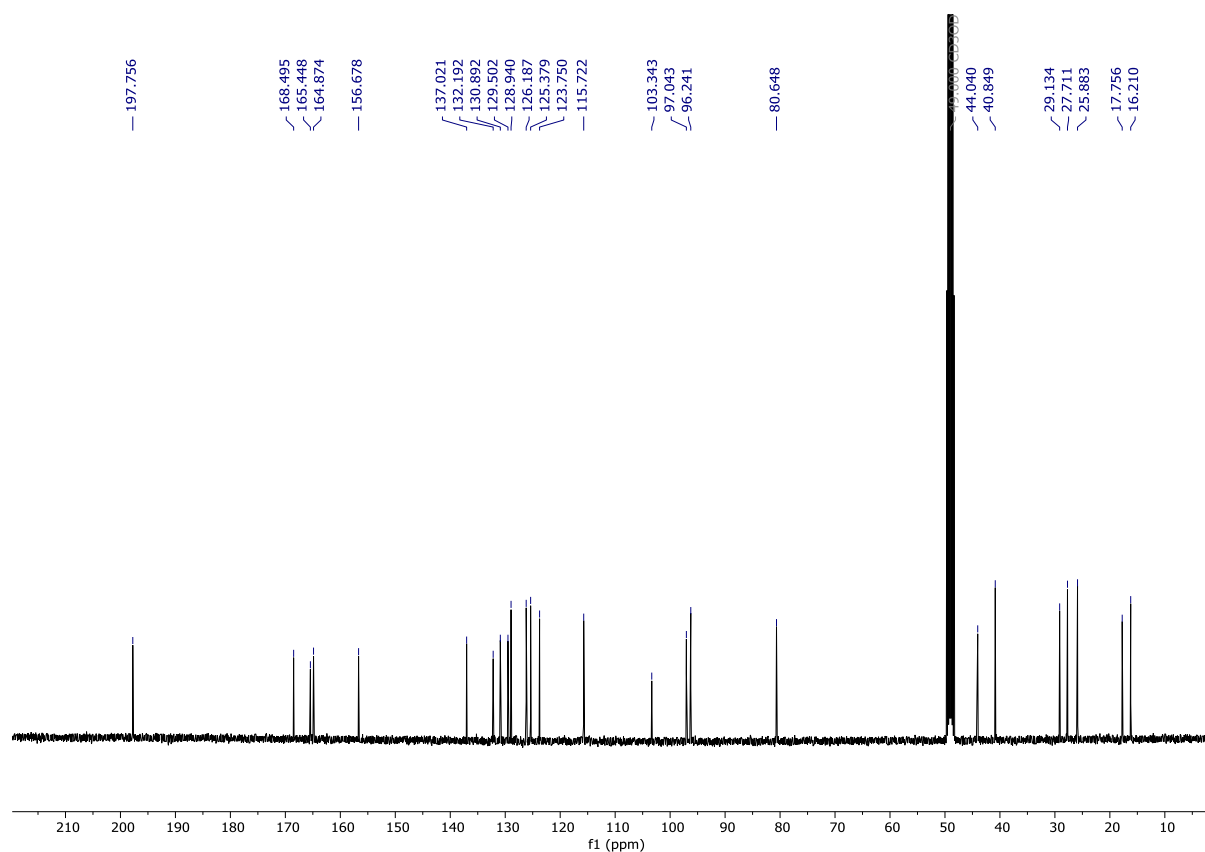


Figure S18. HSQC Spectrum of **4** in $\text{MeOH-}d_4$.

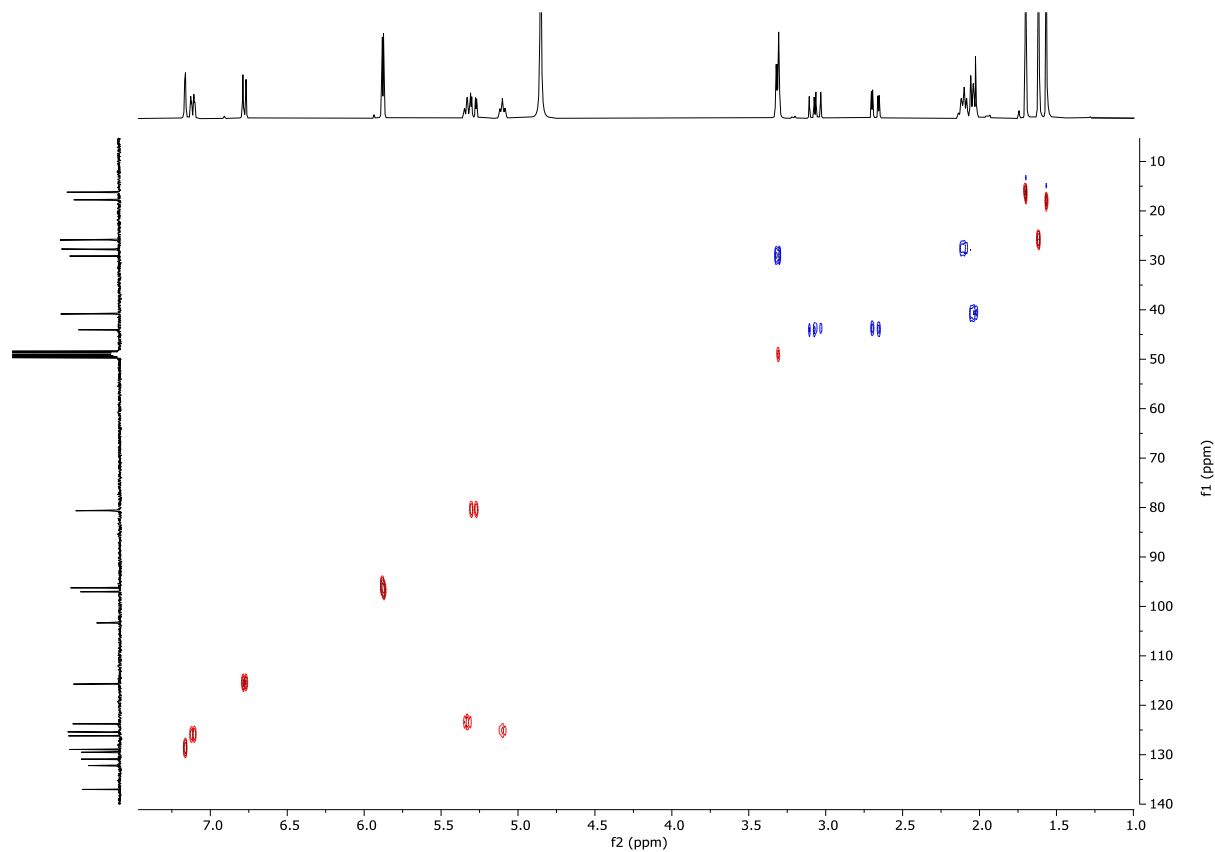


Figure S19. gCOSY Spectrum of **4** in MeOH-*d*₄.

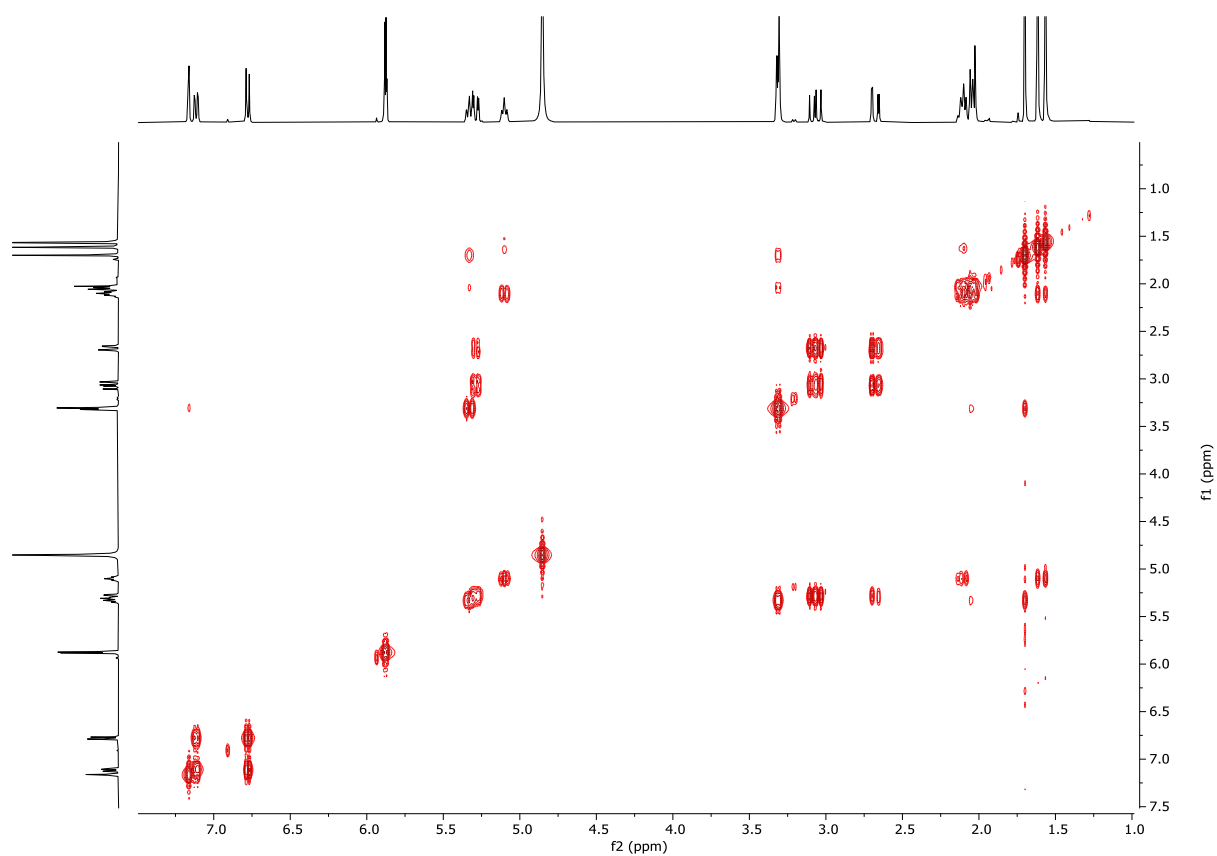


Figure S20. HMBC Spectrum of **4** in MeOH-*d*₄.

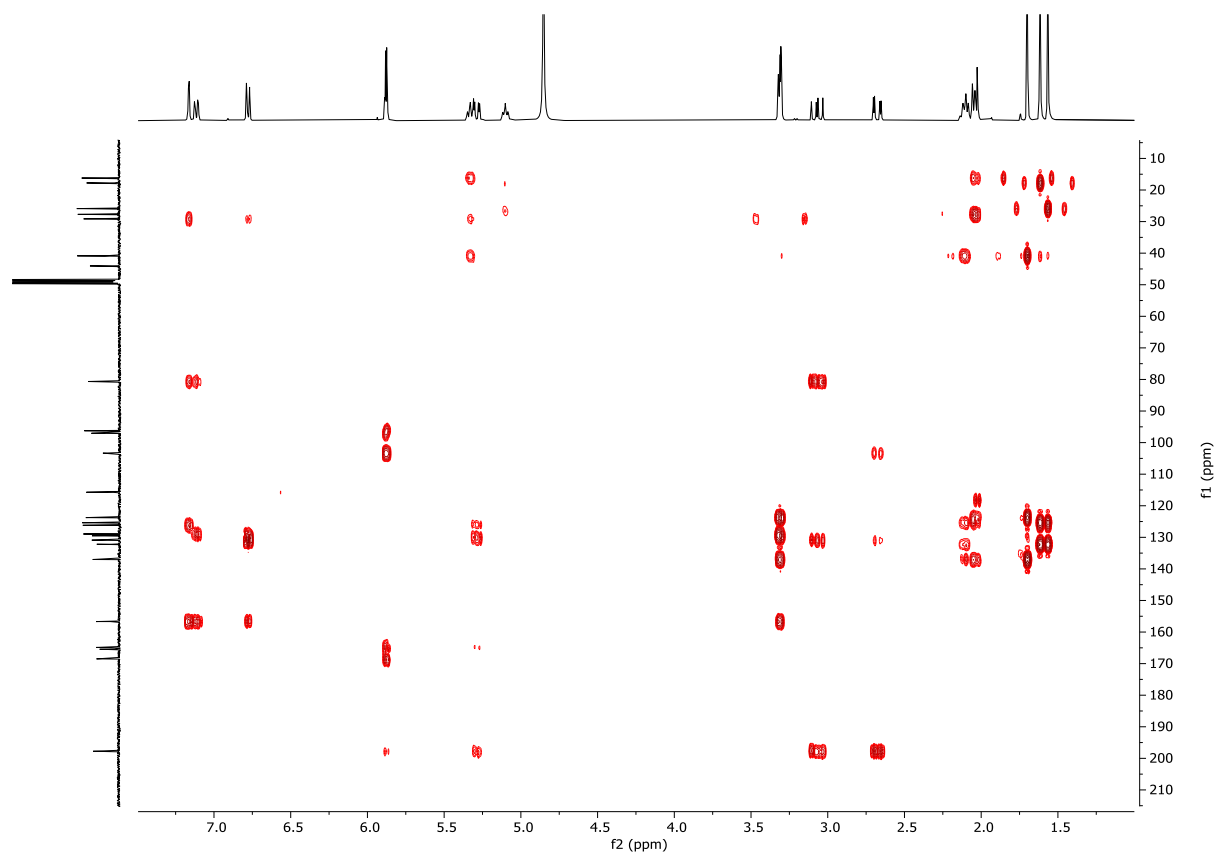


Figure S21. ^1H Spectrum of **5** in CHCl_3-d .

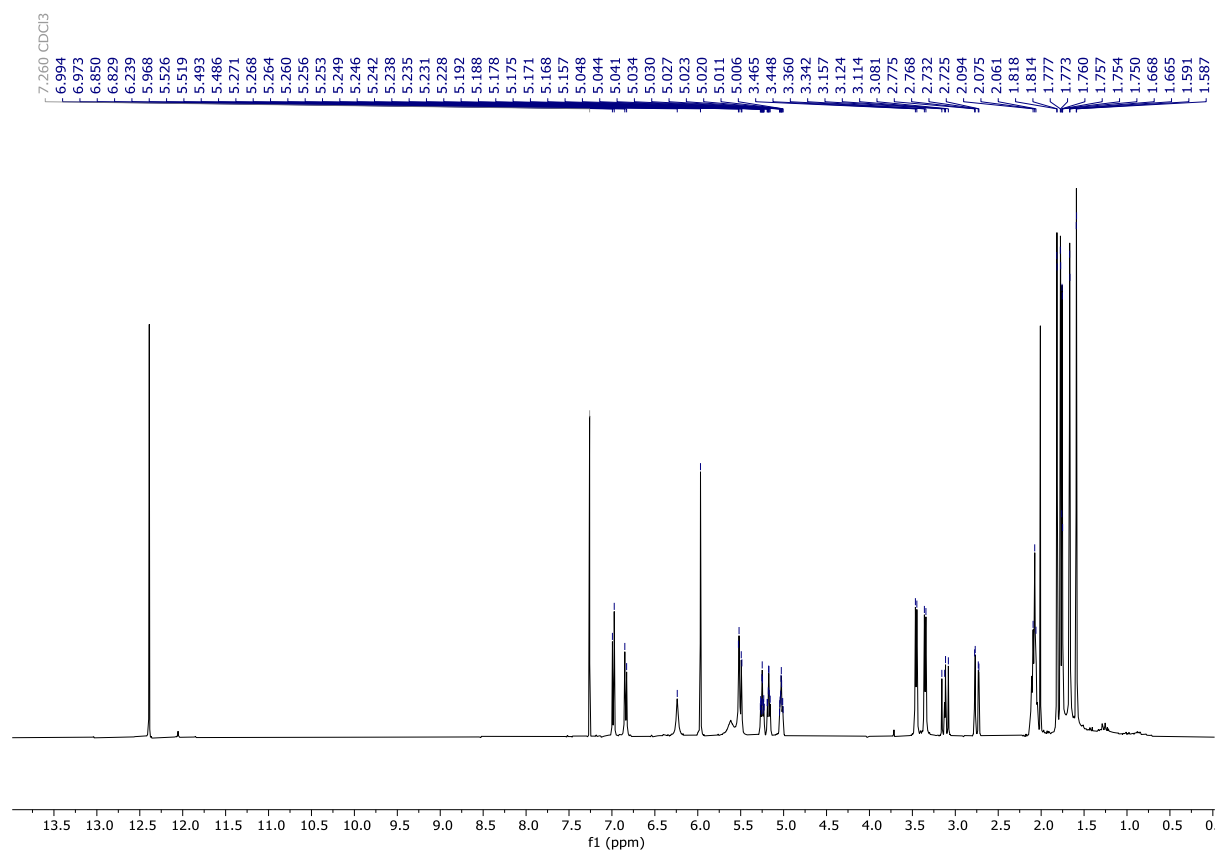


Figure S22. ^{13}C Spectrum of **5** in CHCl_3-d .

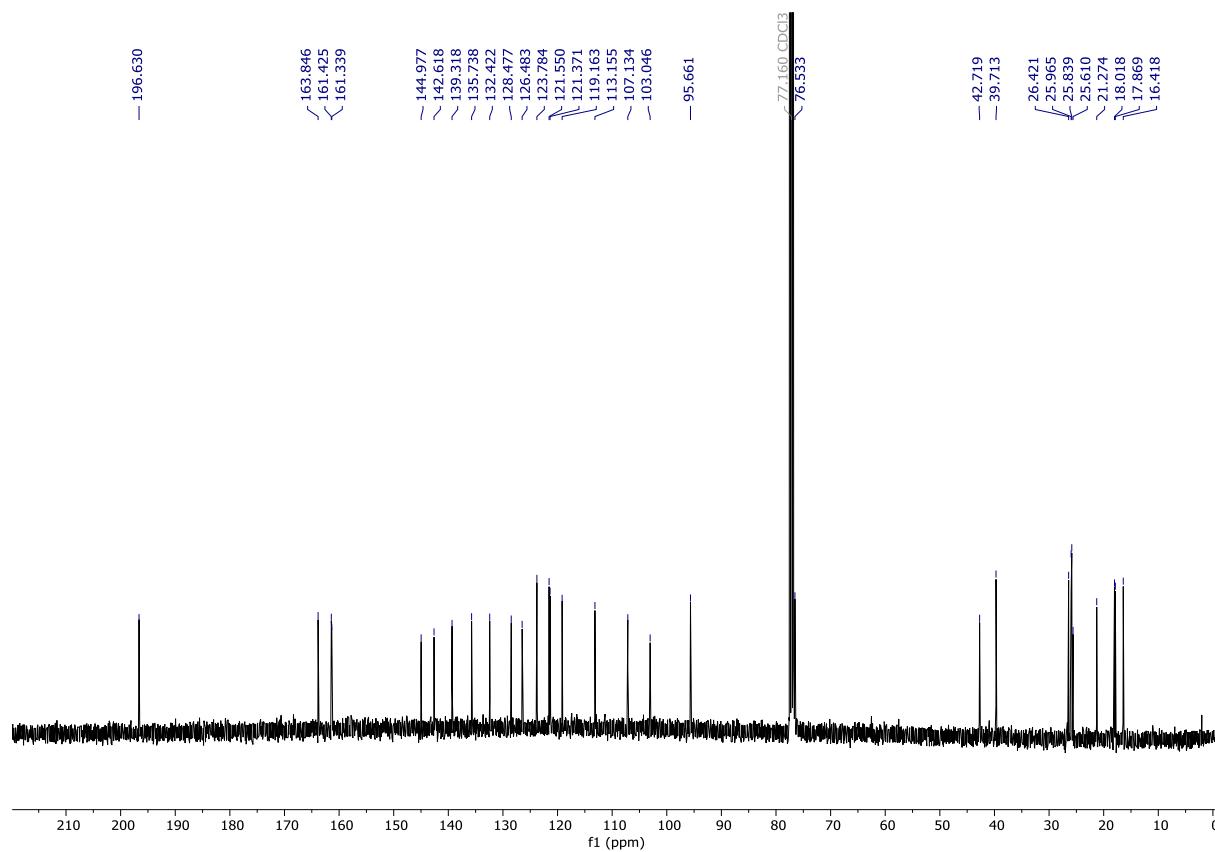


Figure S23. HSQC Spectrum of **5** in CHCl_3-d .

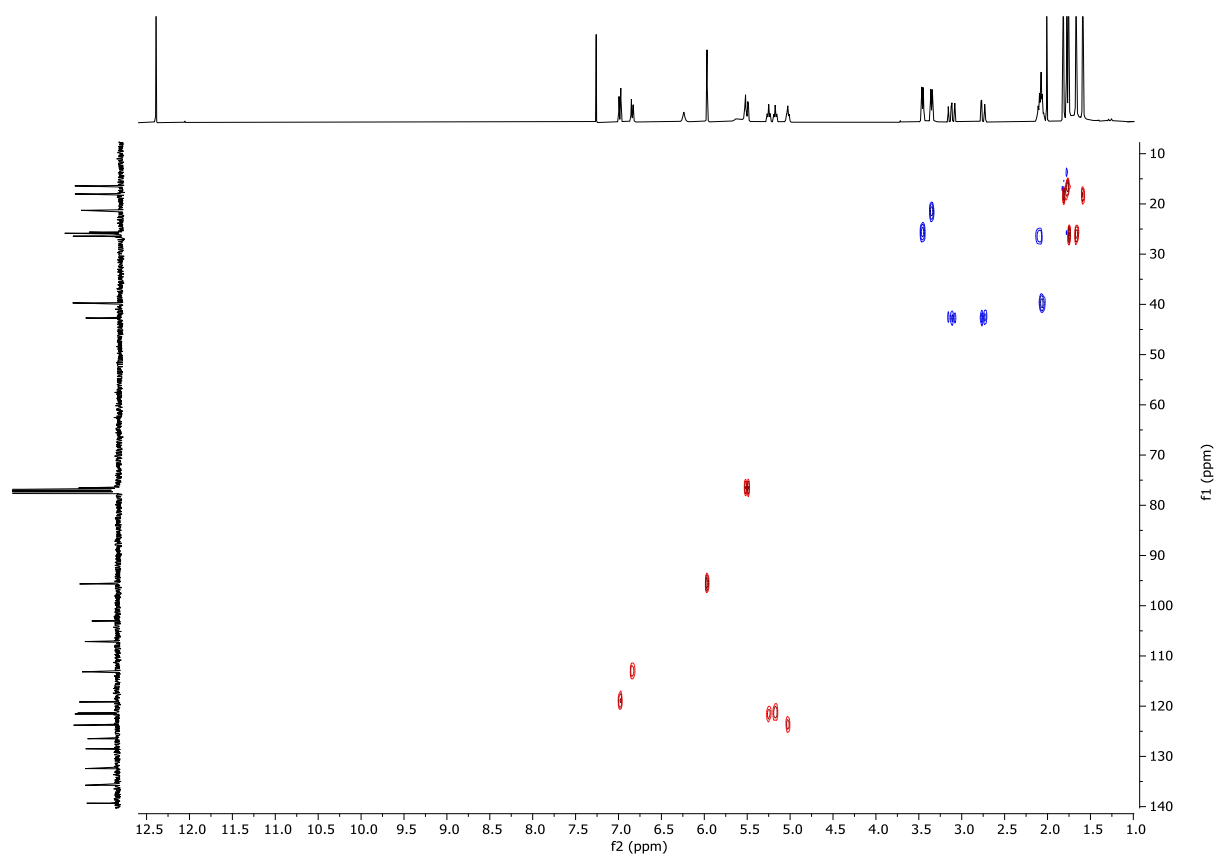


Figure S24. gCOSY Spectrum of **5** in CHCl_3-d .

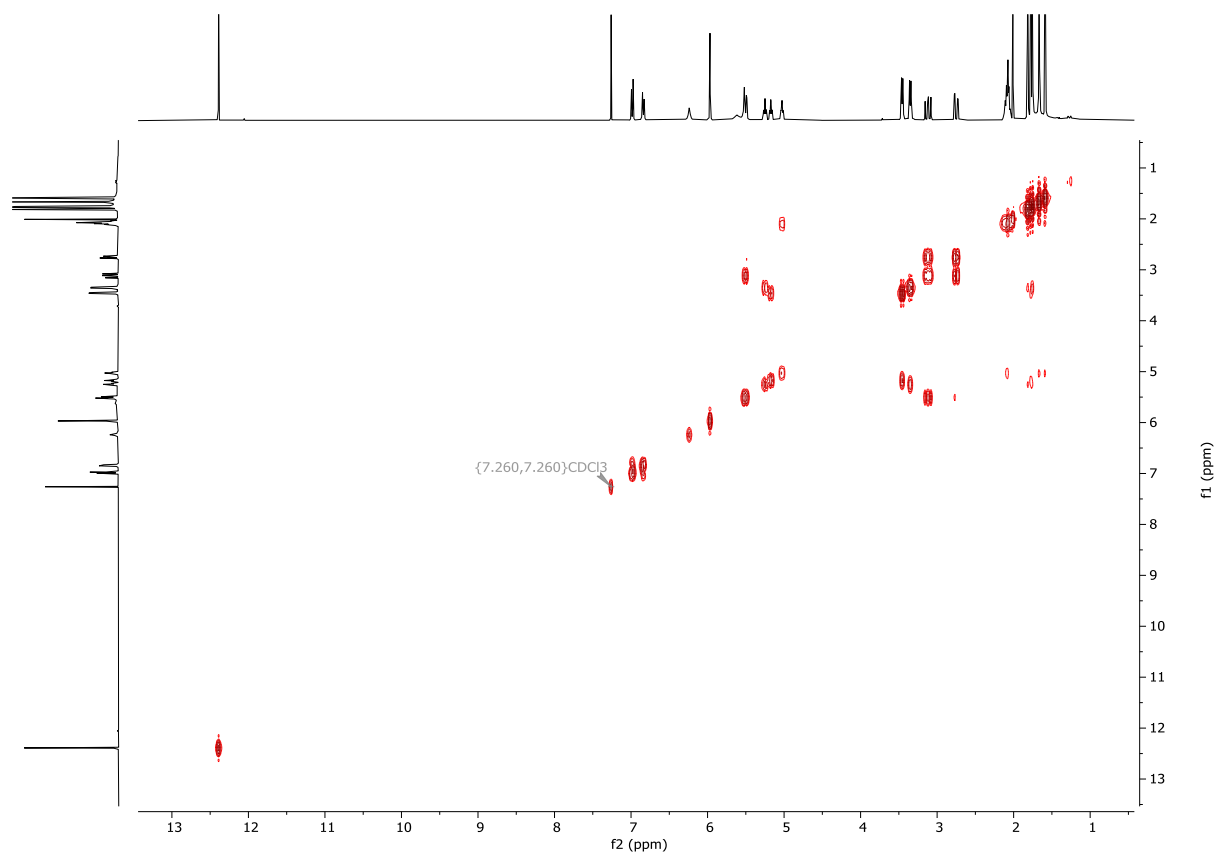


Figure S25. HMBC Spectrum of **5** in $\text{CHCl}_3\text{-}d$.

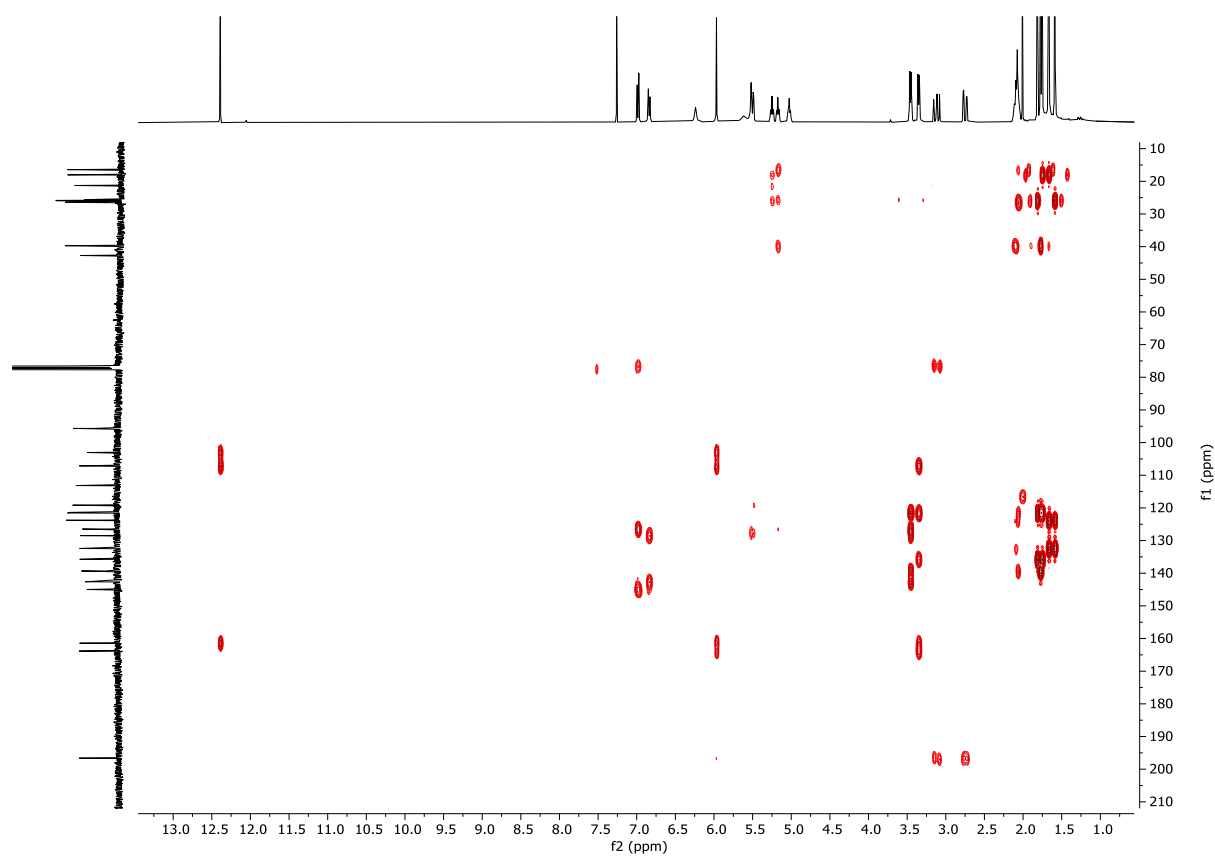


Figure S26. ^1H Spectrum of **6** in $\text{MeOH-}d_4$.

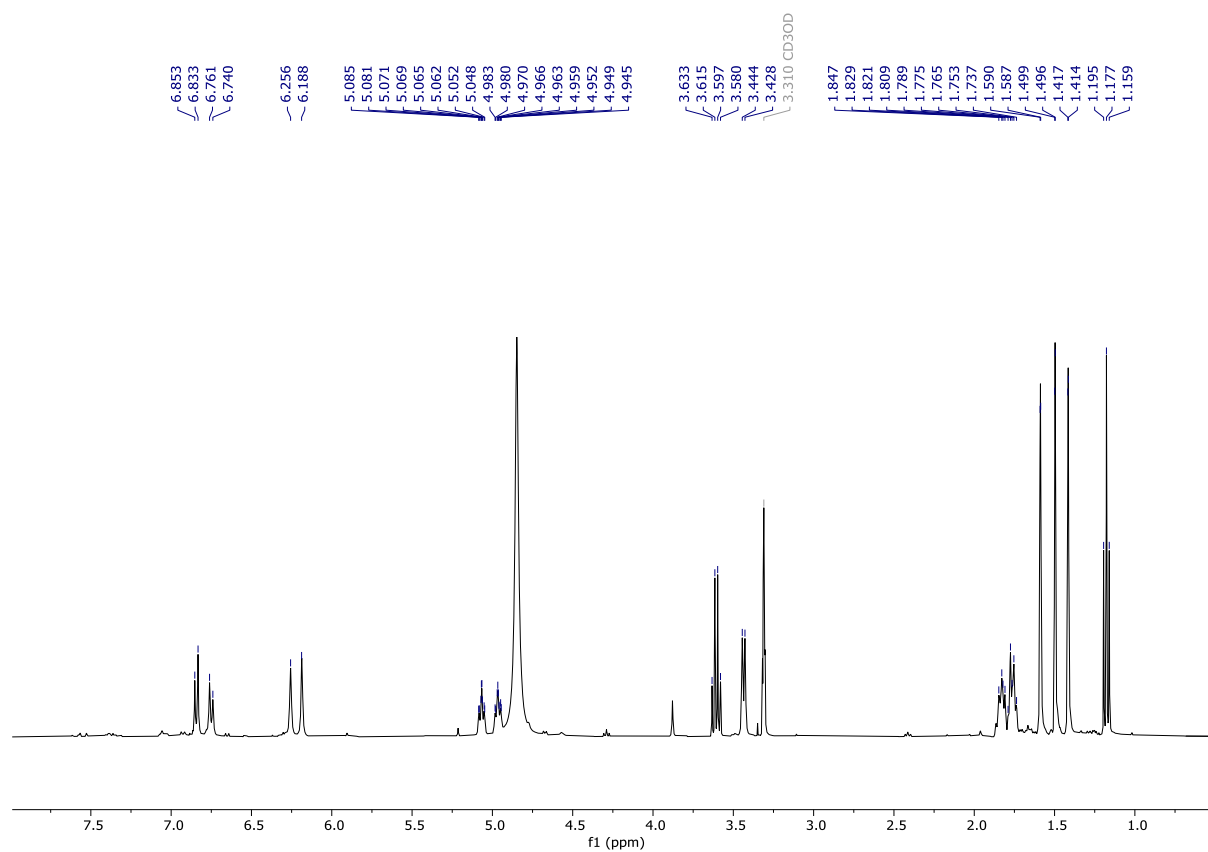


Figure S27. ^{13}C Spectrum of **6** in $\text{MeOH-}d_4$.

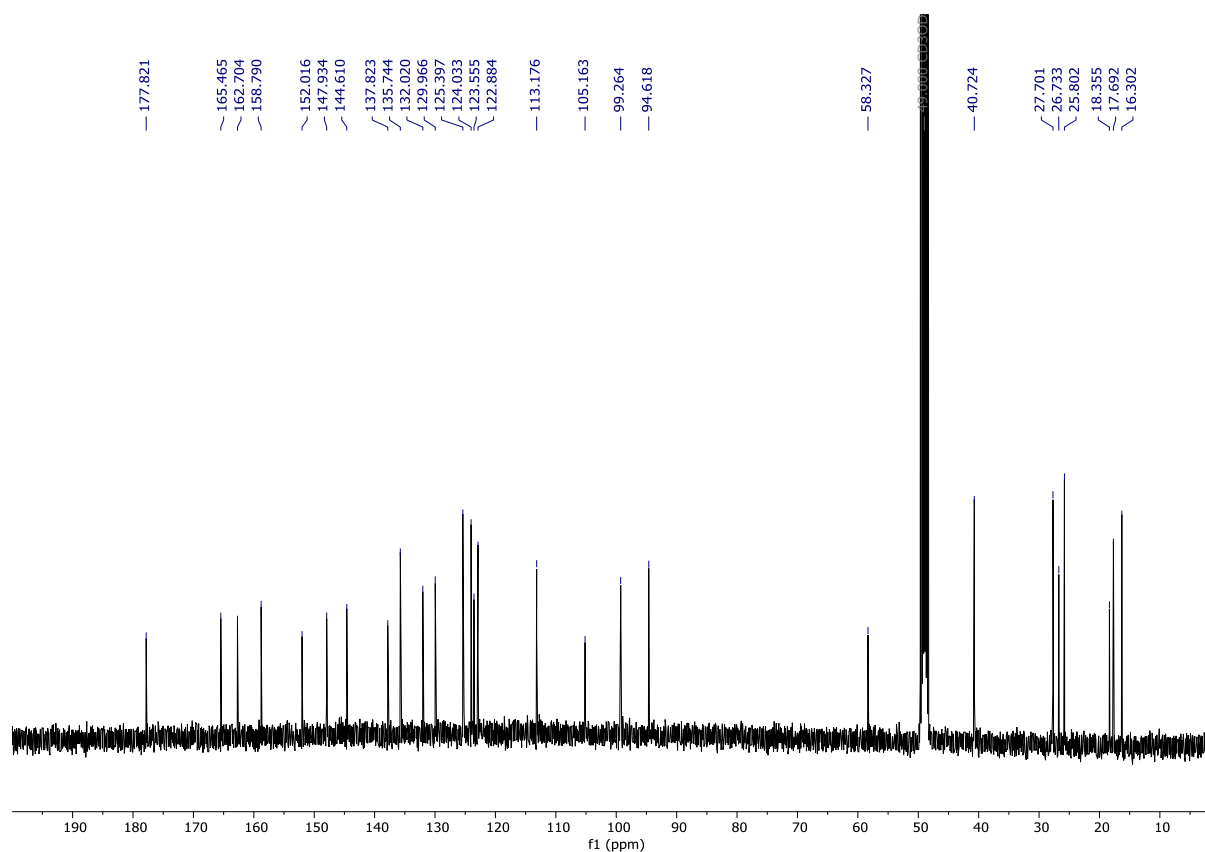


Figure S28. HSQC Spectrum of **6** in $\text{MeOH-}d_4$.

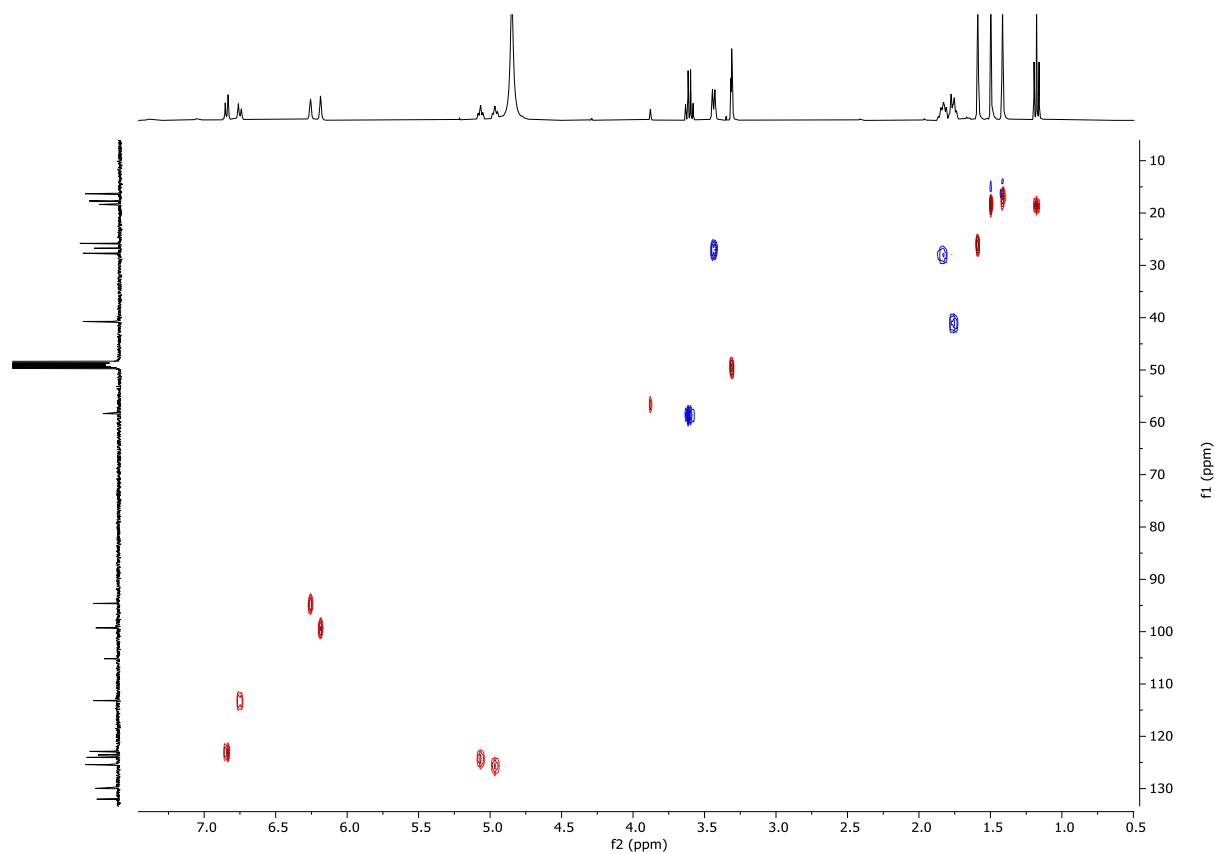


Figure S29. gCOSY Spectrum of **6** in MeOH- d_4 .

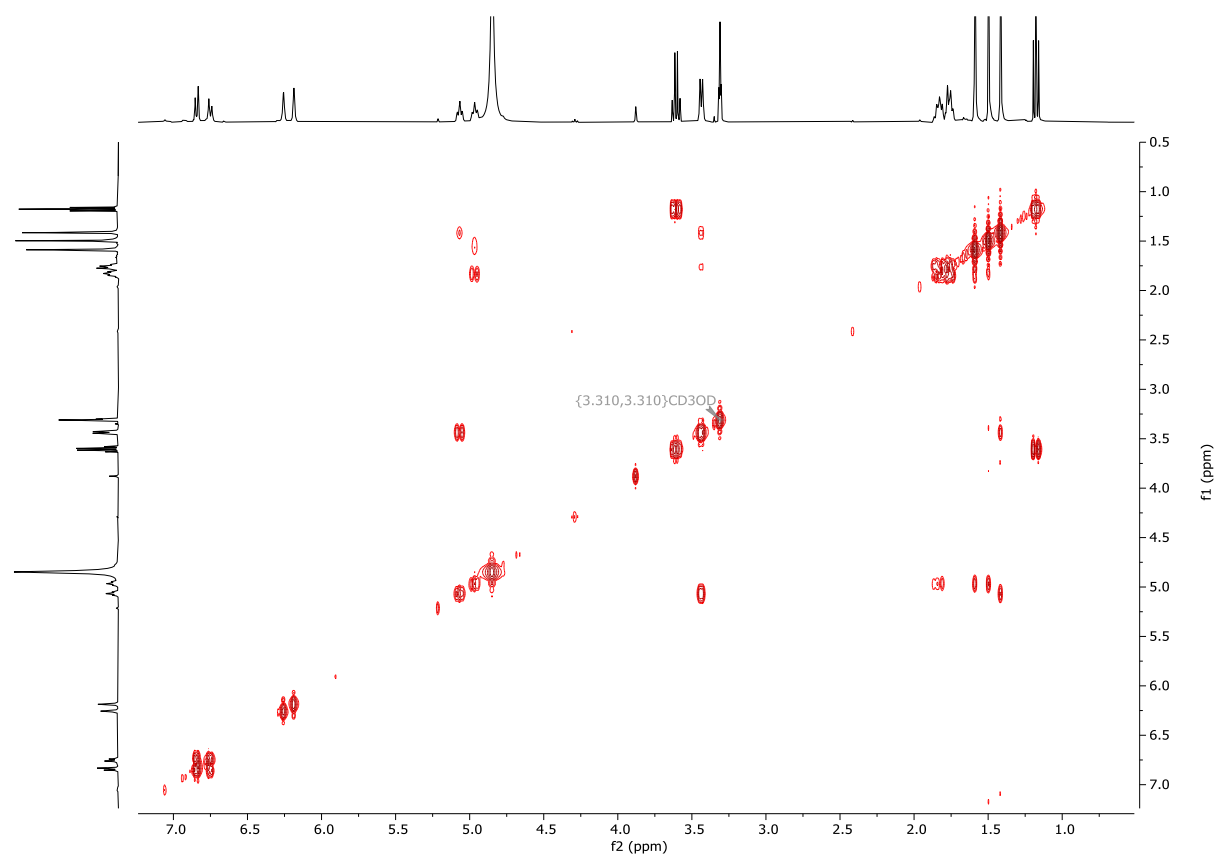


Figure S30. HMBC Spectrum of **6** in MeOH- d_4 .

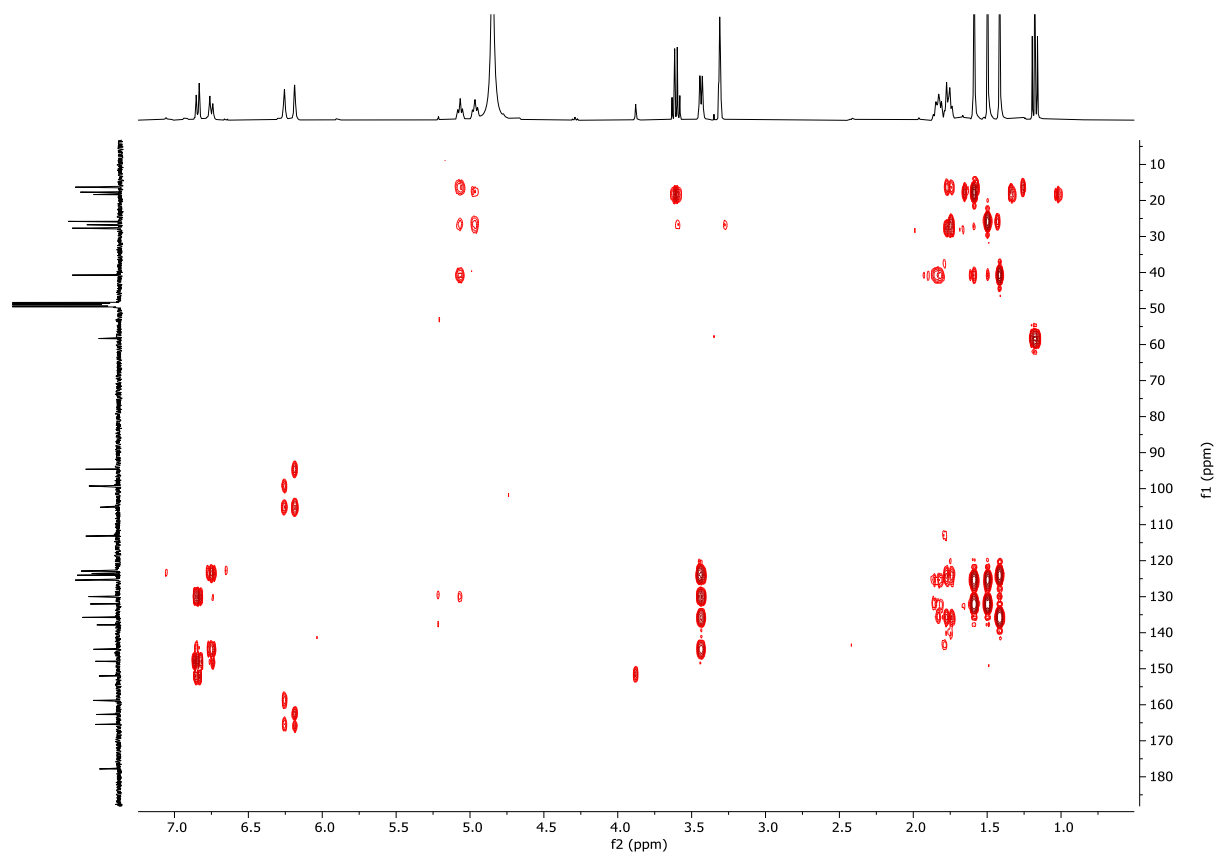


Figure S31. Two-dimensional diagrams showing non-covalent interactions of **1-9** and acarbose (**10**) with α -glucosidase (2ZQ0).

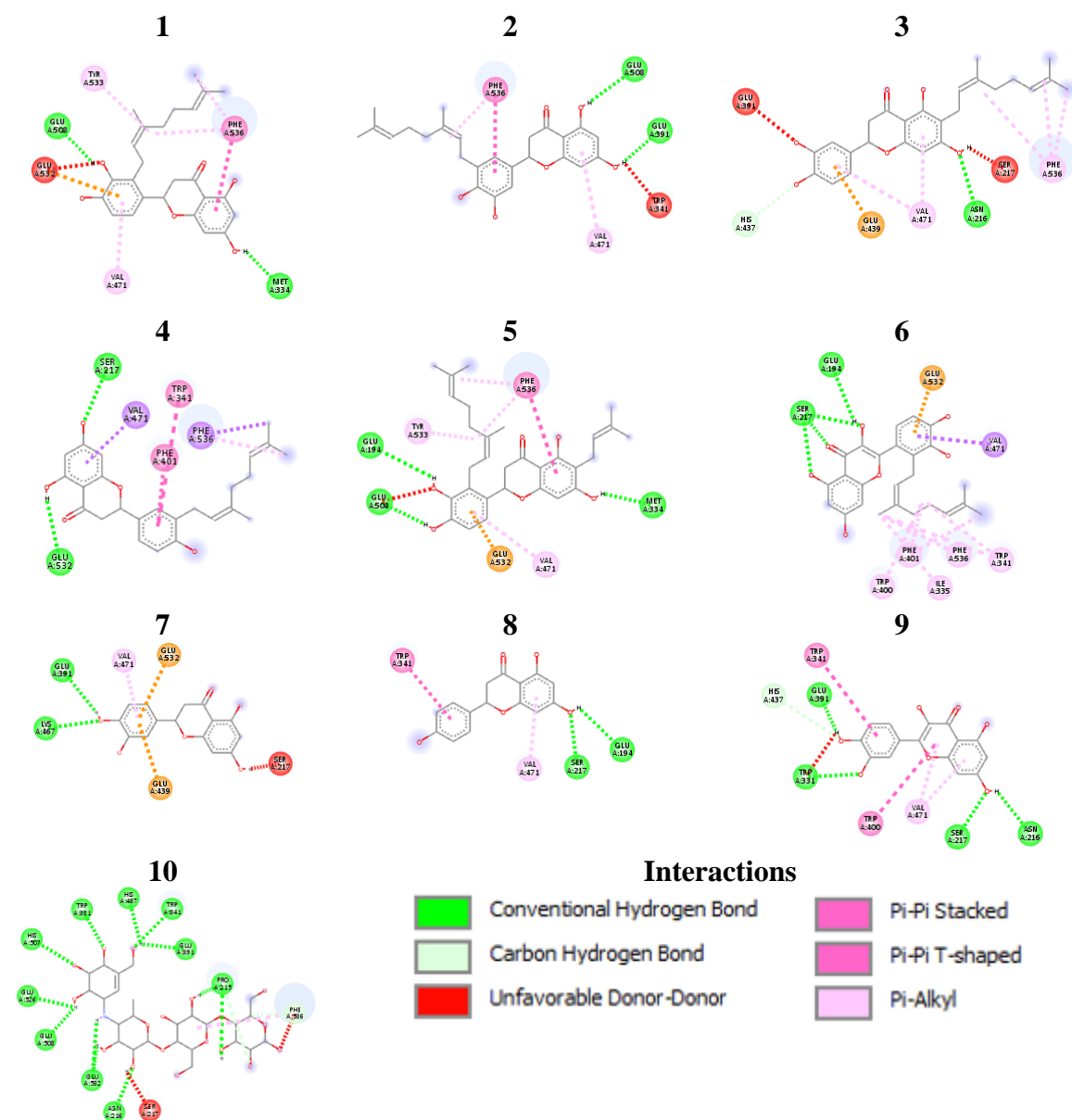


Figure S32. Two-dimensional diagrams showing non-covalent interactions of **1-9** and acarbose (**10**) with α -amylase (2QV4).

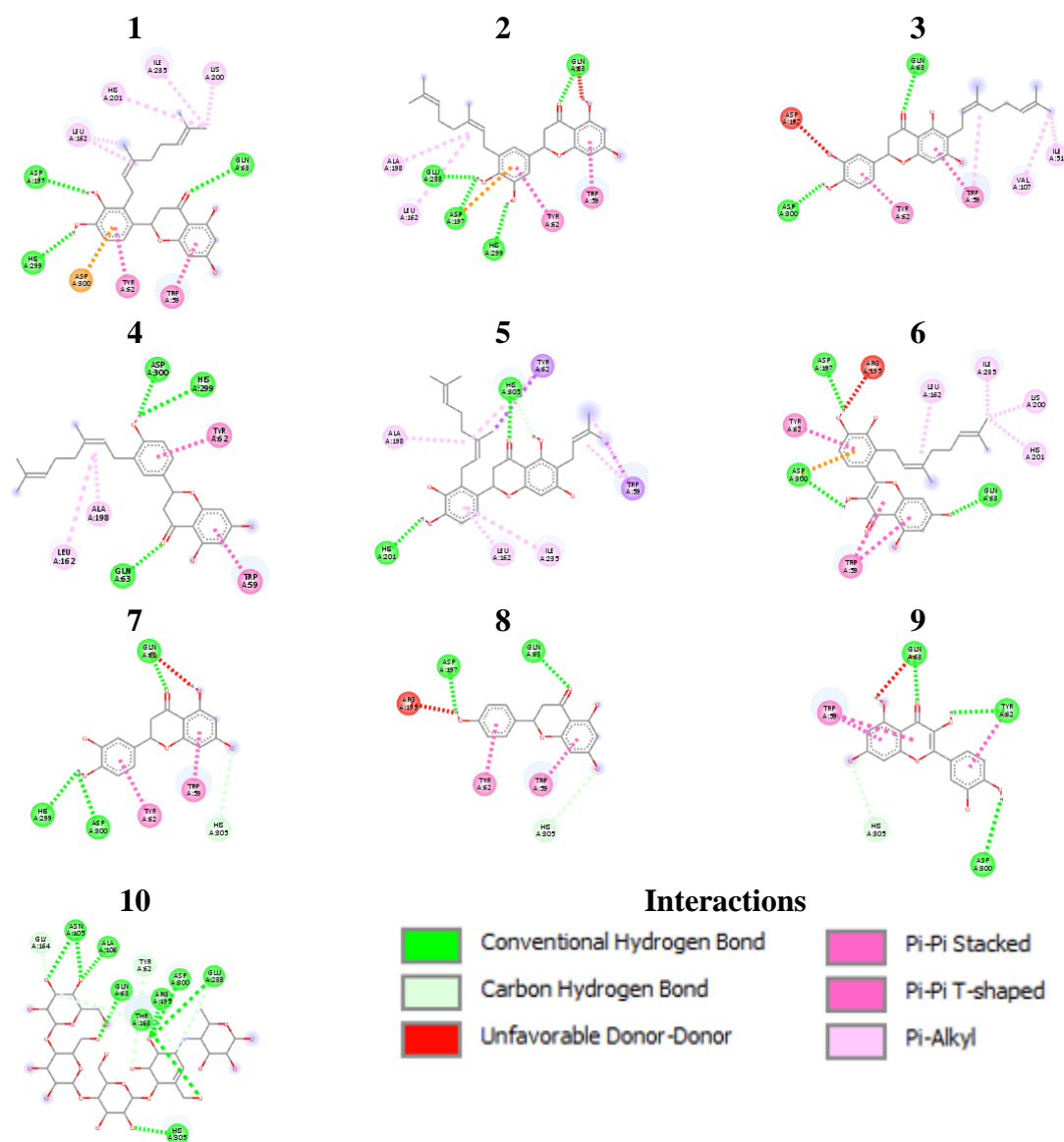


Figure S33. Two-dimensional diagrams showing non-covalent interactions of **1-9** and orlistat (**11**) with lipase (6KSM).

