Electronic Supplementary Material (ESI) for Green Chemistry.

Efficient, one-step, cascade synthesis of densely functionalized furans from unprotected carbohydrates in basic aqueous media

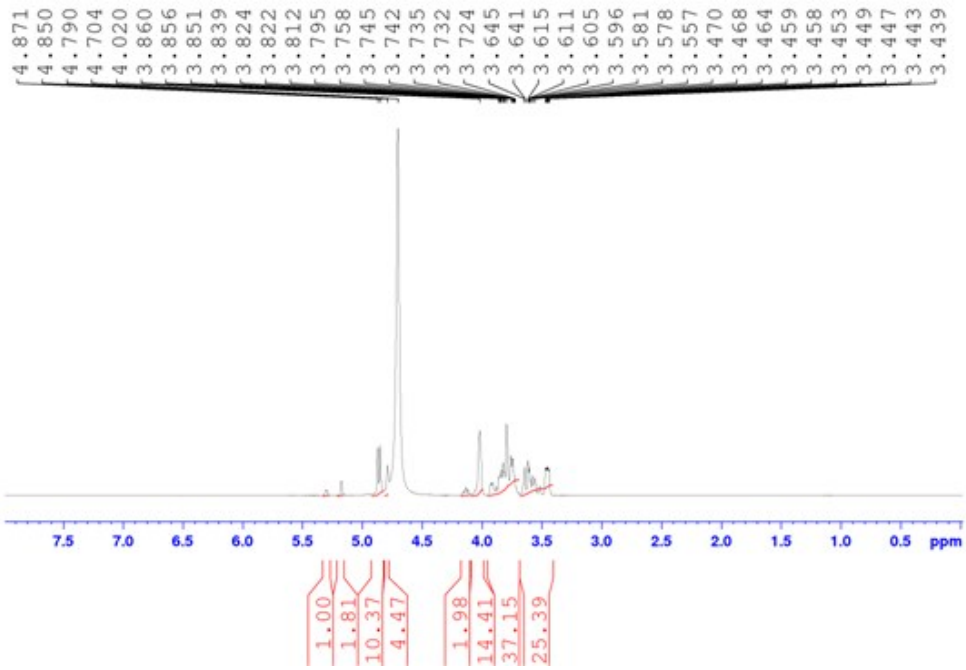
Mallikharjuna Rao Lambu and Zaher M. A. Judeh*

[a]*School of Chemical and Biomedical Engineering, Nanyang Technological University, 62 Nanyang Drive, N1.2-B1-14, Singapore 637459. Tel.: +65-67906738; Fax: +65-67947553. Email: Zaher@ntu.edu.sg*

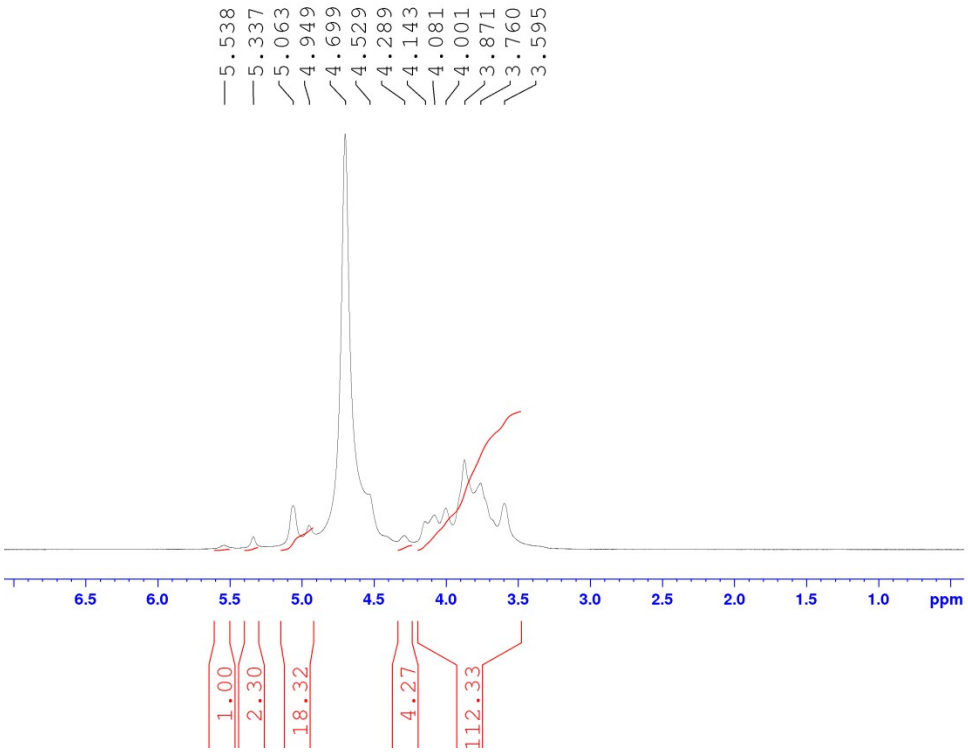
Contents

Copies of spectra ……..2-47

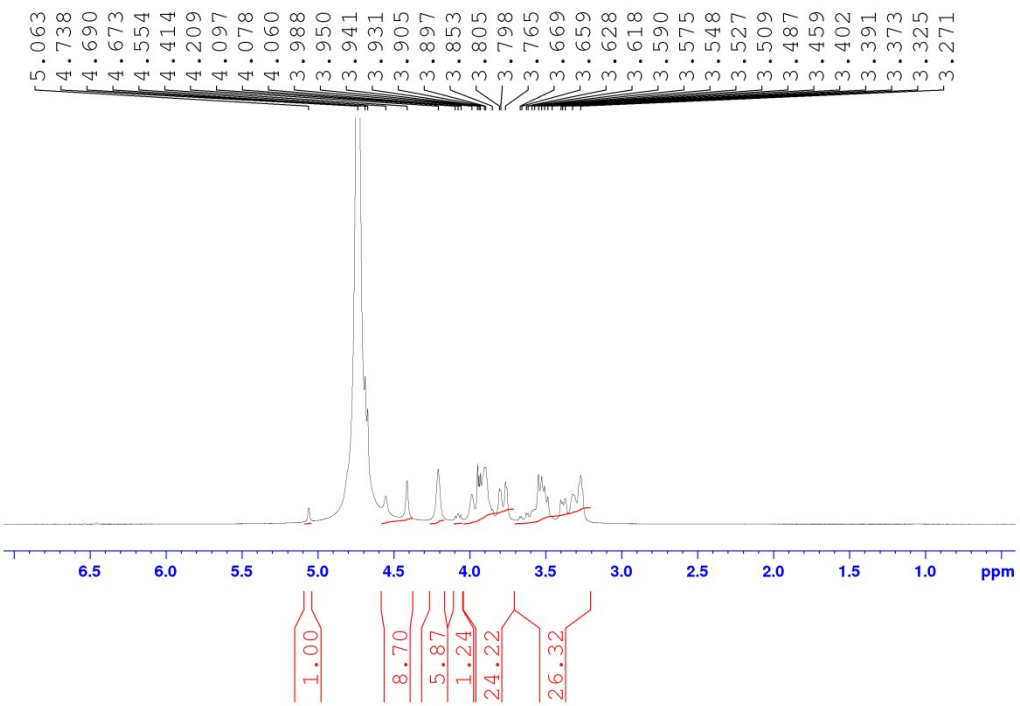
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of $InCl_3$ in D_2O



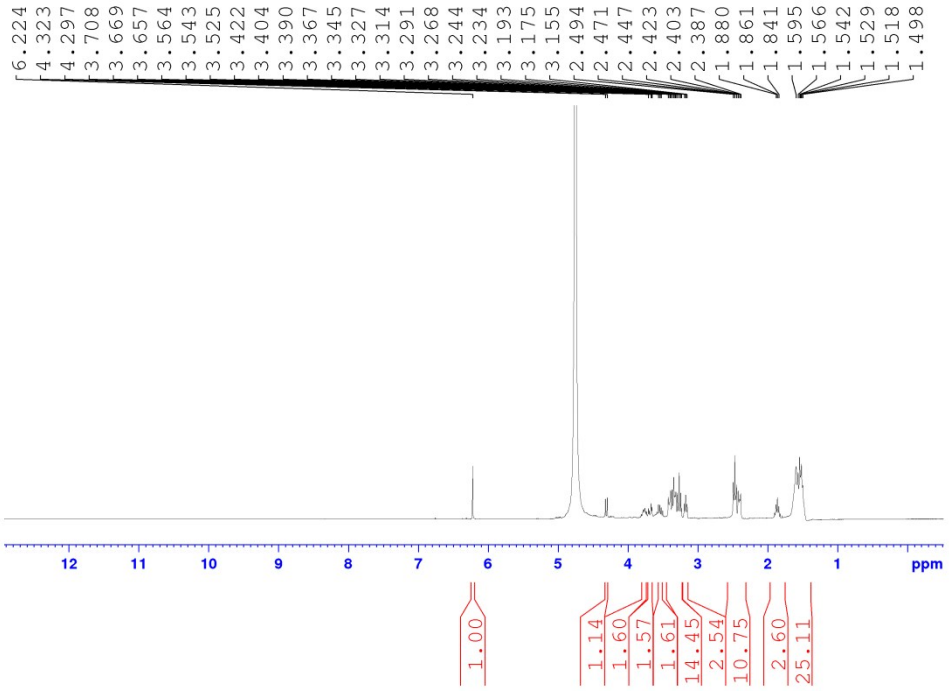
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of $Yb(OTf)_3$ in D_2O



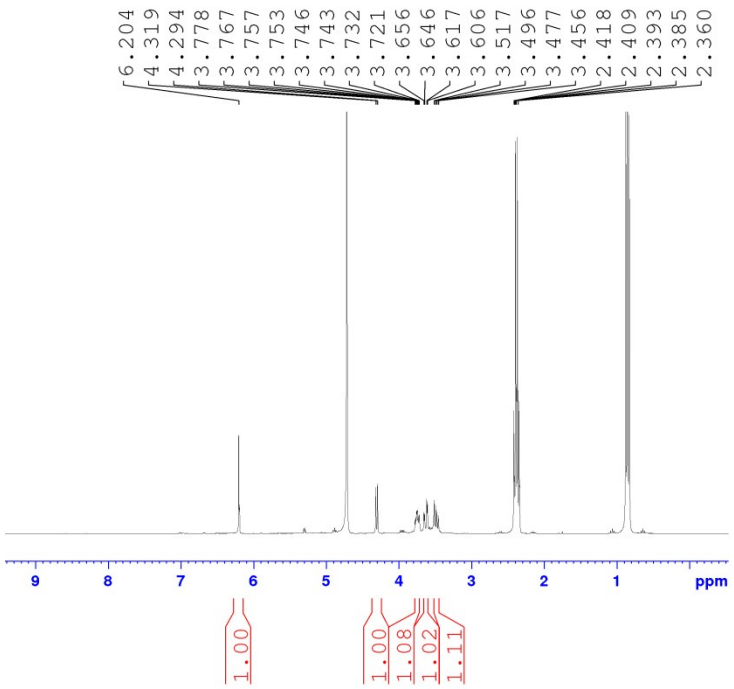
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of $CeCl_3$ in D_2O



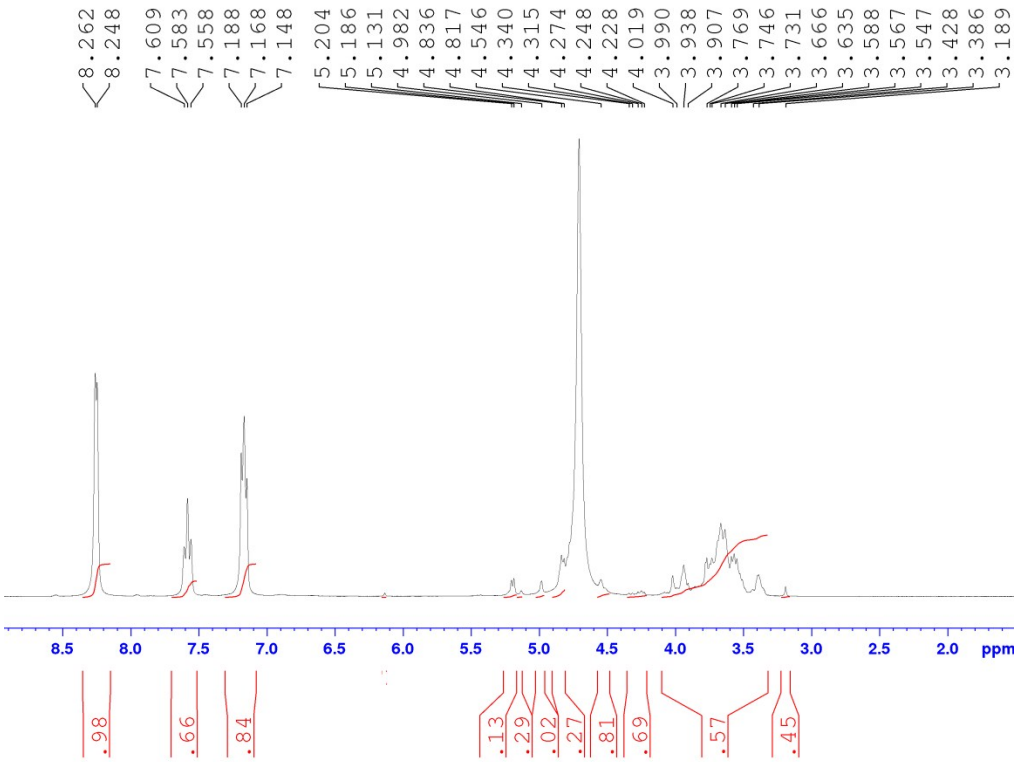
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of DBU (1.0 equiv.) in D_2O



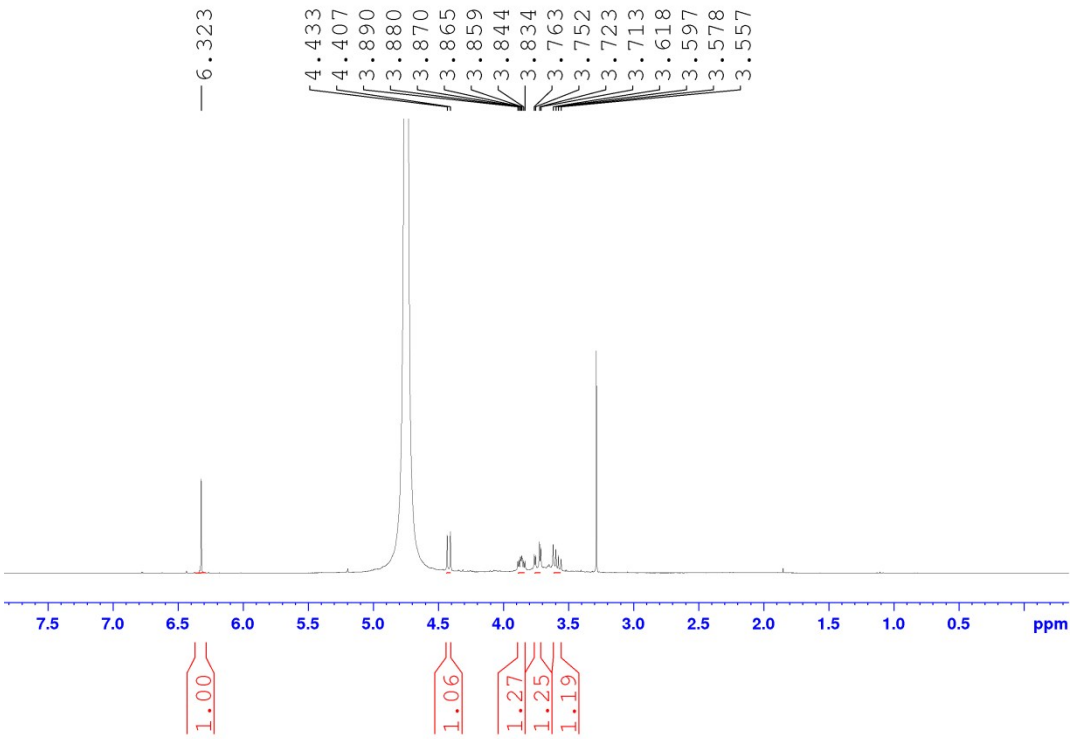
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of EtN_3 (1.0 equiv.) in D_2O



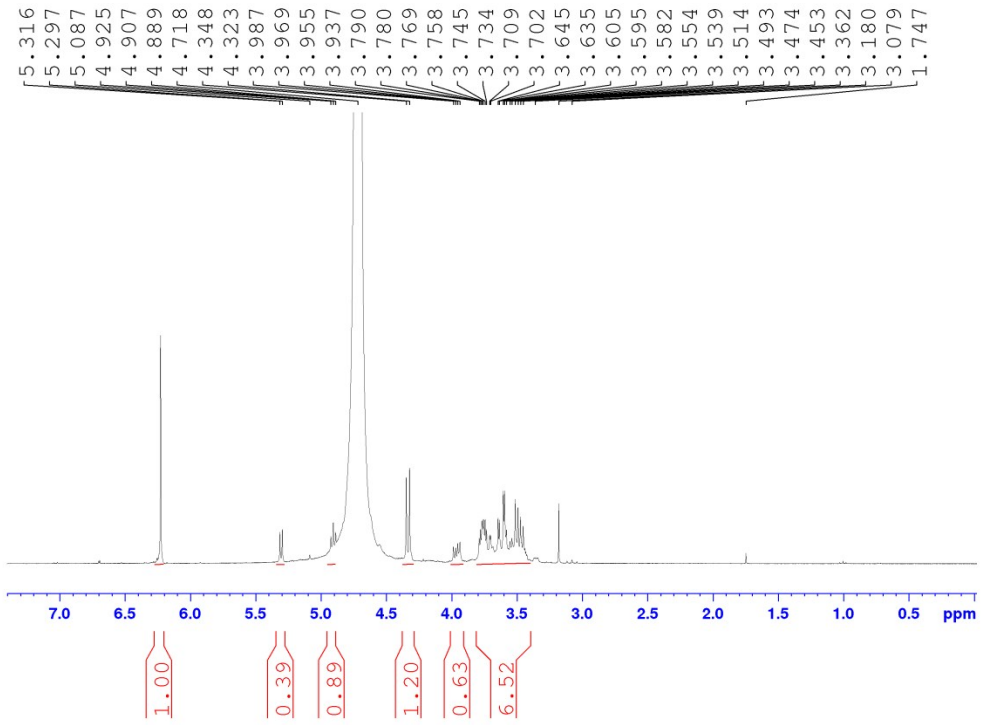
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of pridine (1.0 equiv.) in D_2O



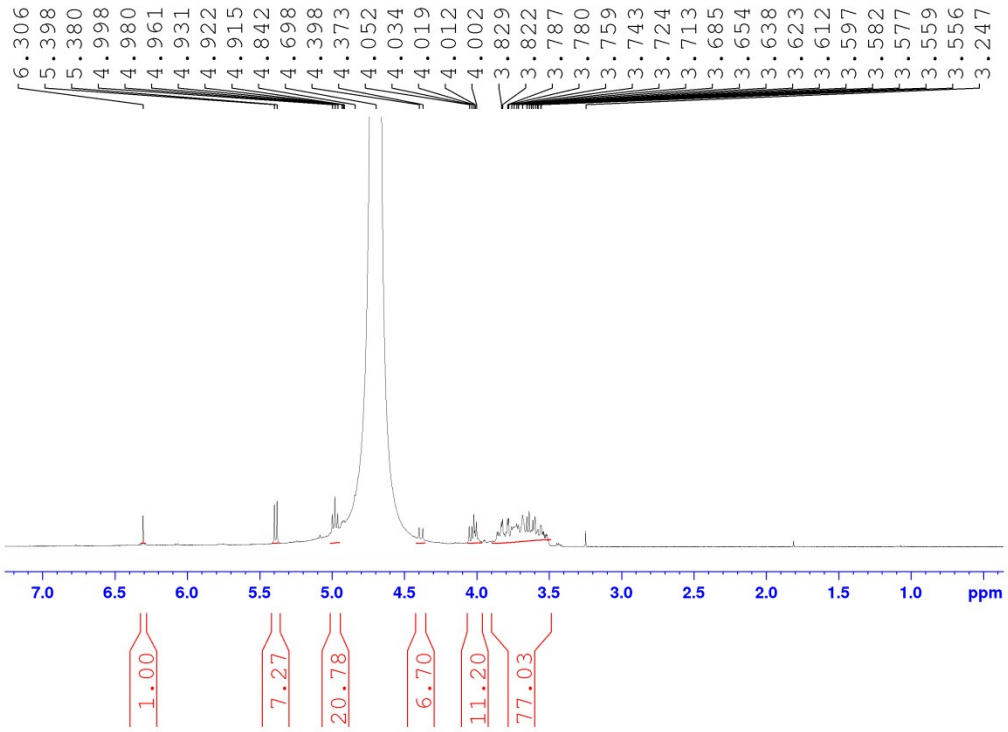
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of NaOMe (1.0 equiv.) in D_2O



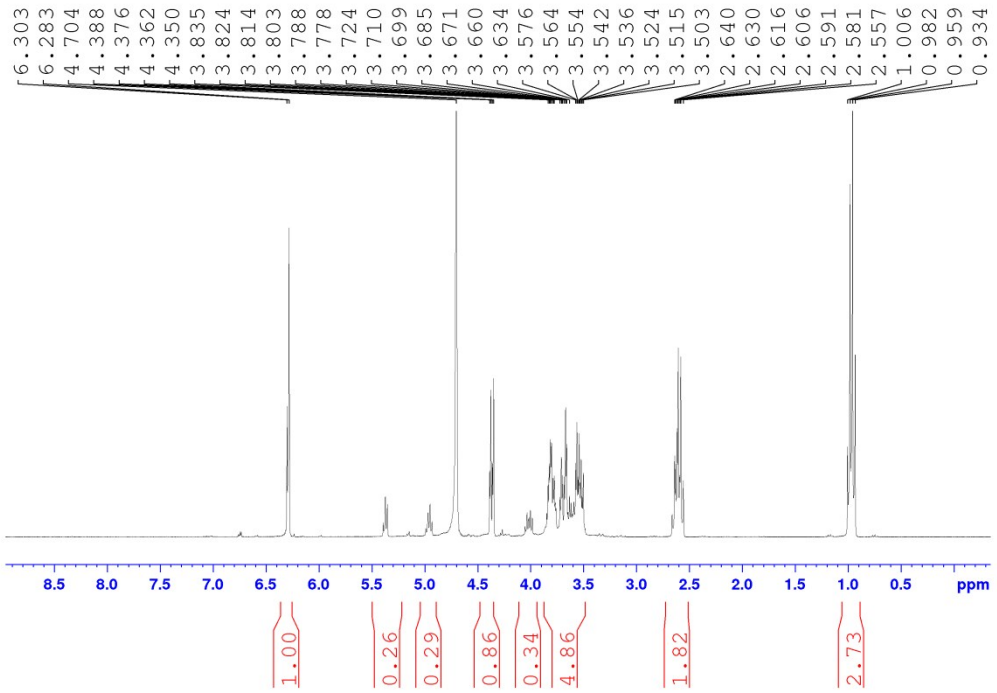
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of K_2CO_3 (1.0 equiv.) in D_2O



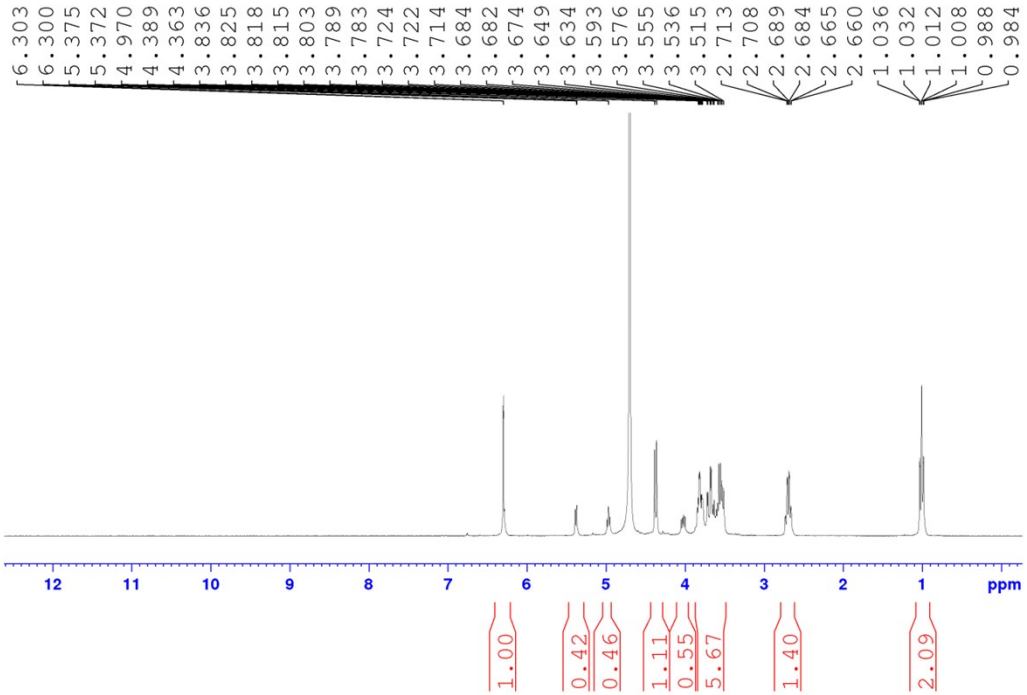
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of $NaHCO_3$ (1.0 equiv.) in D_2O



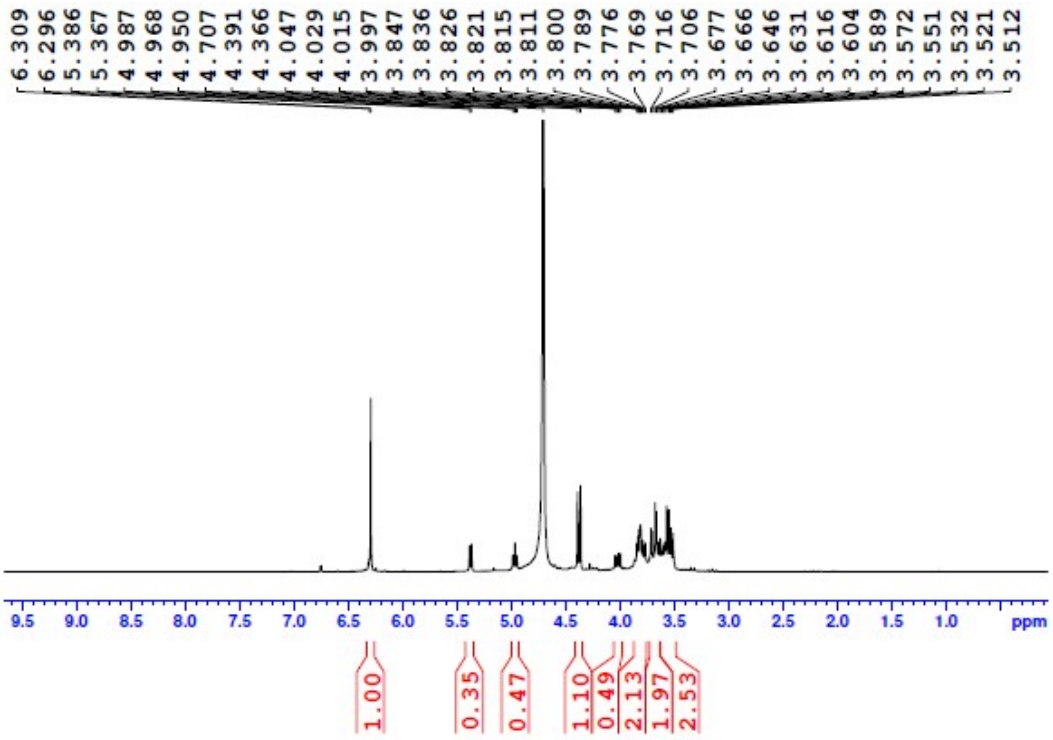
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 10 mol% Et_3N after 4 h in D_2O



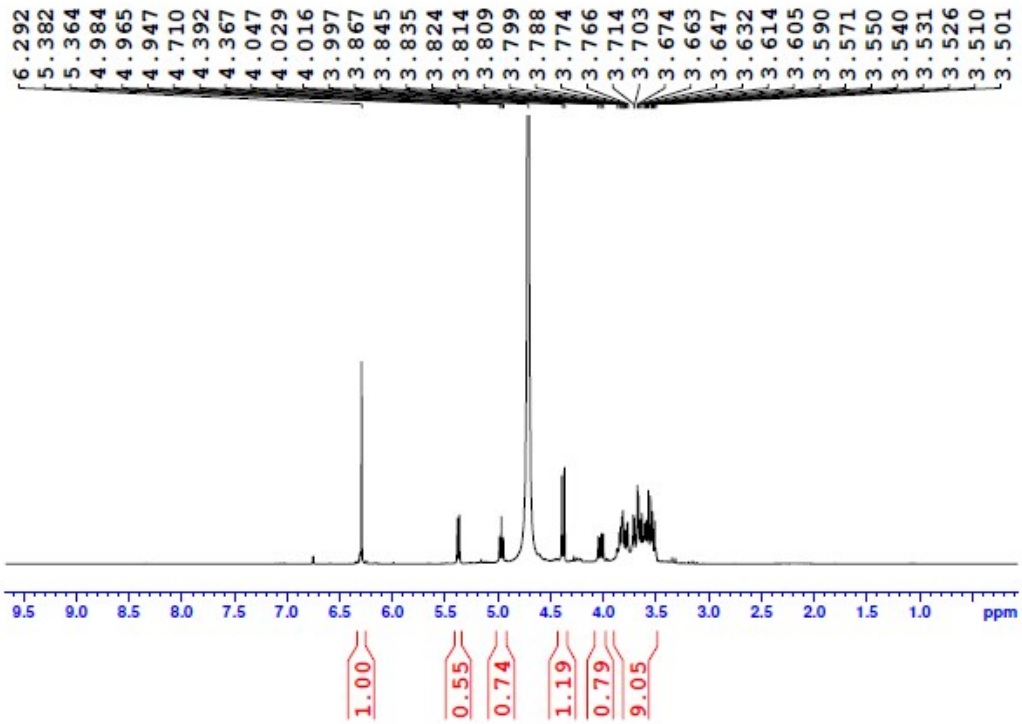
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 5 mol% Et_3N after 4 h in D_2O



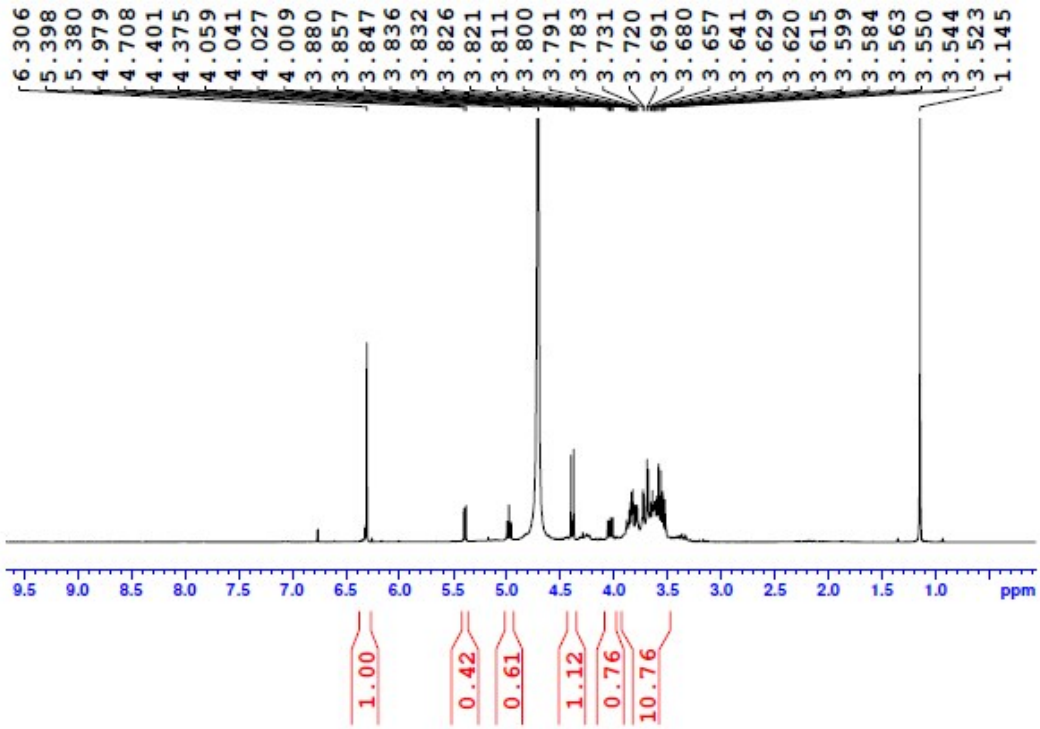
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 15 mol% $CsCO_3$ after 4 h in D_2O



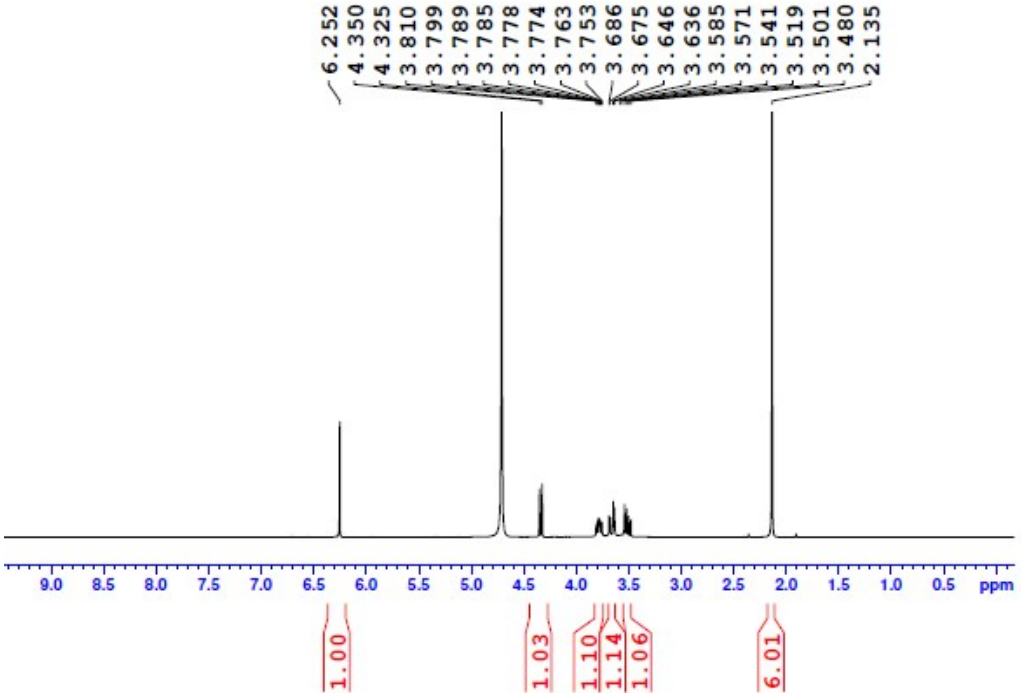
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 15 mol% K_3PO_4 after 4 h in D_2O



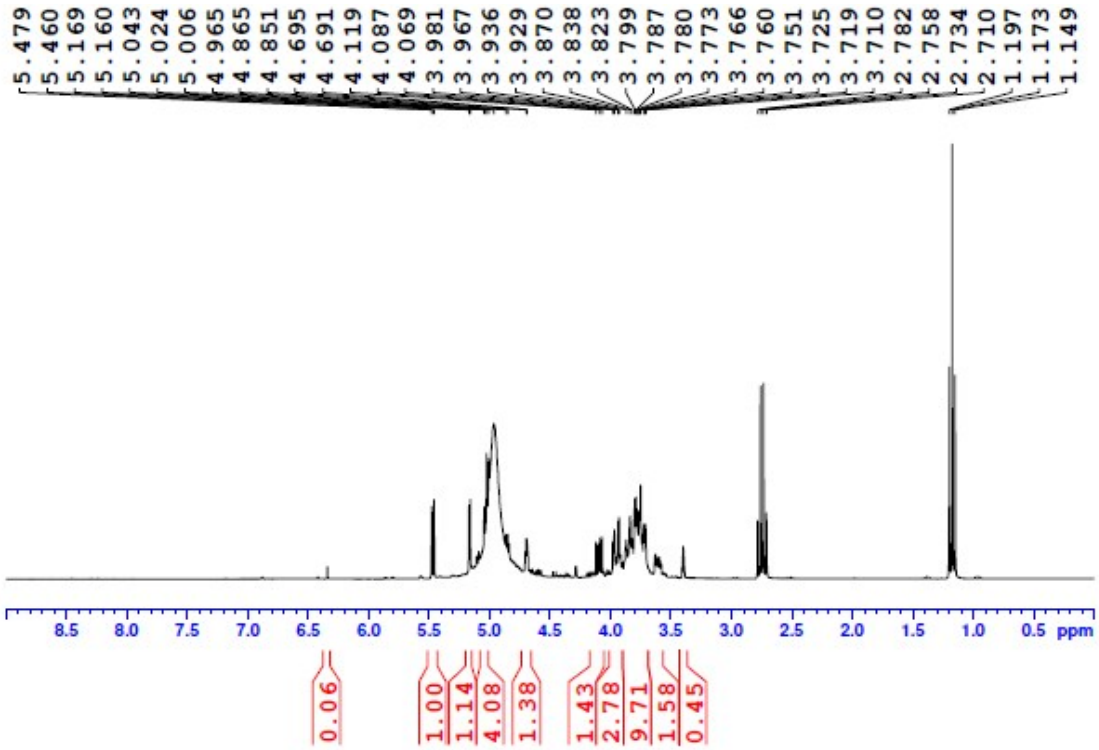
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 15 mol% NaO^{t}Bu after 4 h in D_2O



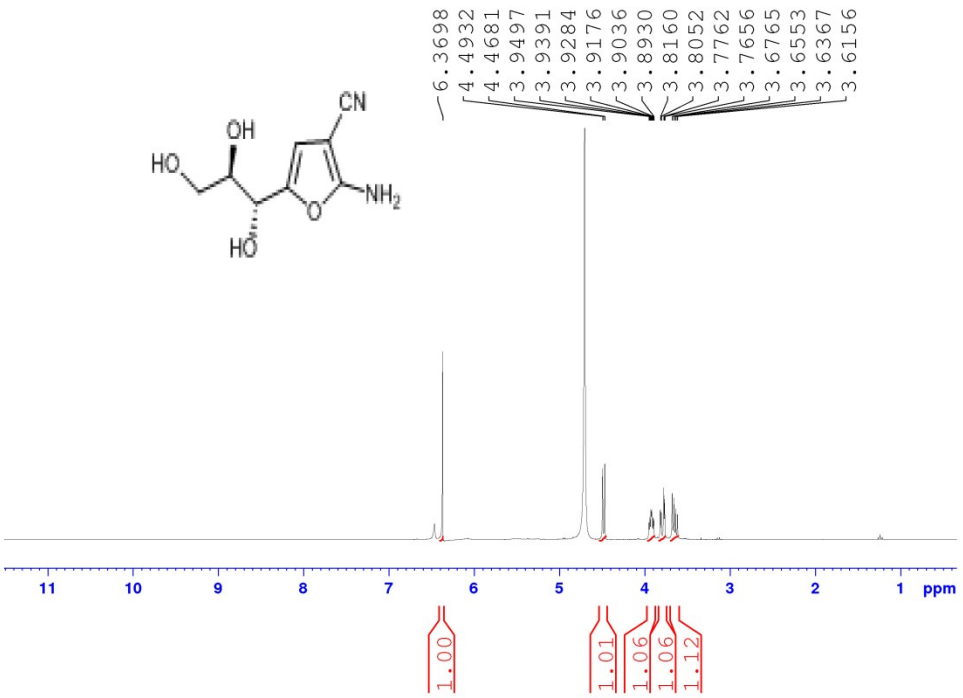
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 15 mol% Me_3N after 4 h in D_2O



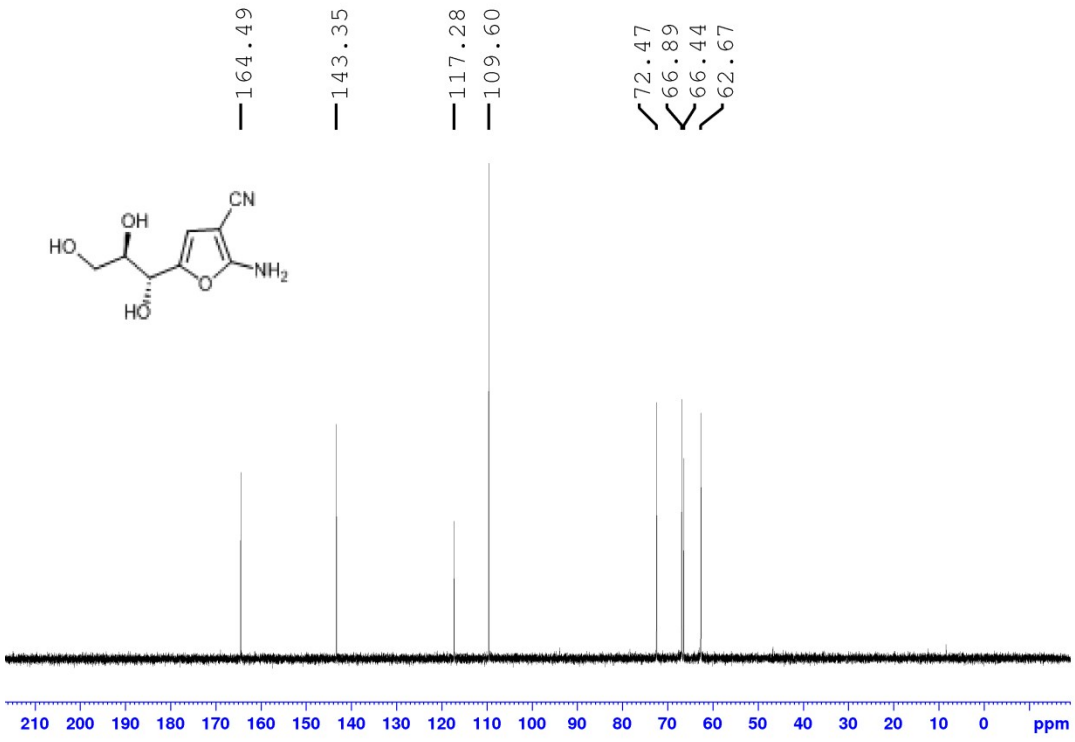
^{1}H NMR of the recation between D-(+)- ribose and malononitrile in presence of 15 mol% Et_3N after 4 h in MeOD



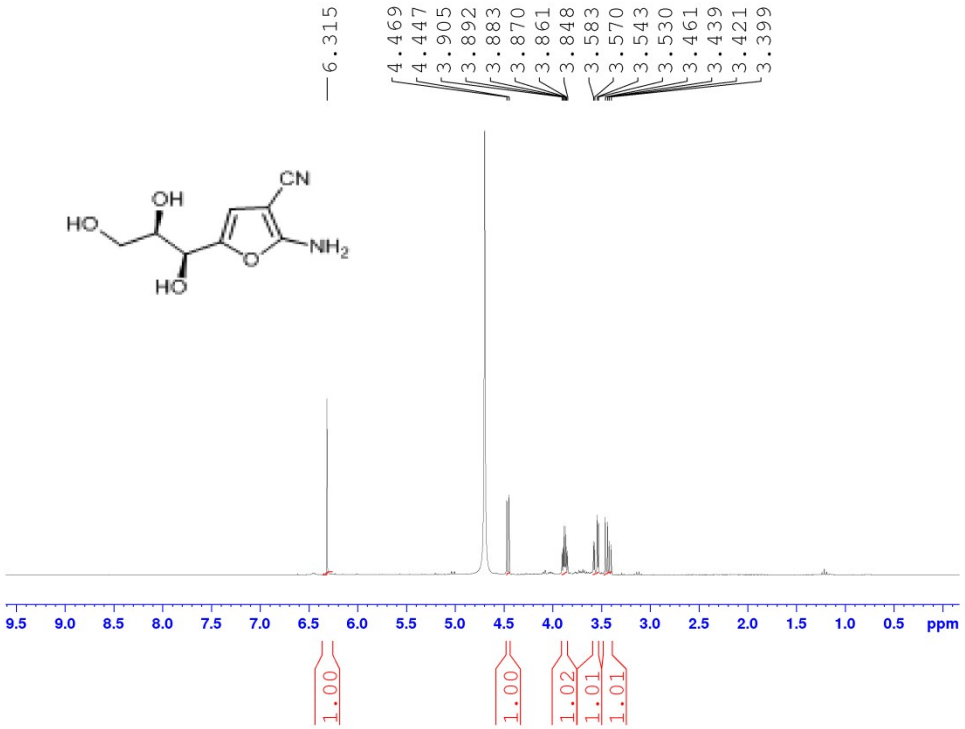
^{1}H NMR Spectra of compound 7a



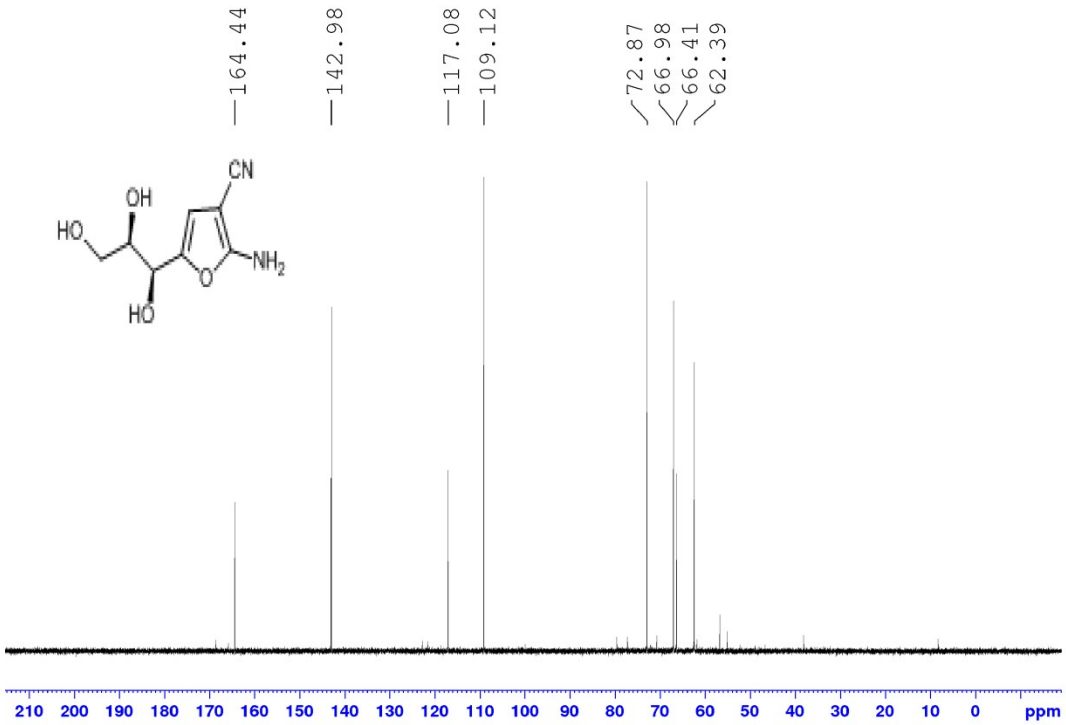
^{13}C NMR Spectra of compound 7a



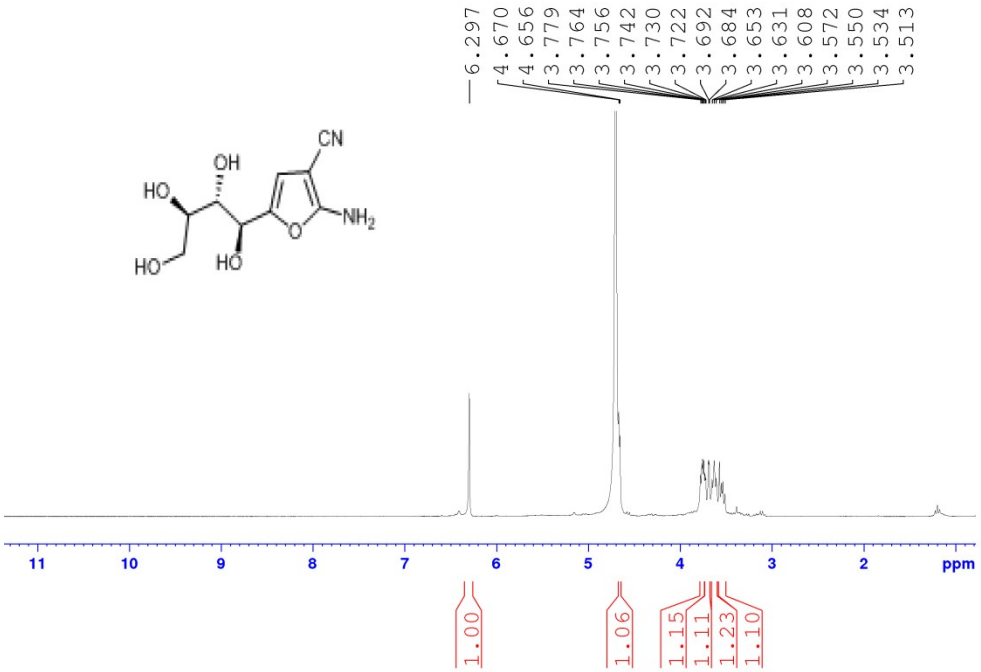
^{1}H NMR Spectra of compound 9a



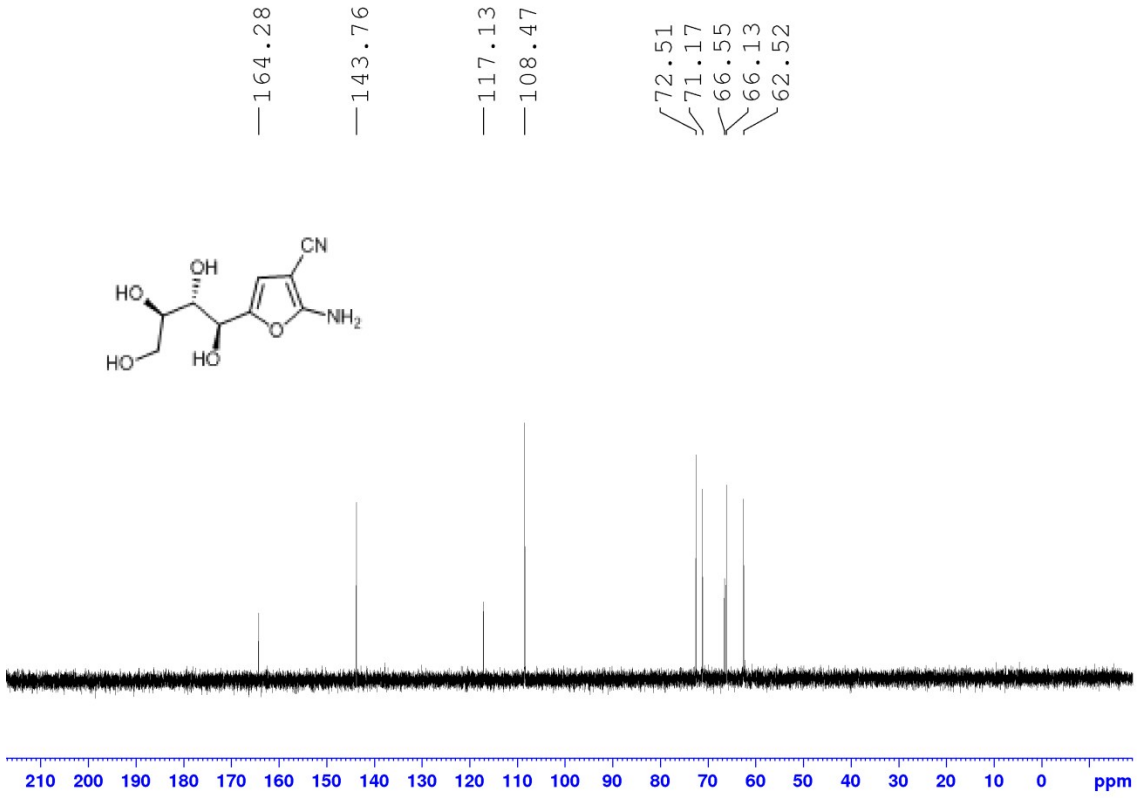
^{13}C NMR Spectra of compound 9a



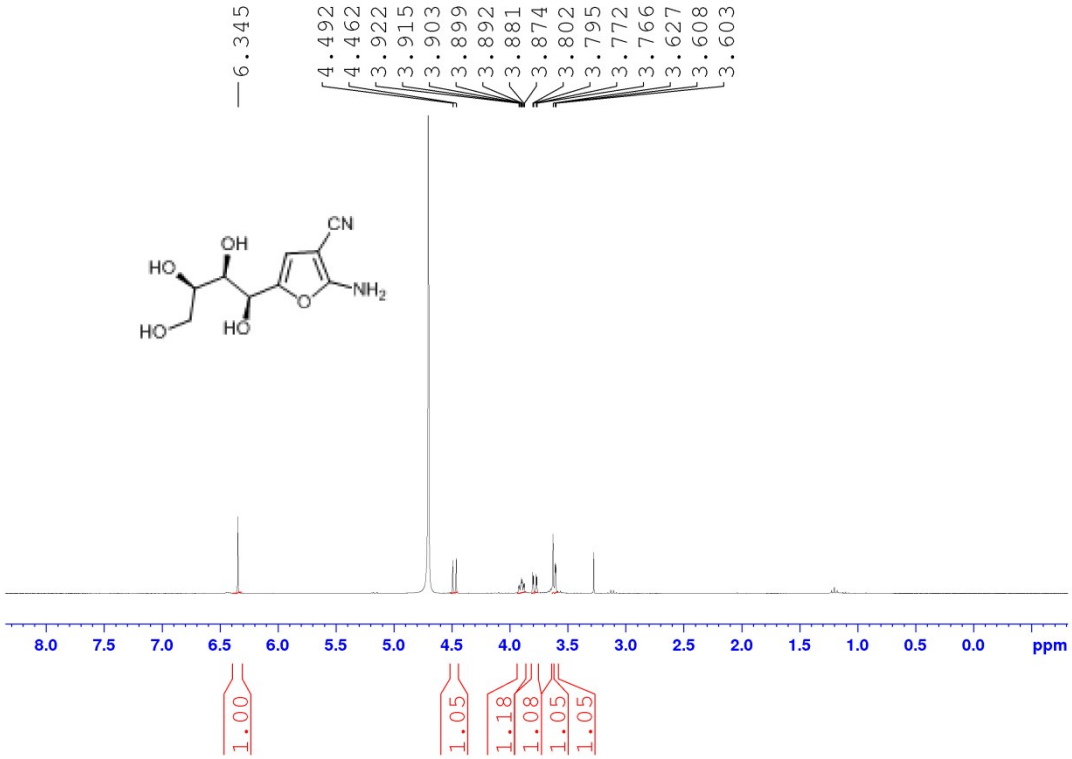
^{1}H NMR Spectra of compound 10a



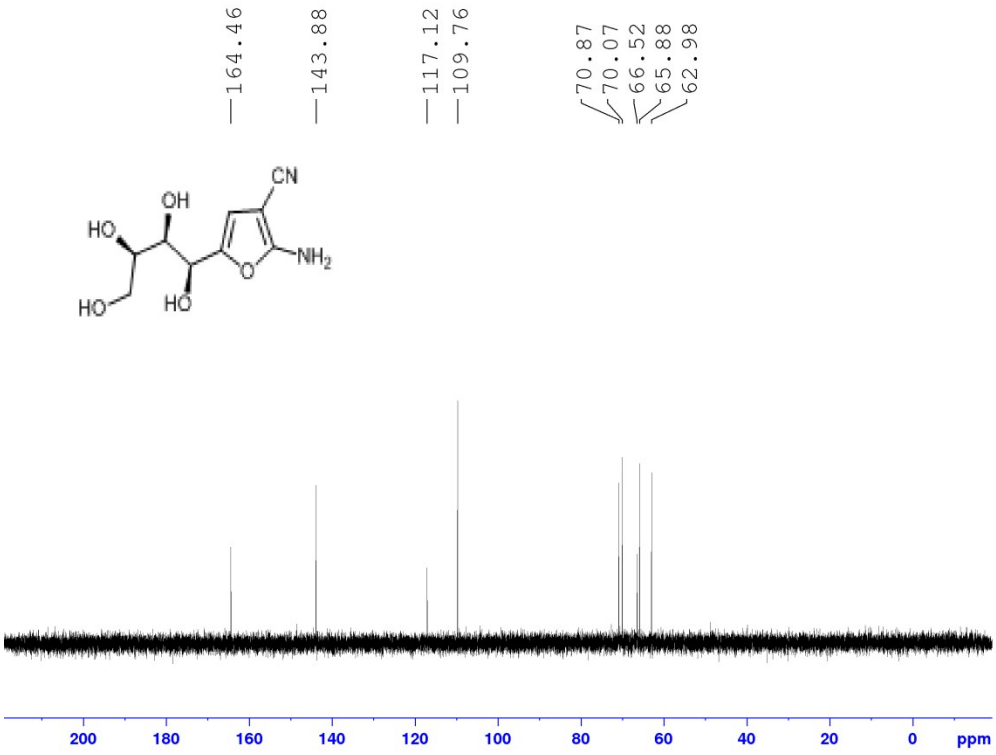
^{13}C NMR Spectra of compound 10a



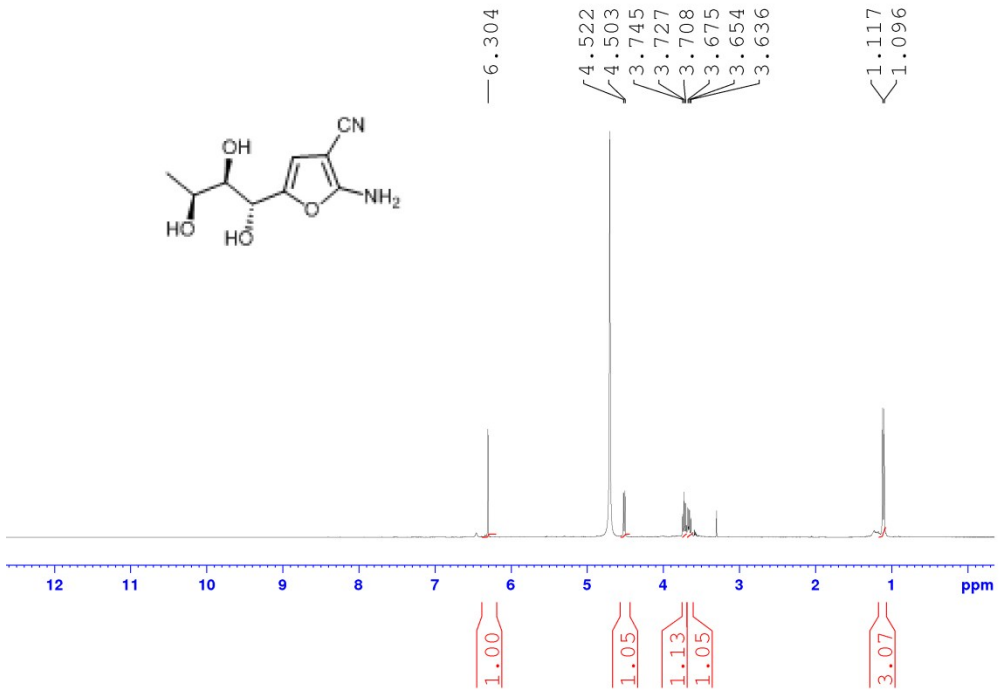
[1]H NMR Spectra of compound 12a



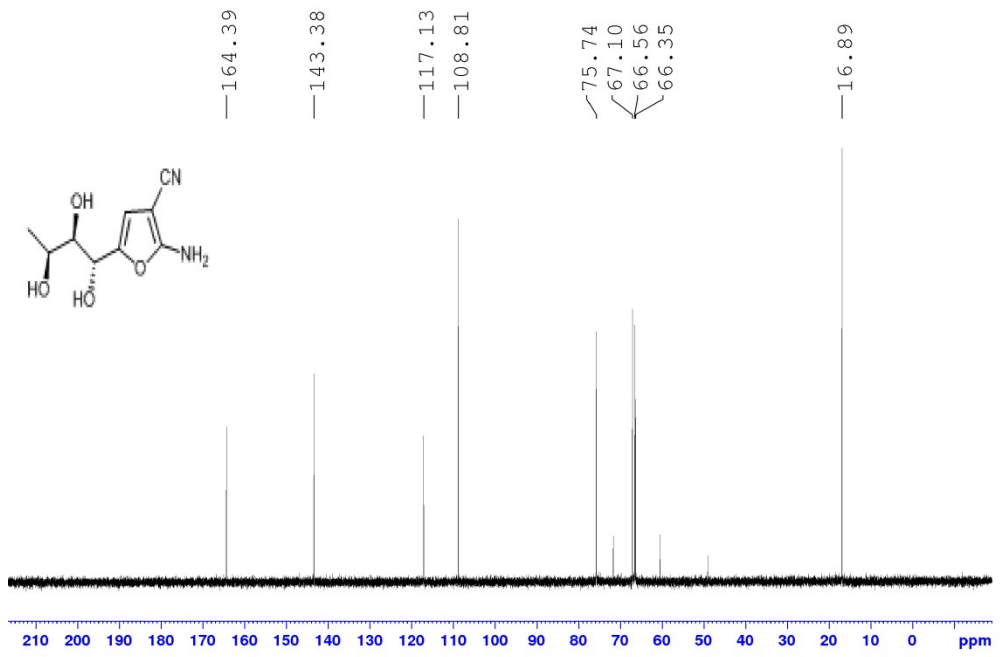
[3]C NMR Spectra of compound 12a



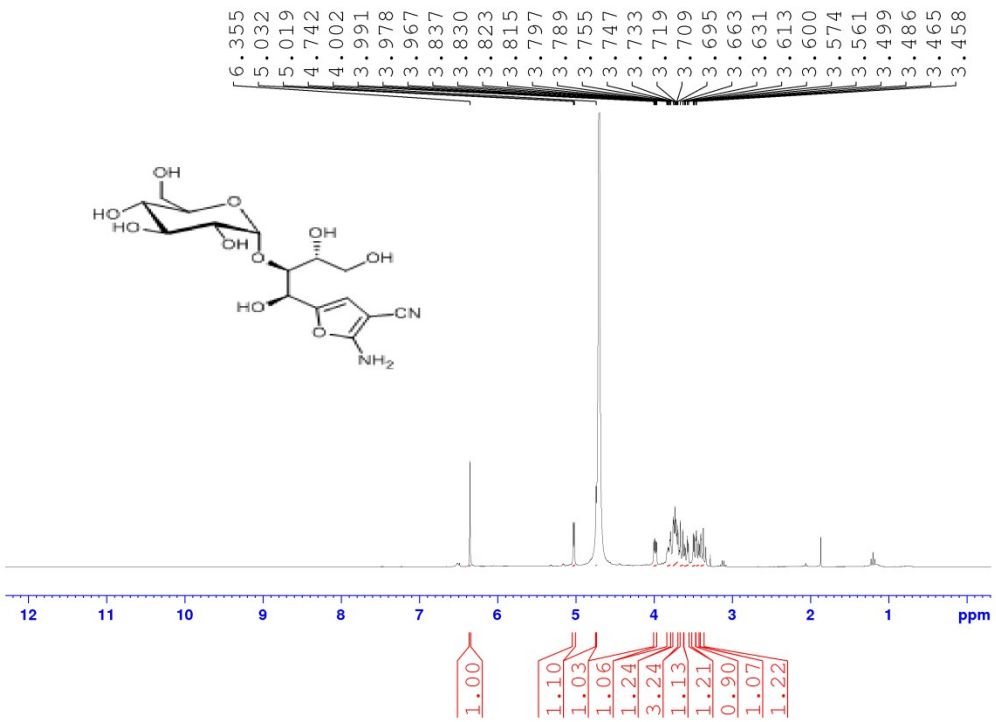
^{1}H NMR Spectra of compound 13a



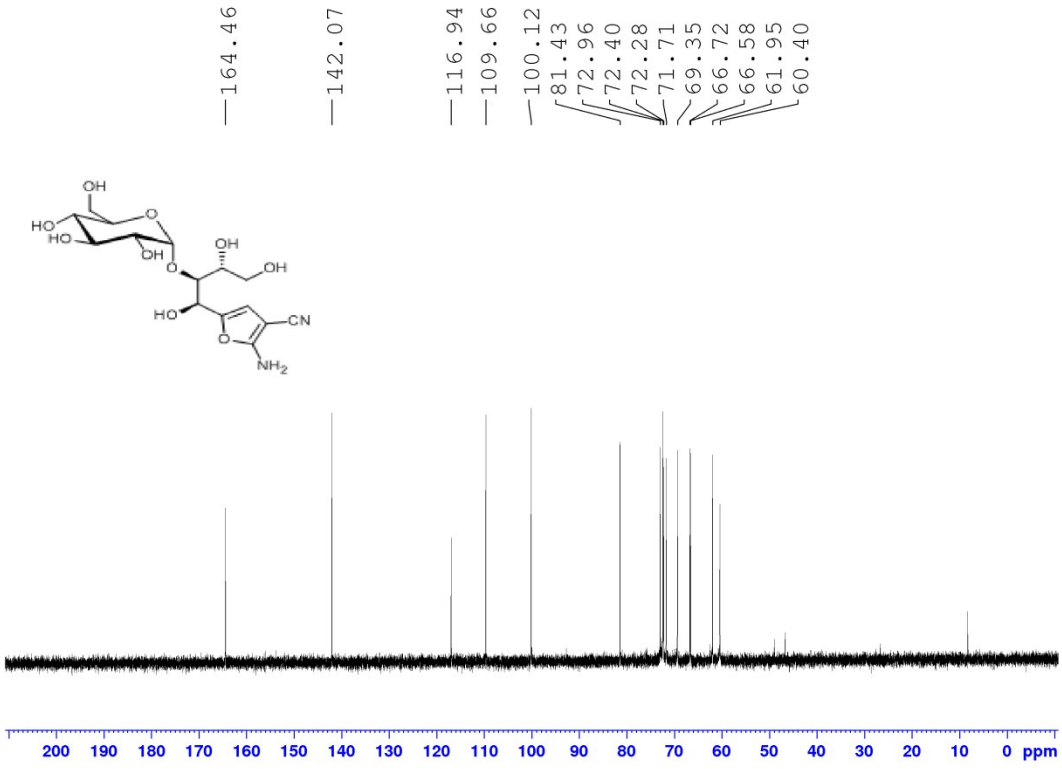
^{13}C NMR Spectra of compound 13a



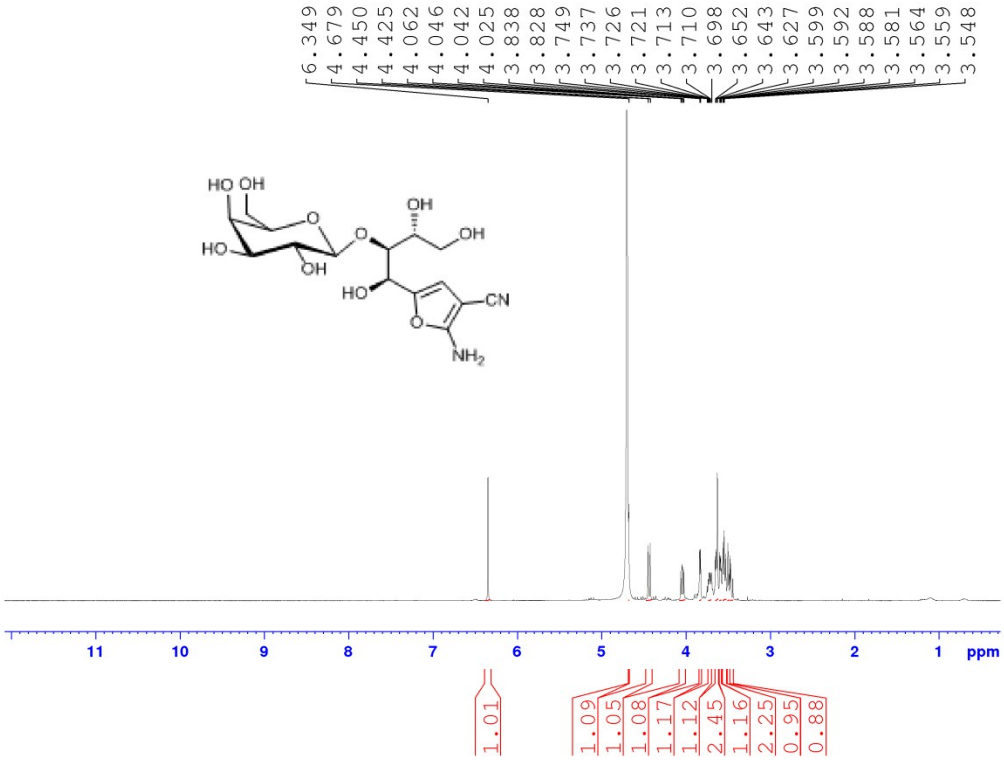
^{1}H NMR Spectra of compound 14a



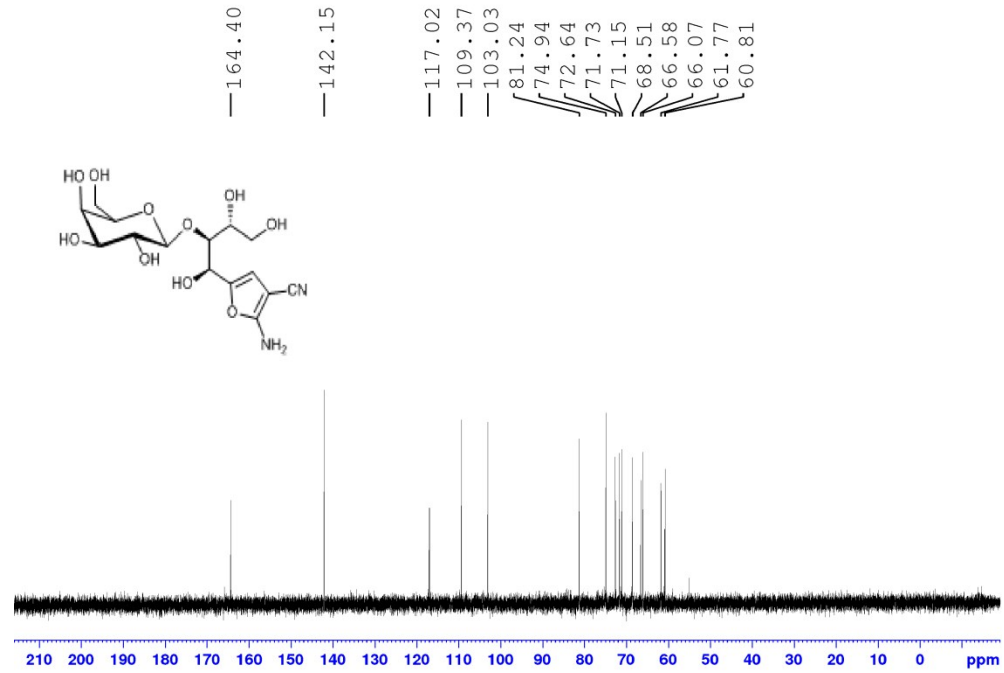
^{13}C NMR Spectra of compound 14a



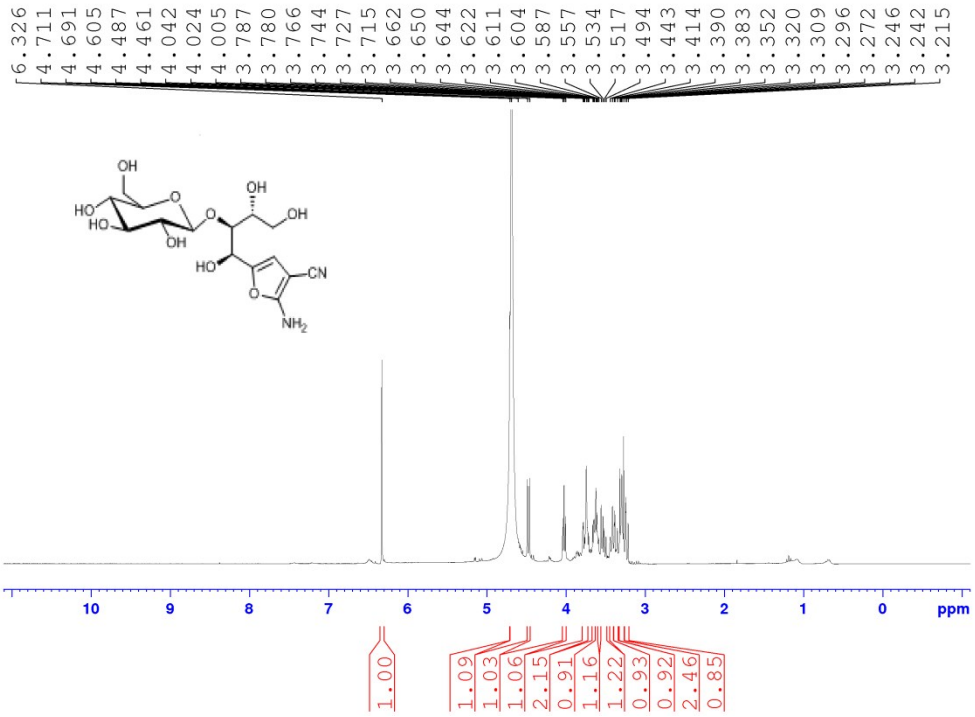
^{1}H NMR Spectra of compound 15a



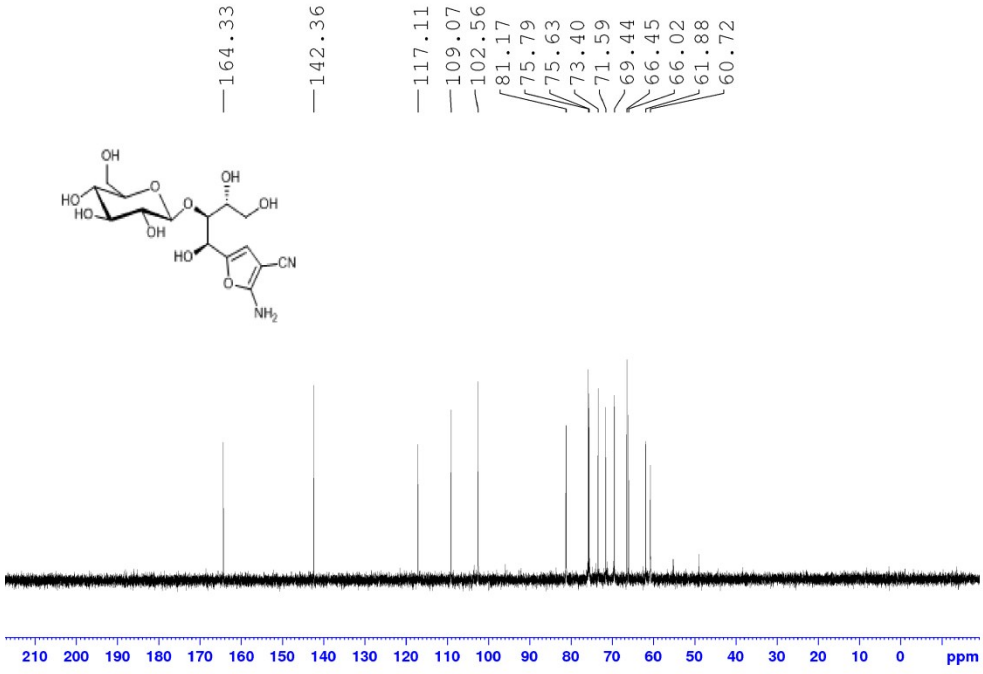
^{13}C NMR Spectra of compound 15a



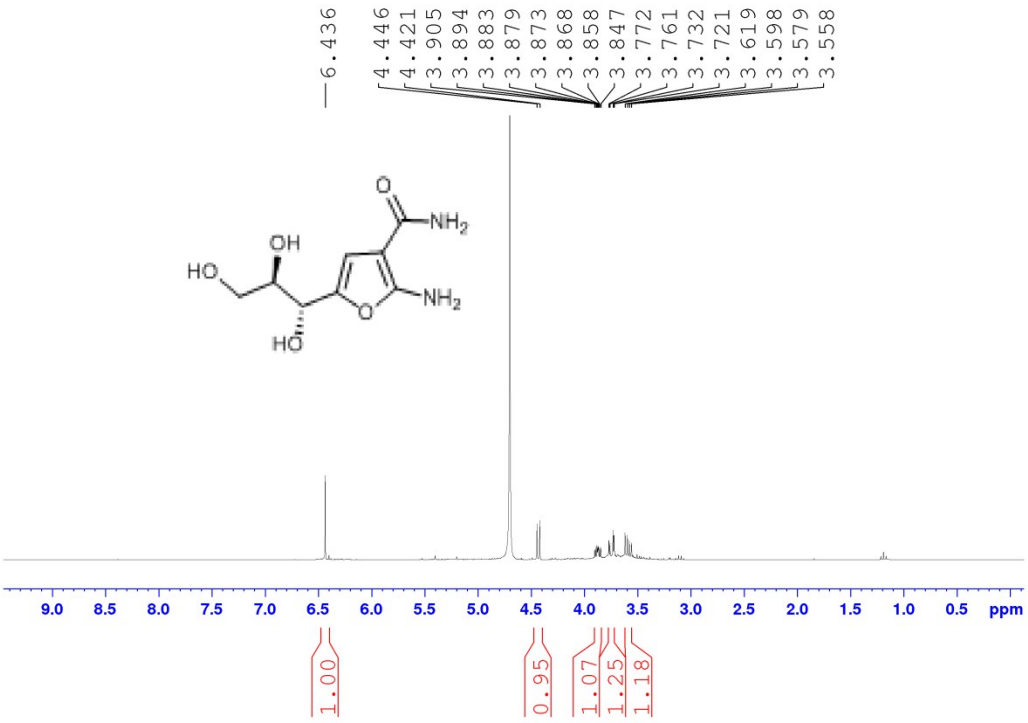
^{1}H NMR Spectra of compound 16a



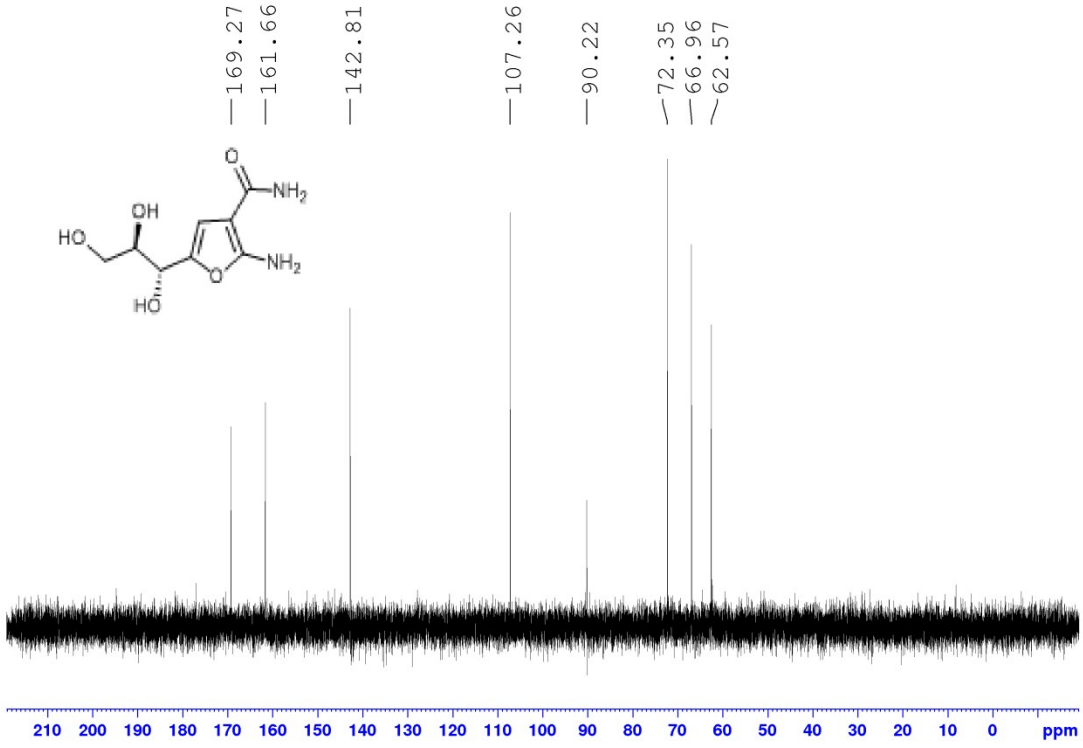
^{13}C NMR Spectra of compound 16a



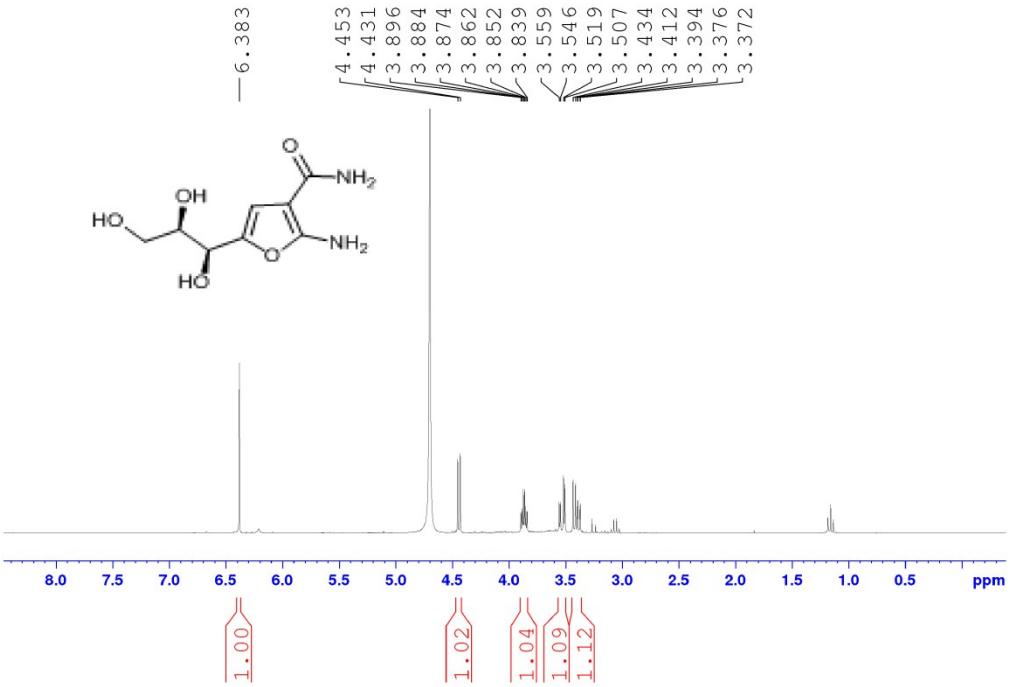
[1]H NMR Spectra of compound 7c



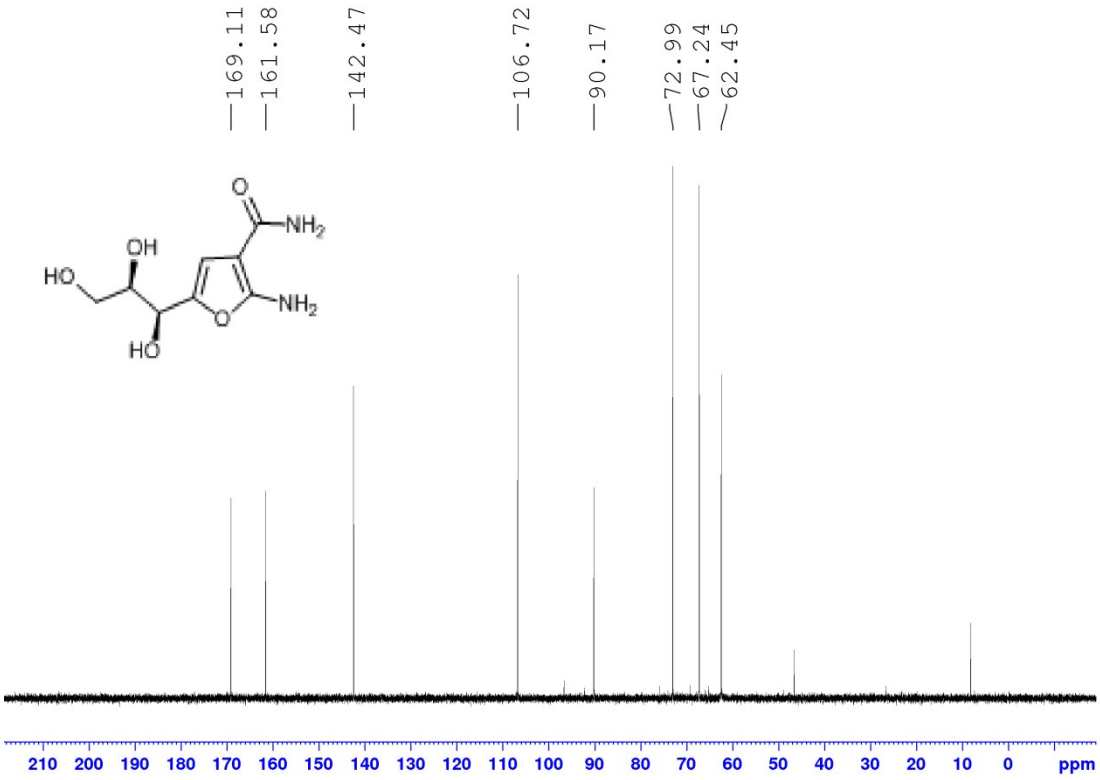
[13]C NMR Spectra of compound 7c



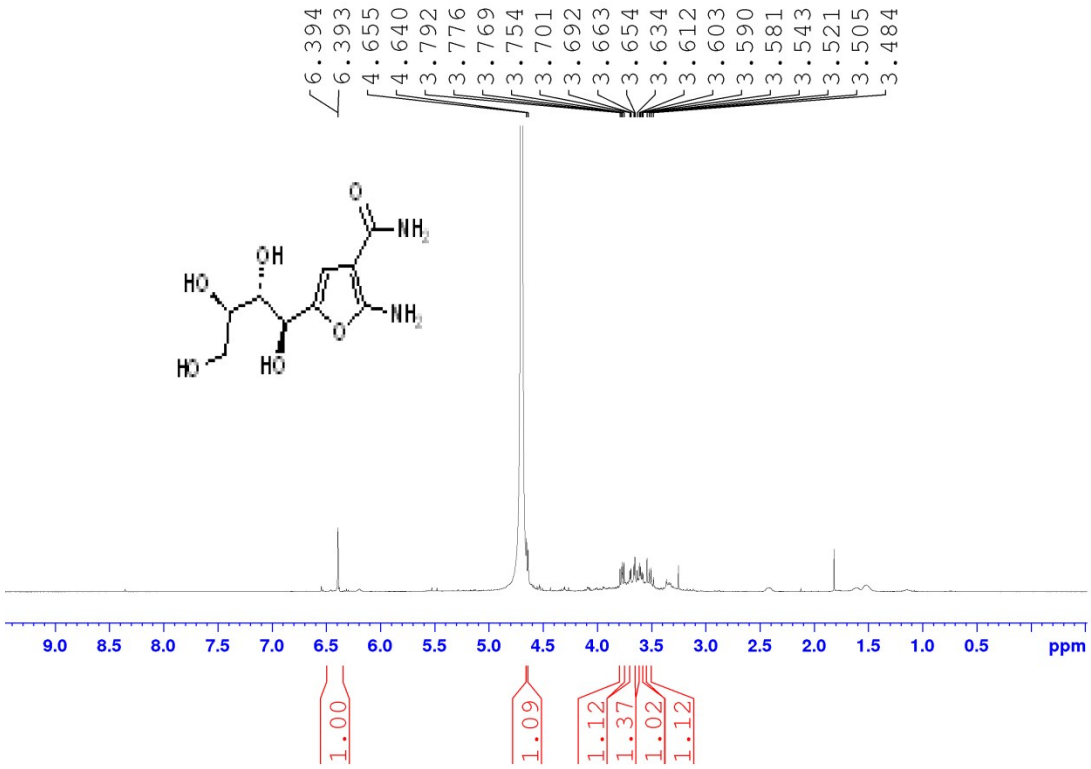
^{1}H NMR Spectra of compound 9c



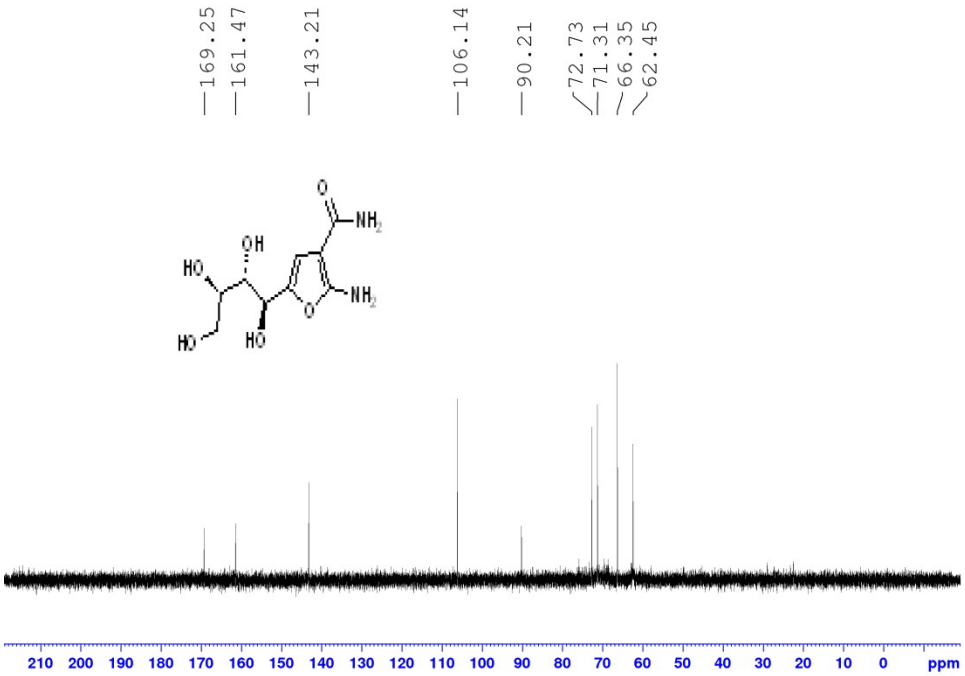
^{13}C NMR Spectra of compound 9c



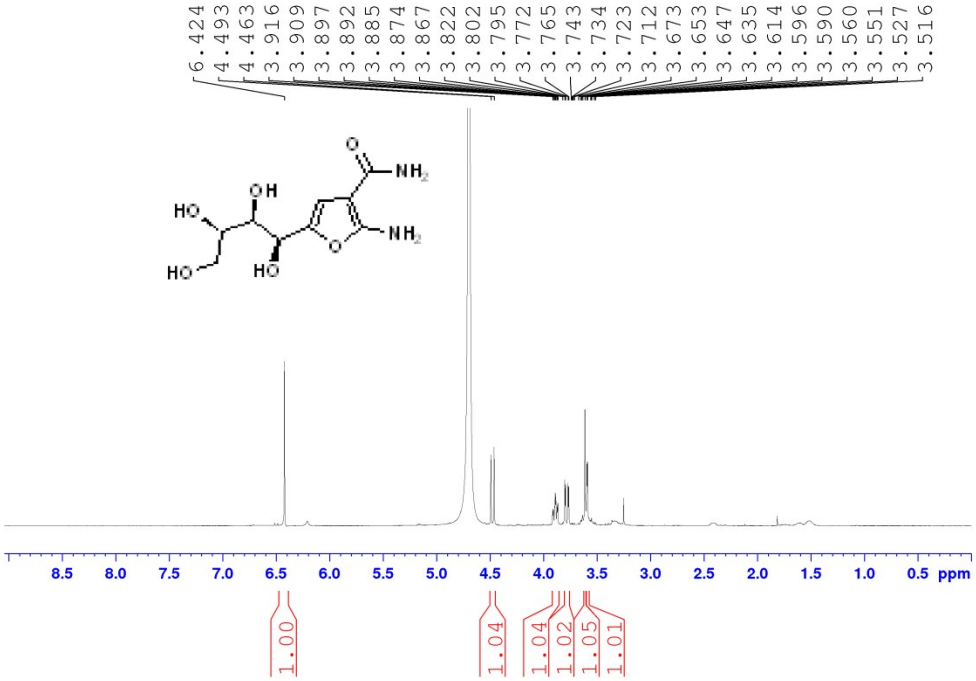
^{1}H NMR Spectra of compound 10c



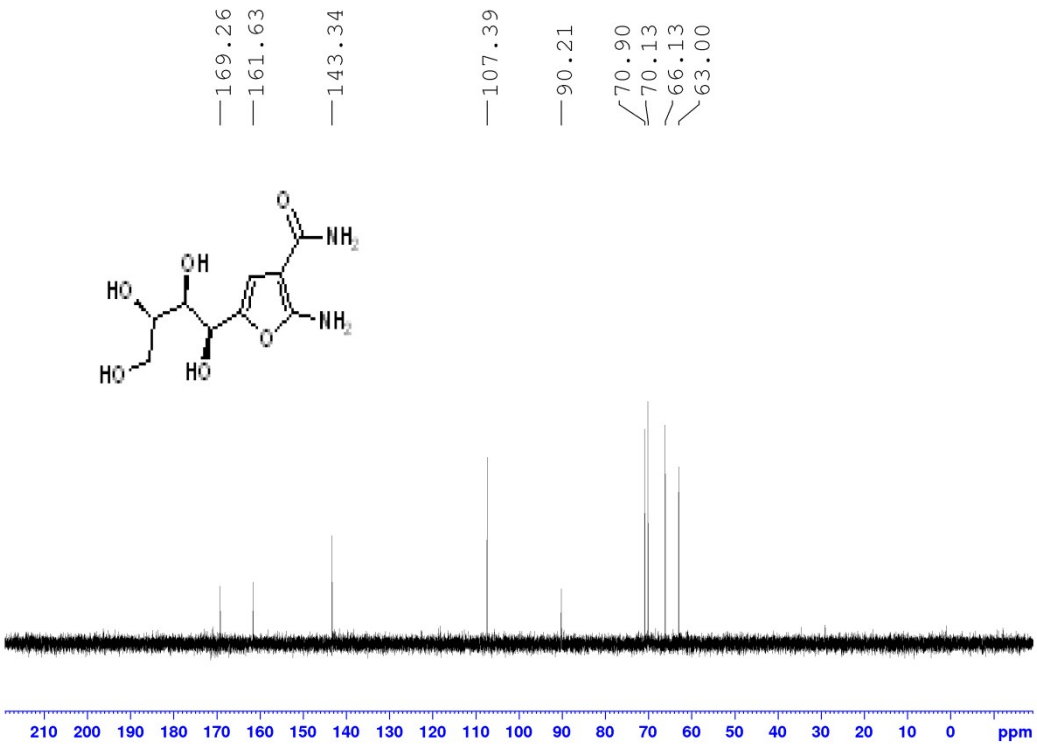
^{13}C NMR Spectra of compound 10c



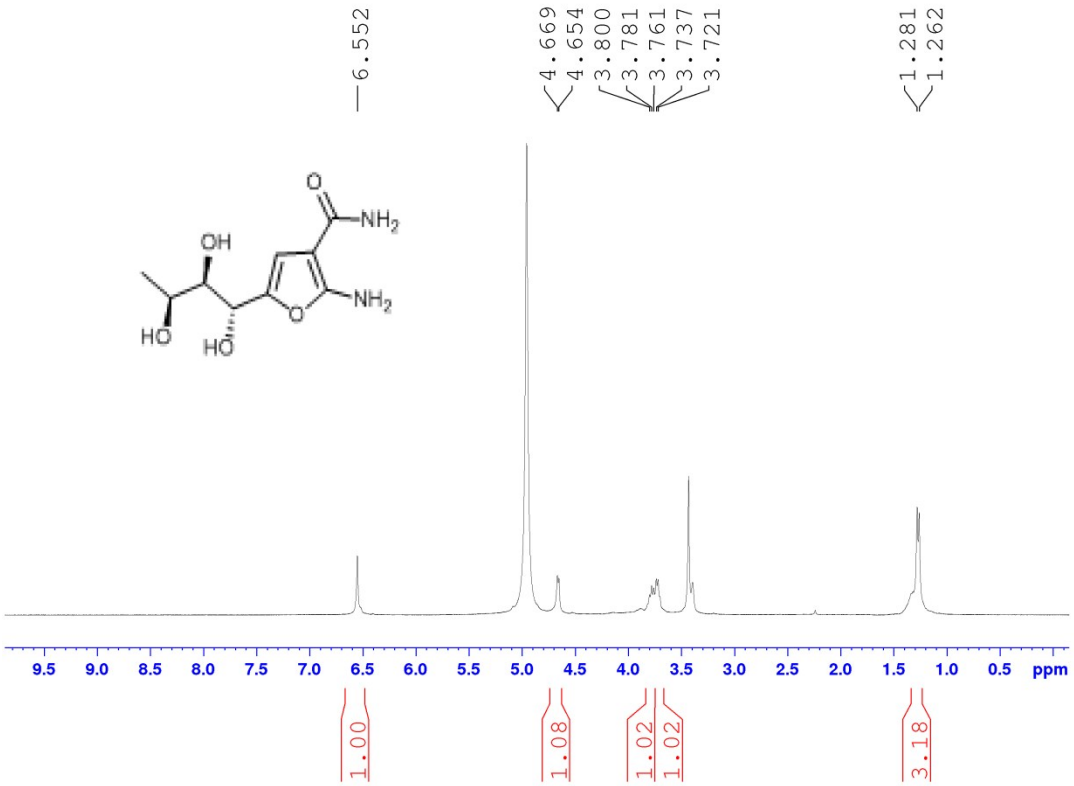
[1]H NMR Spectra of compound 12c



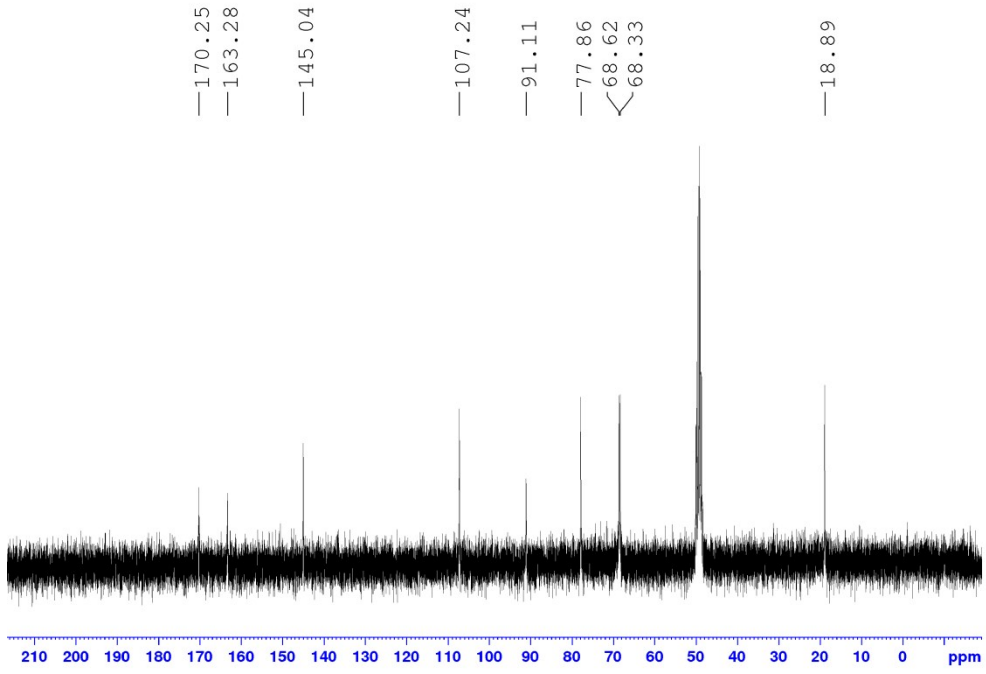
[13]C NMR Spectra of compound 12c



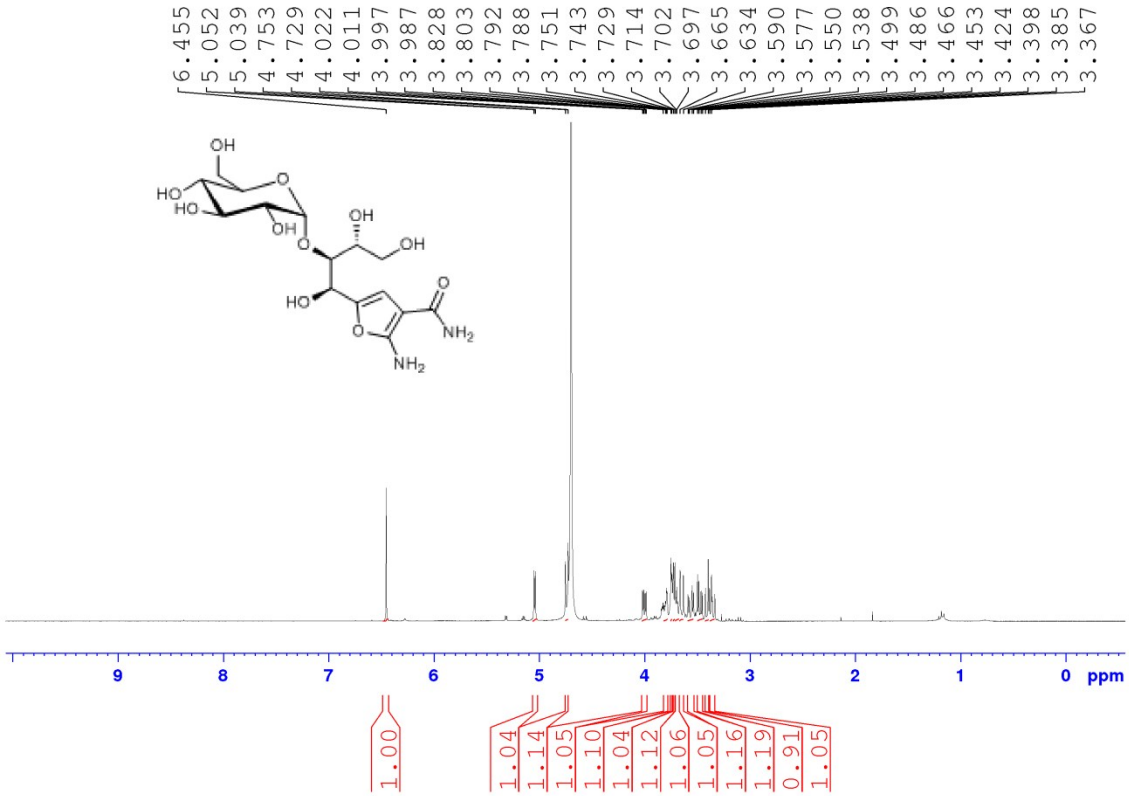
[1]H NMR Spectra of compound 13c (MeOD-D4)



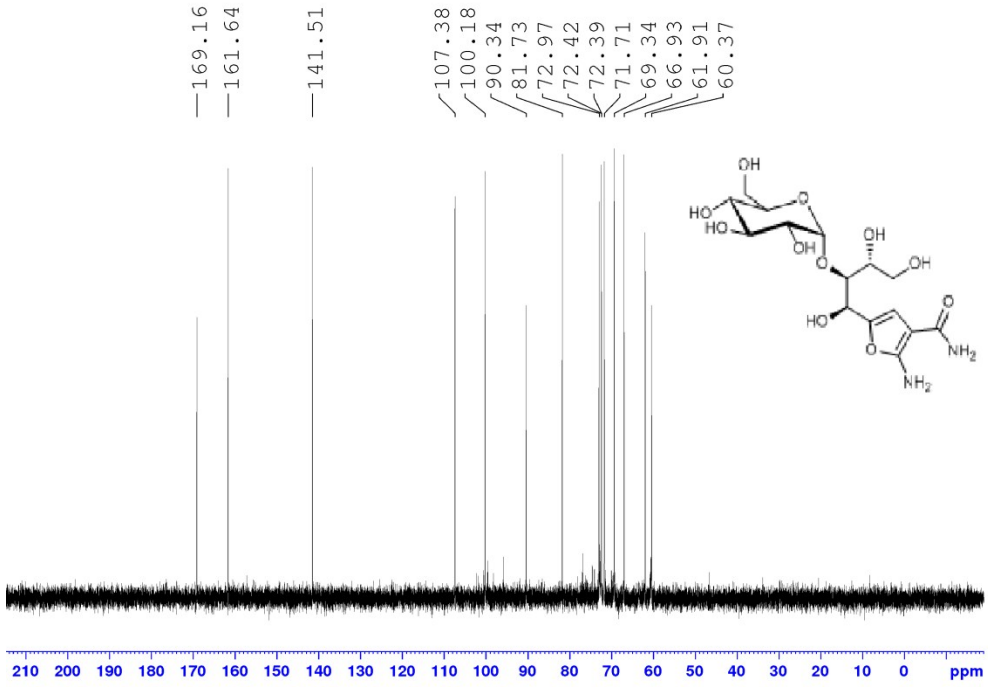
[13]C NMR Spectra of compound 13c (MeOD-D4)



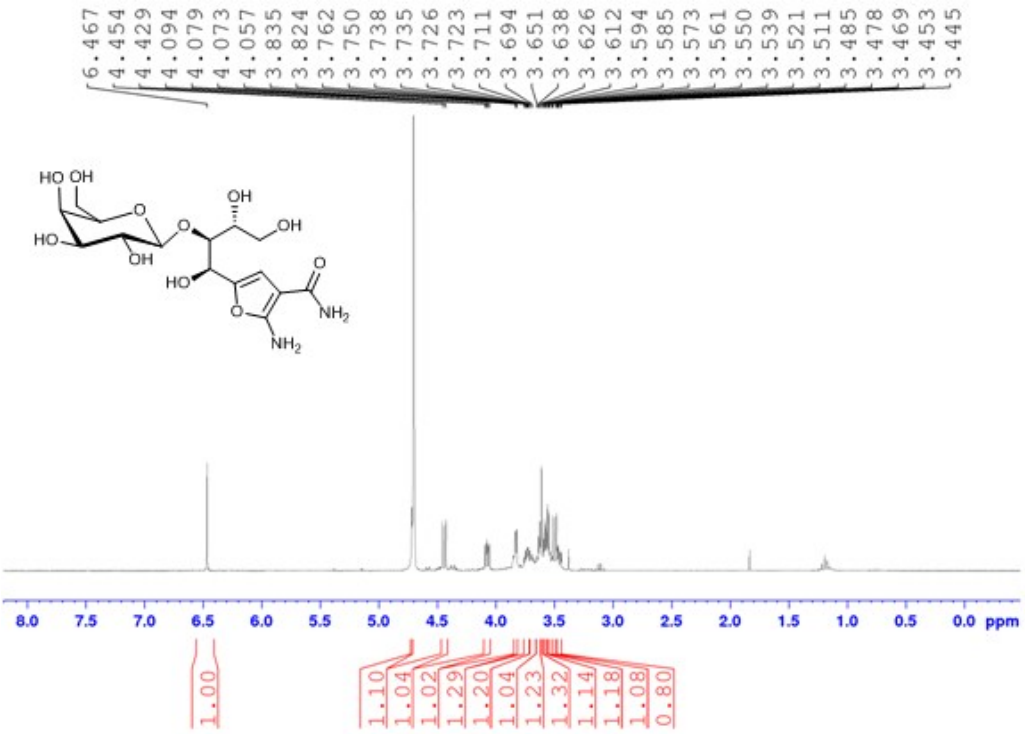
^{1}H NMR Spectra of compound 14c



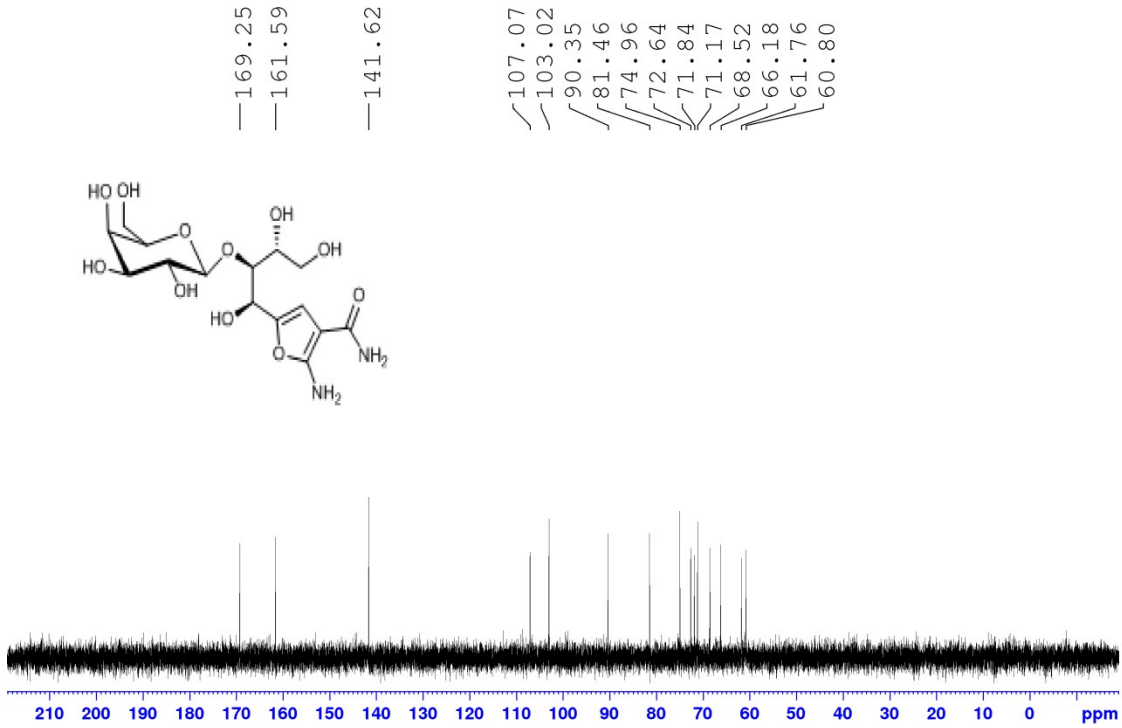
^{13}C NMR Spectra of compound 14c



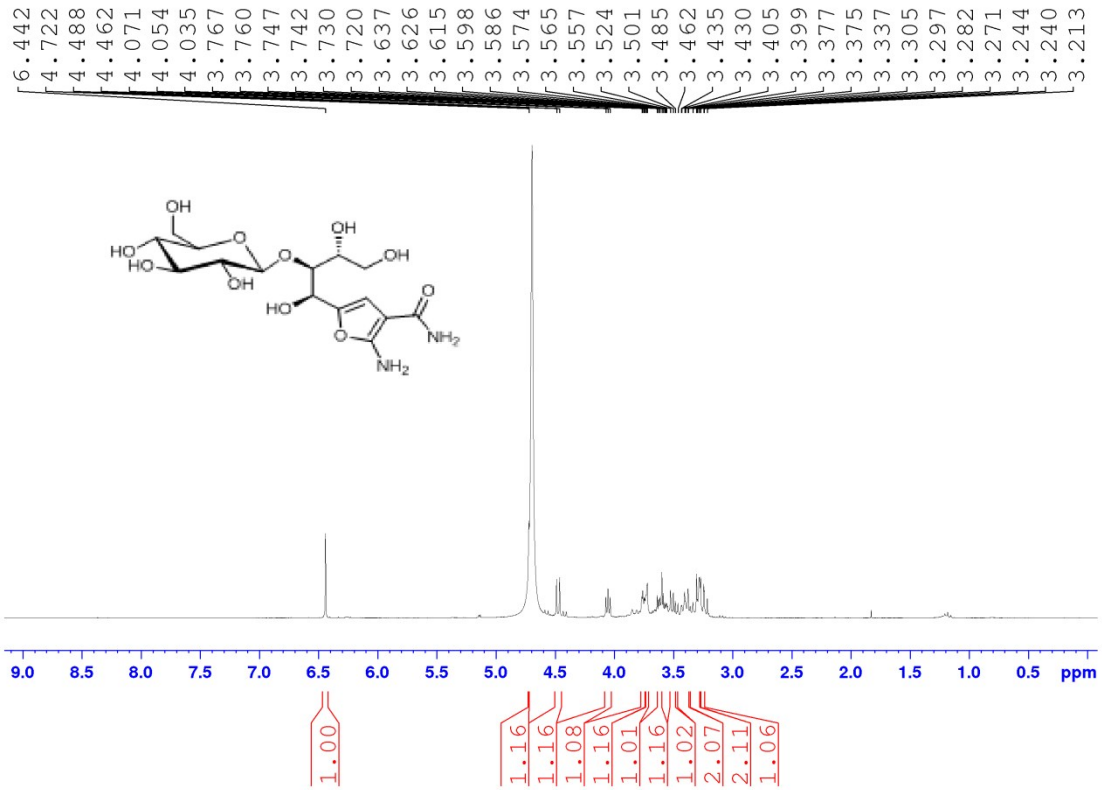
^{1}H NMR Spectra of compound 15c



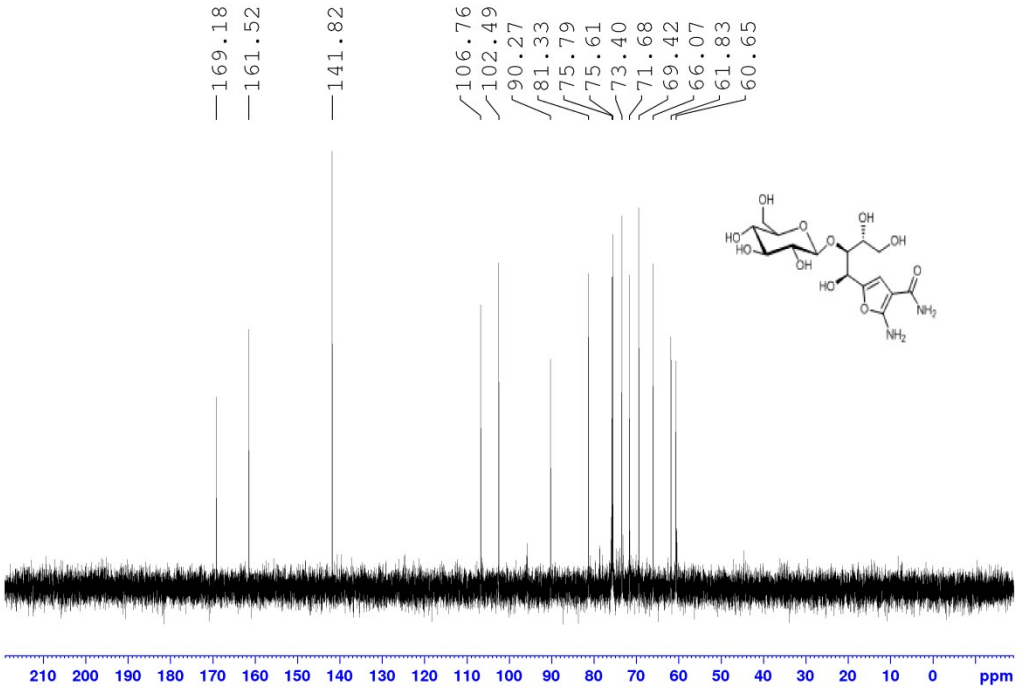
^{13}C NMR Spectra of compound 15c



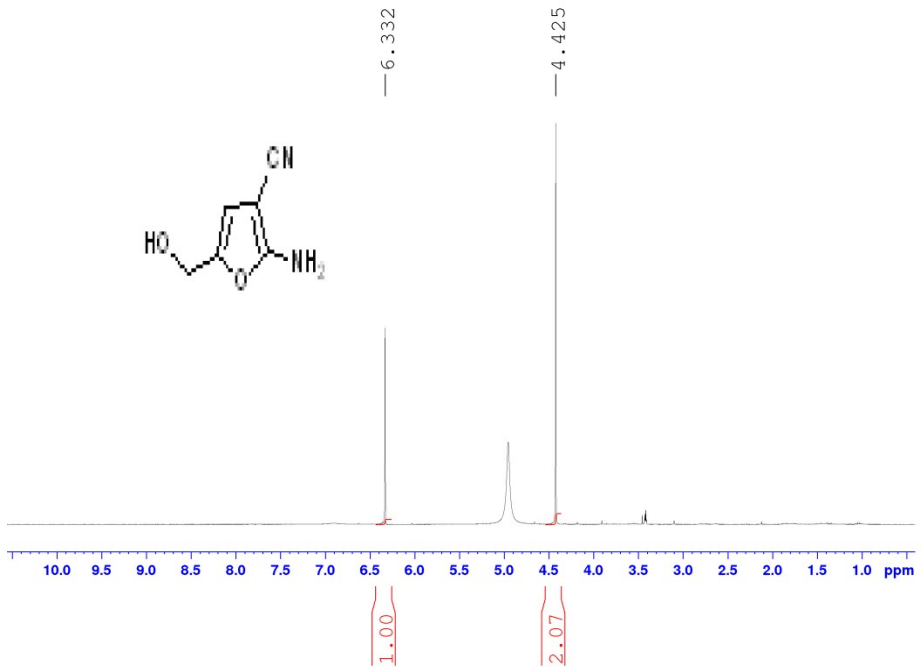
^{1}H NMR Spectra of compound 16c



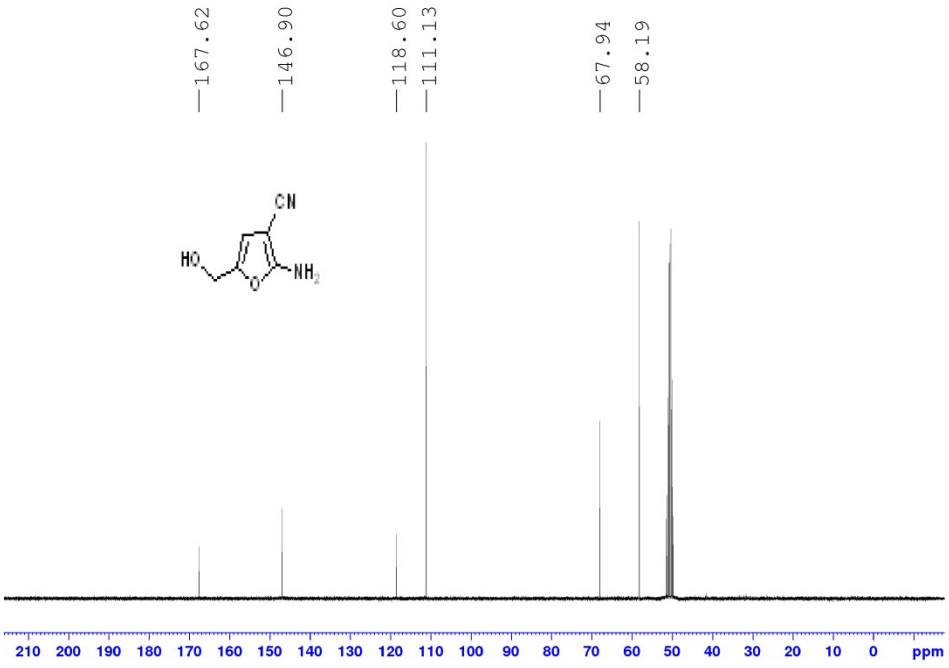
^{13}C NMR Spectra of compound 16c



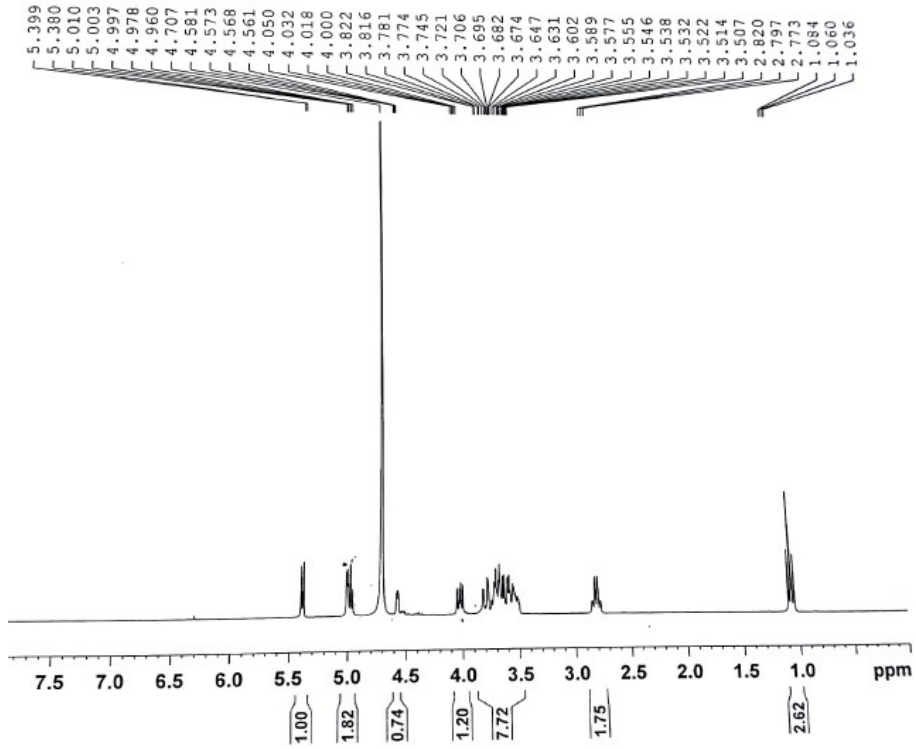
^{1}H NMR Spectra of compound 18



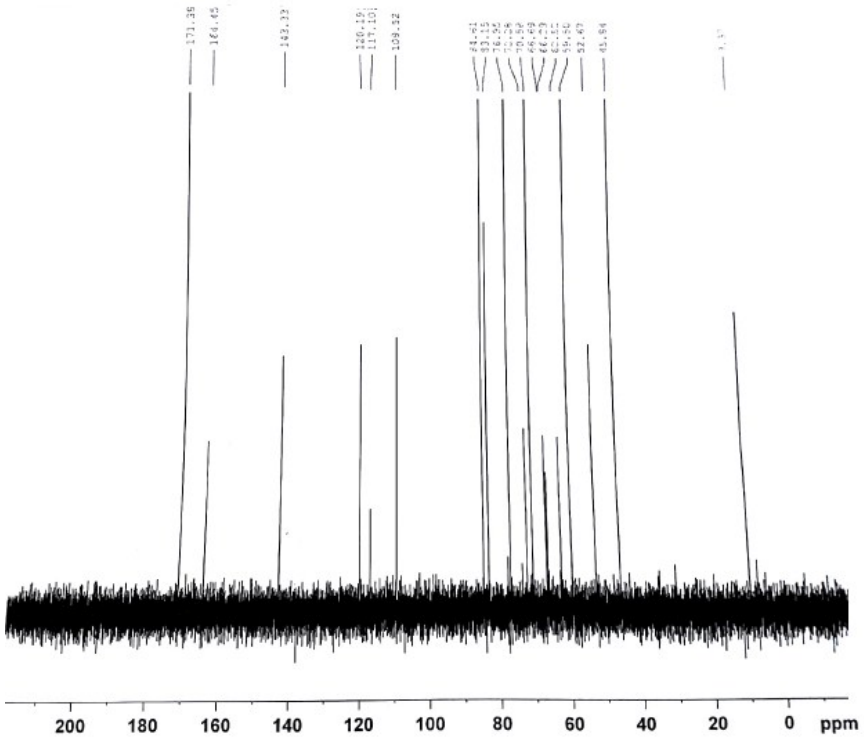
^{13}C NMR Spectra of compound 18



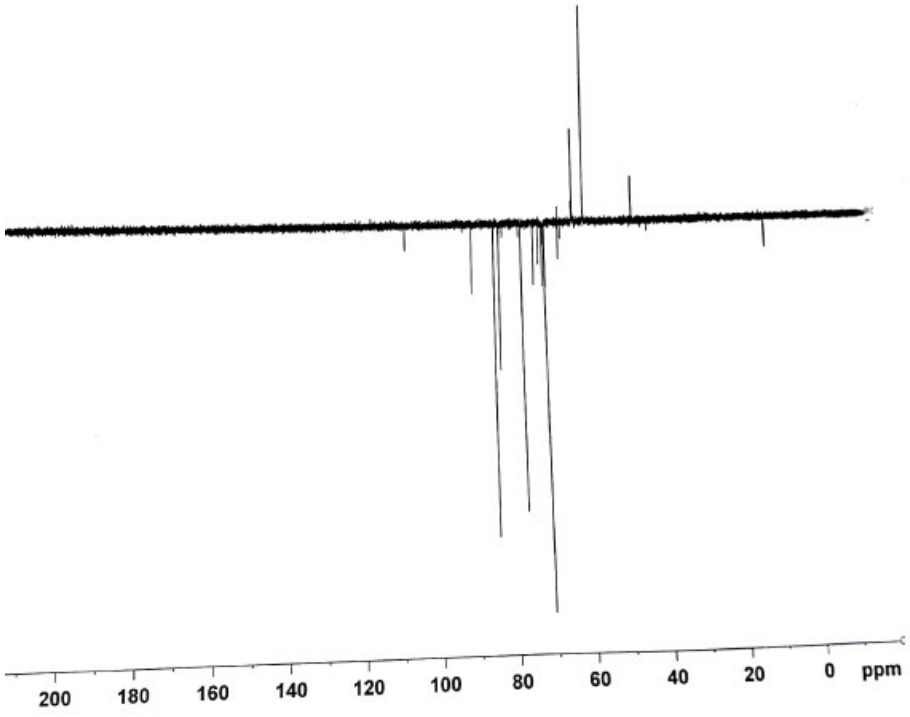
^{1}H NMR Spectra of intermediate III



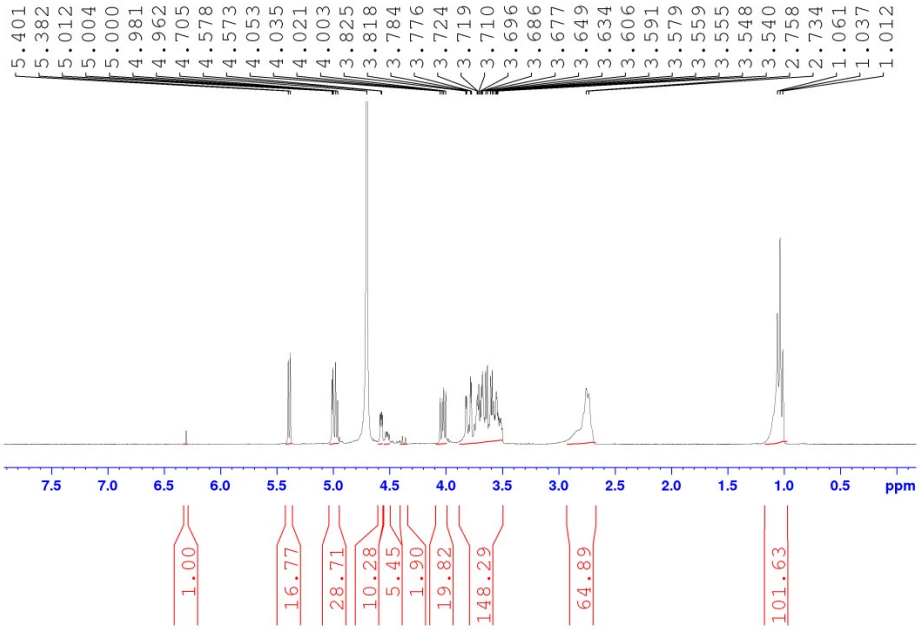
^{13}C NMR Spectra of intermediate III



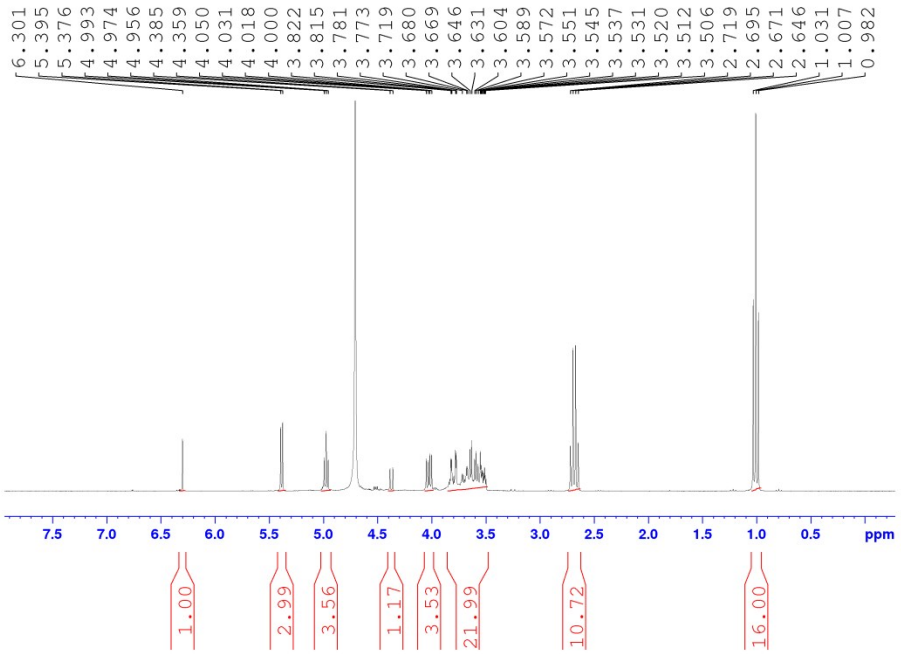
DEPT-135 Spectra of intermediate III



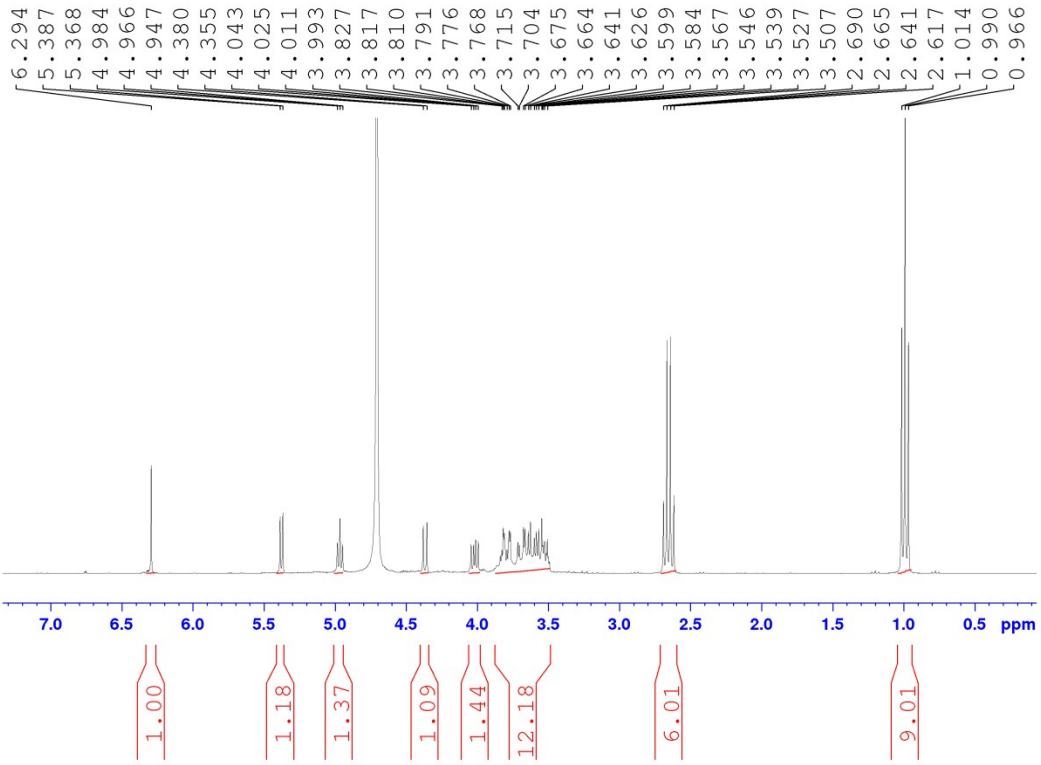
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 20 m



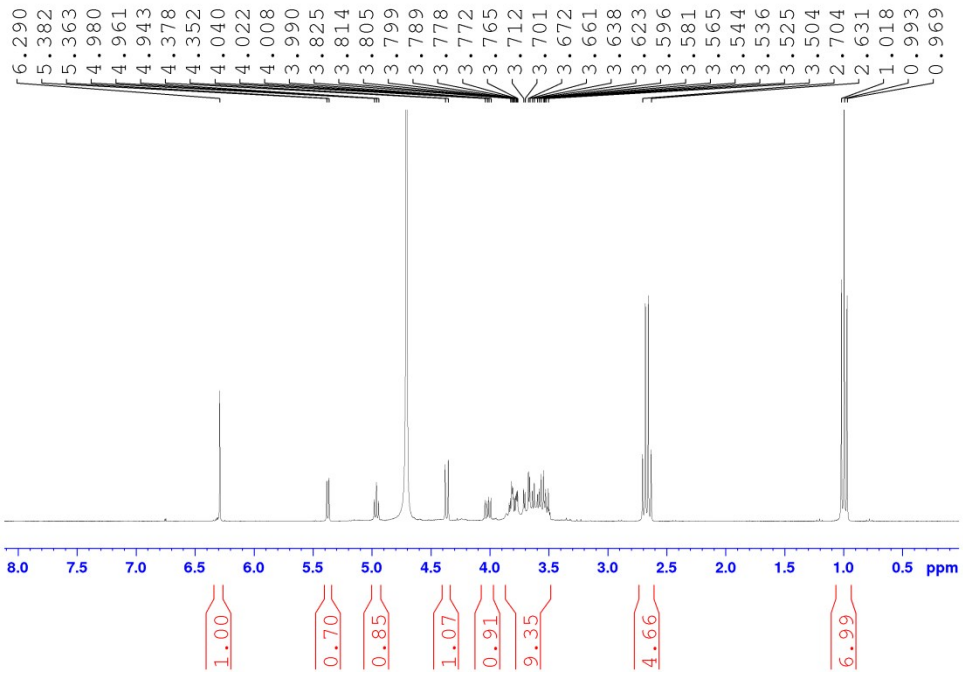
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 40 m



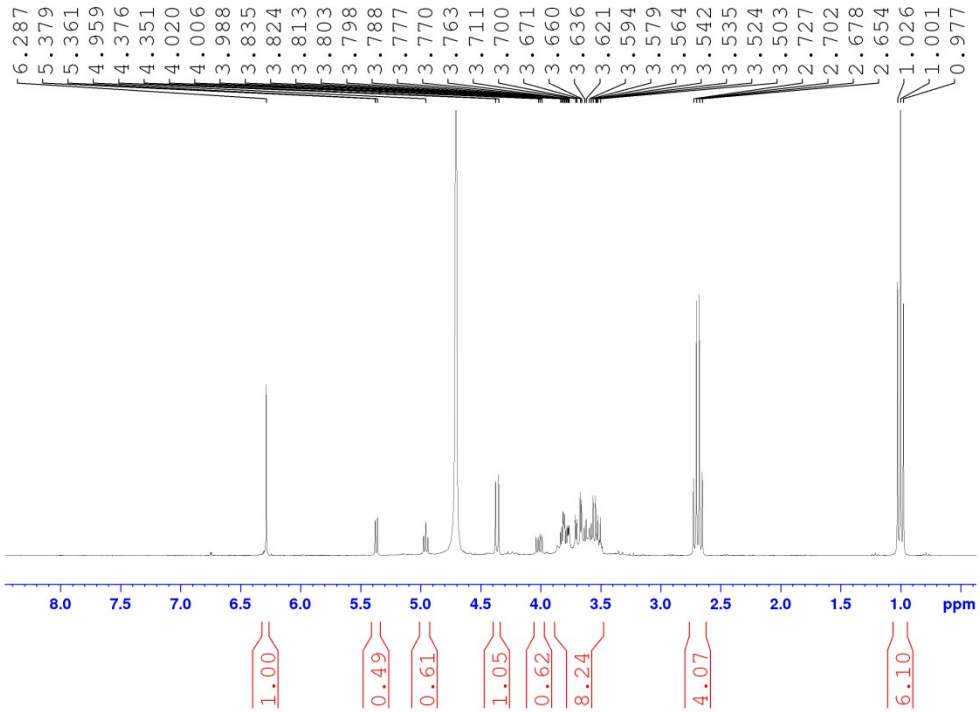
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 60 m



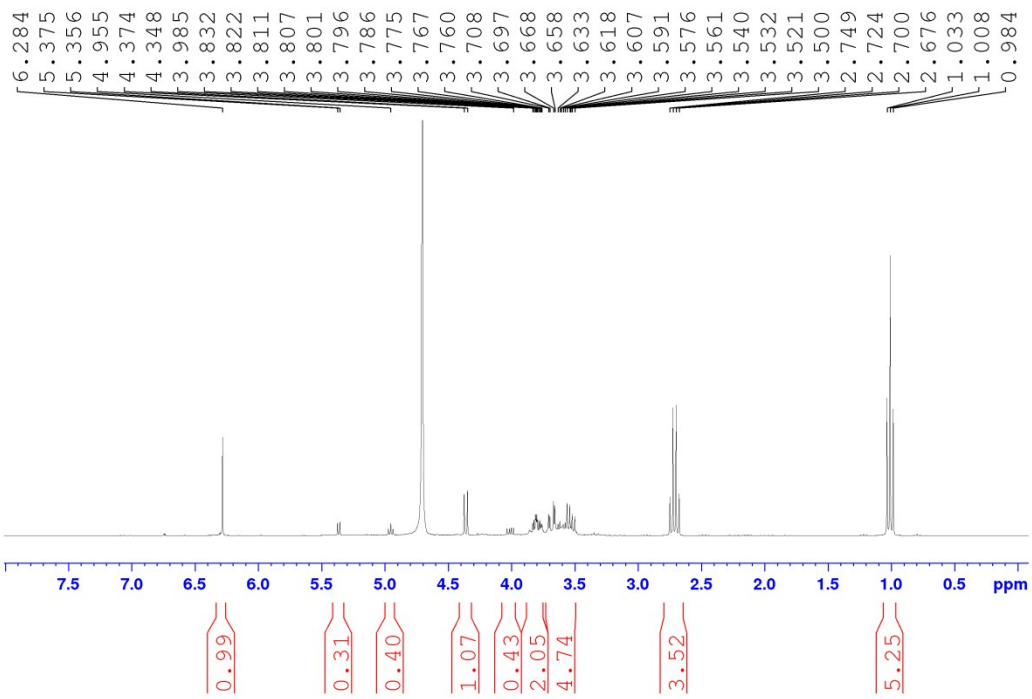
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 80 m



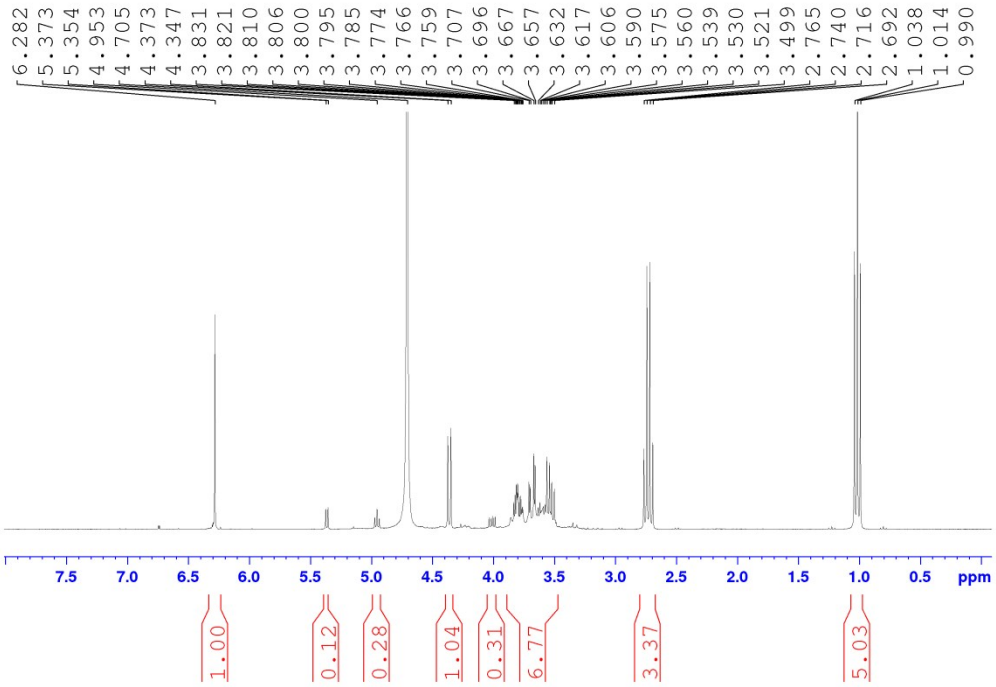
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 100 m



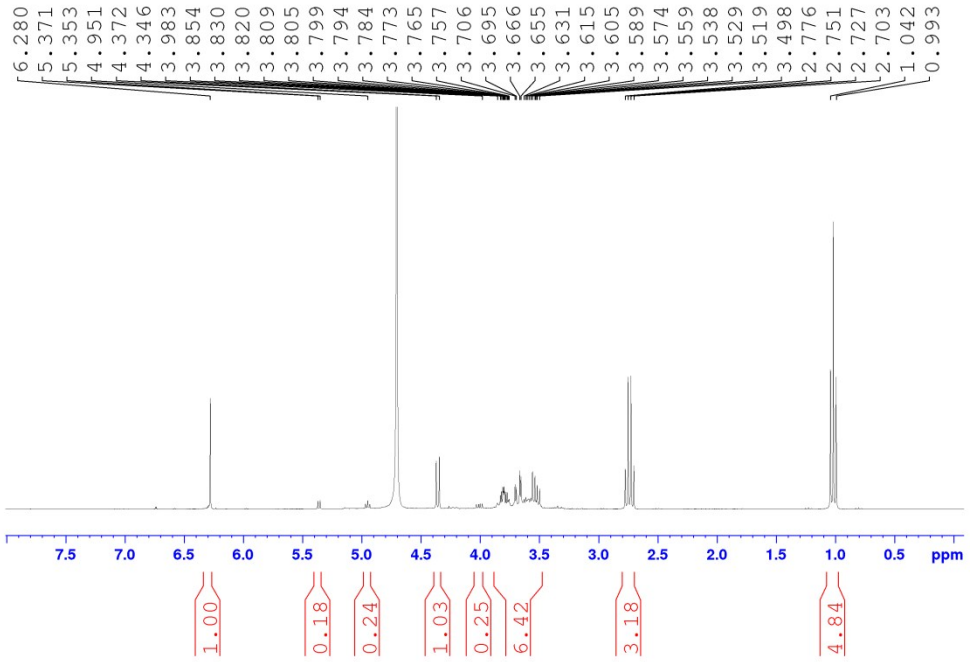
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 120 m



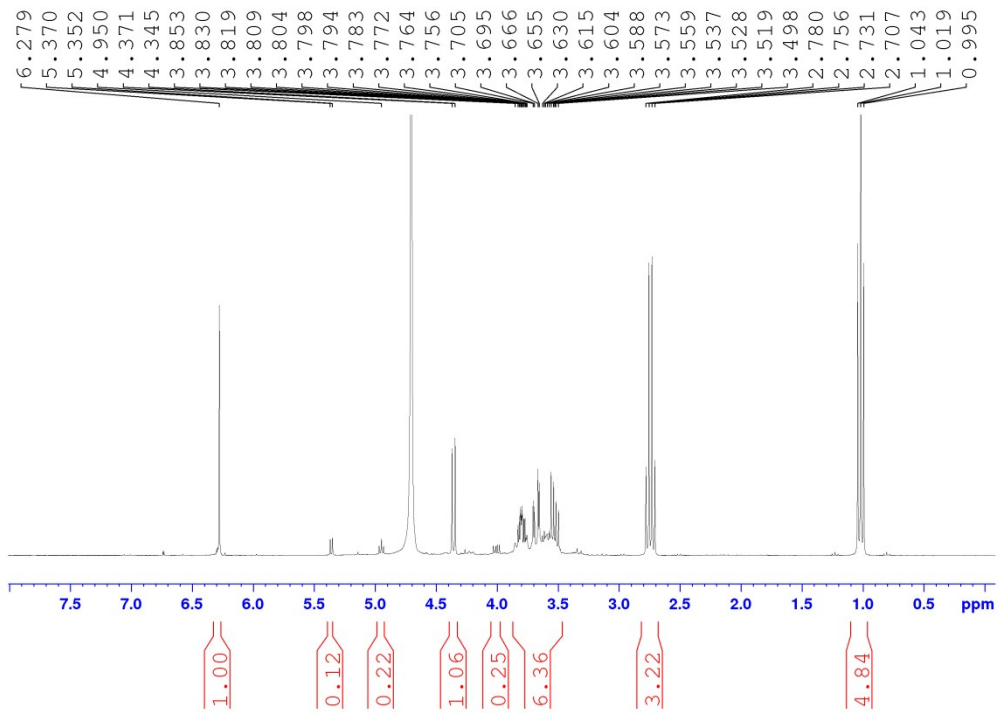
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 140 m



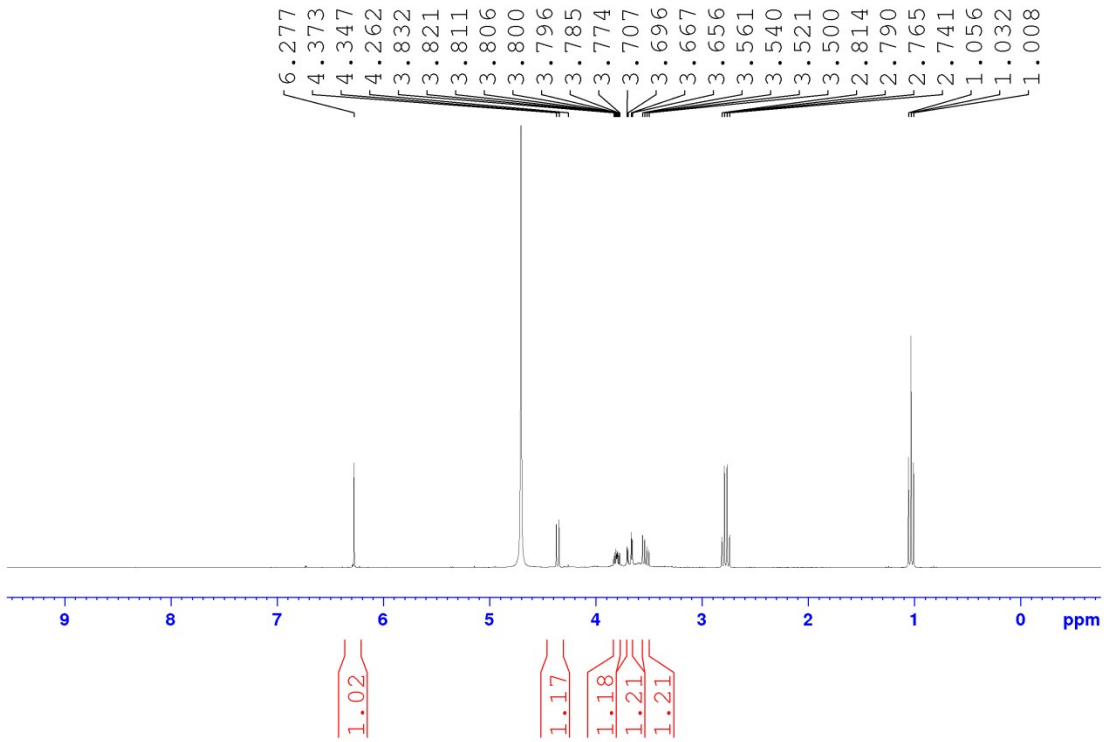
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 160 m



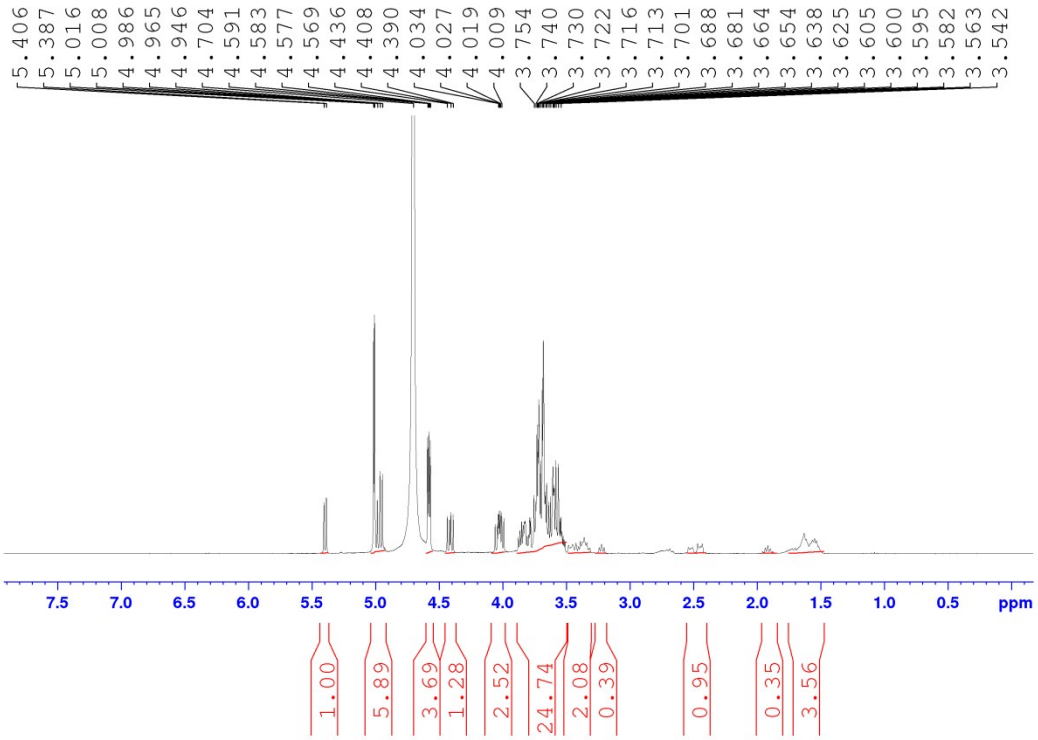
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 180 m



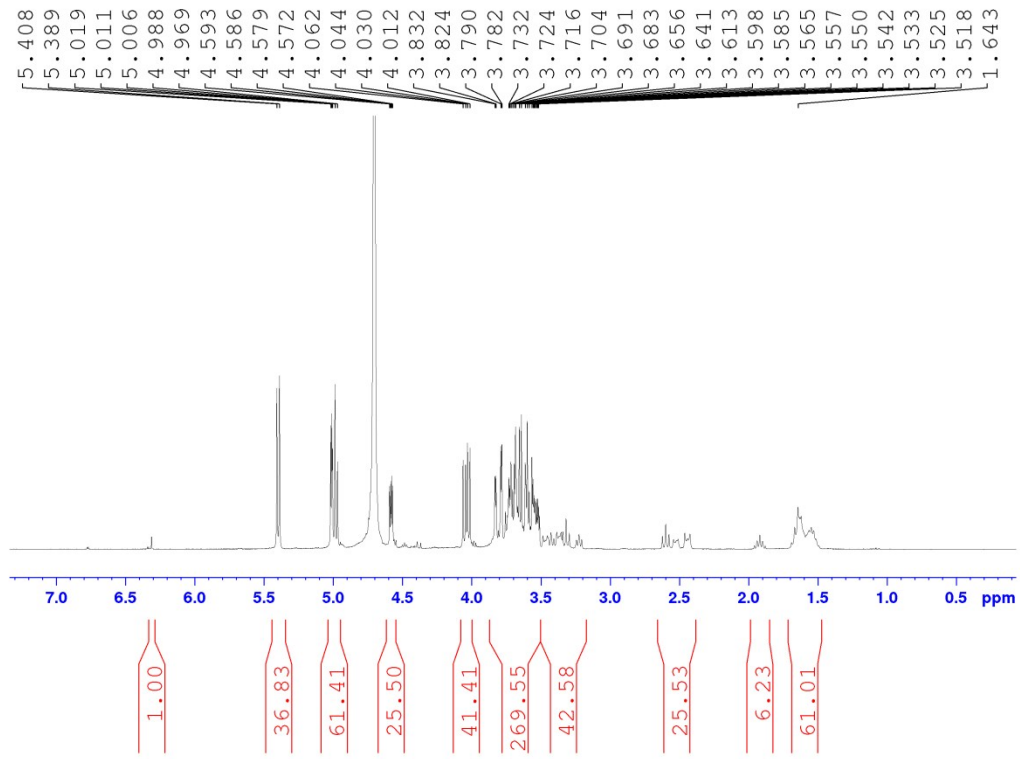
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with Et_3N (15 mol%) in D_2O after 4 h



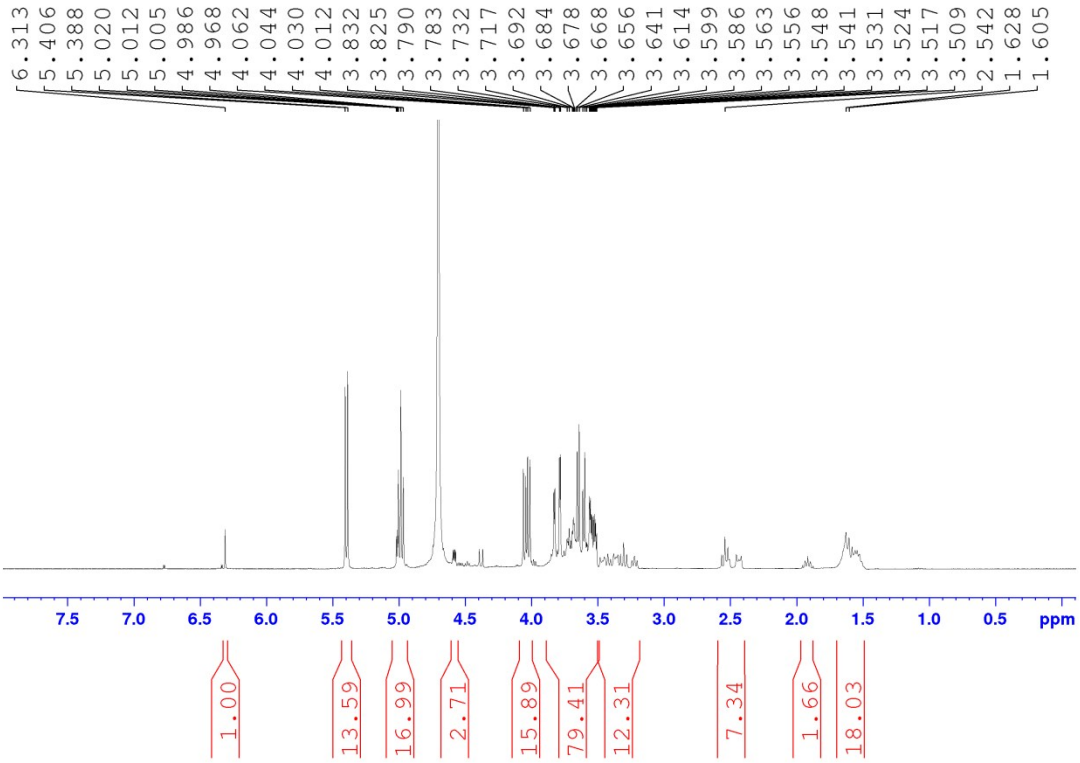
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 20 m



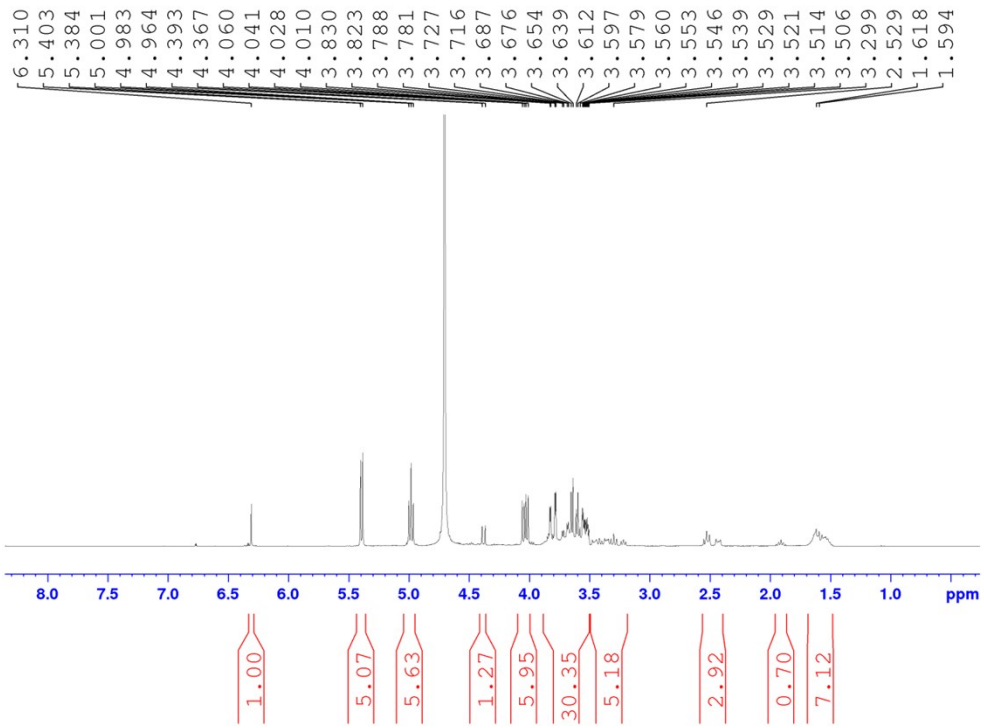
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 40 m



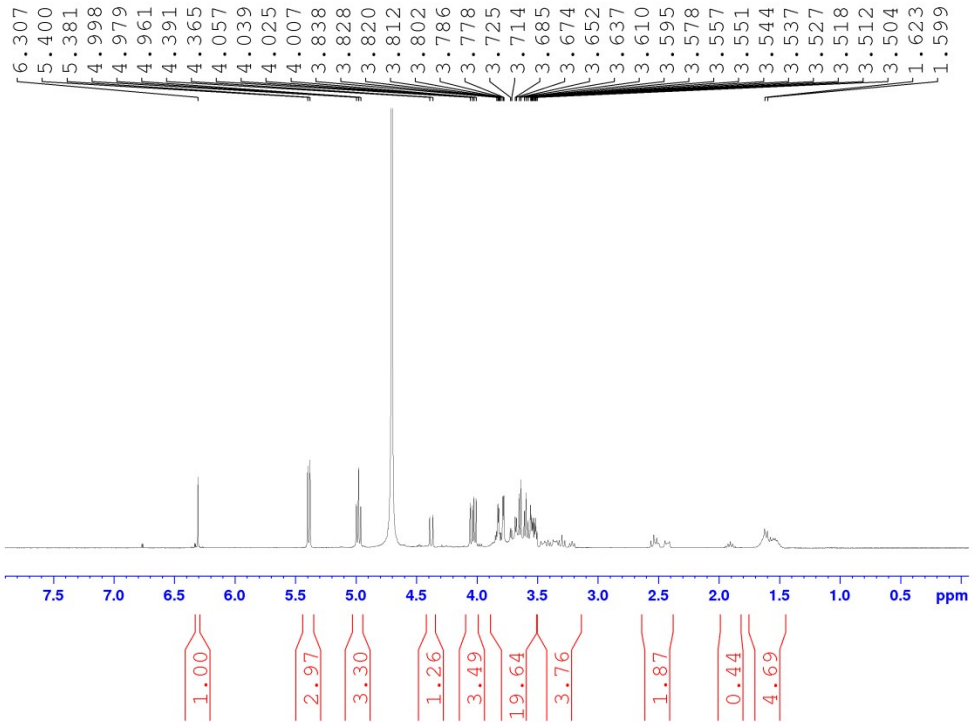
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 60 m



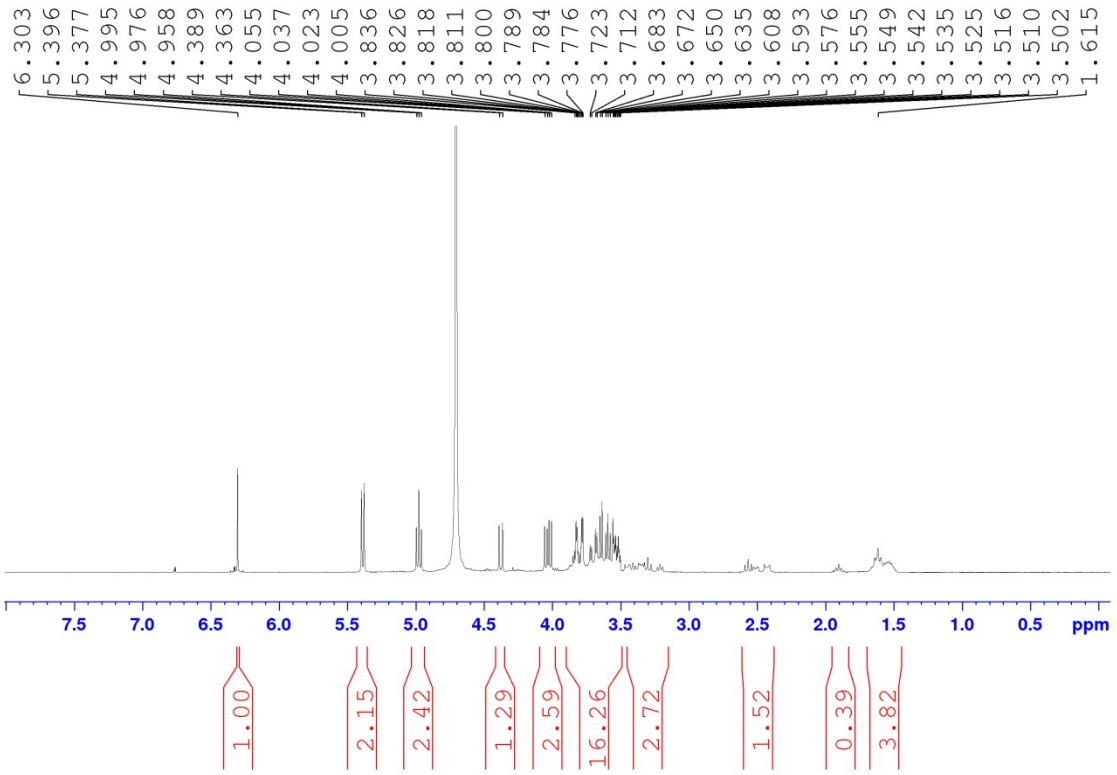
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 80 m



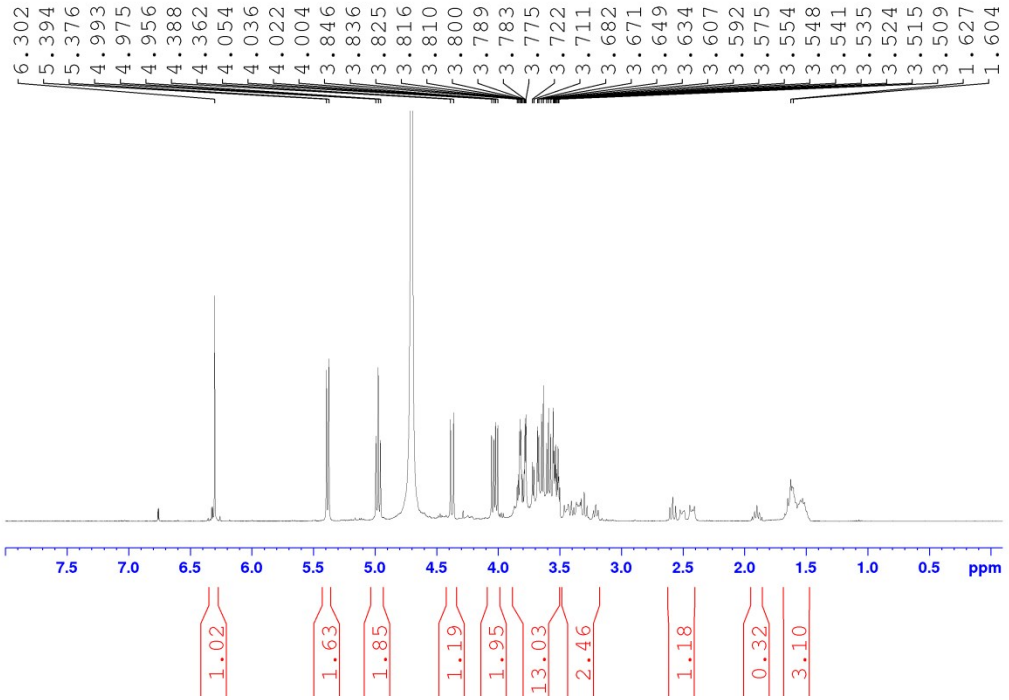
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 100 m



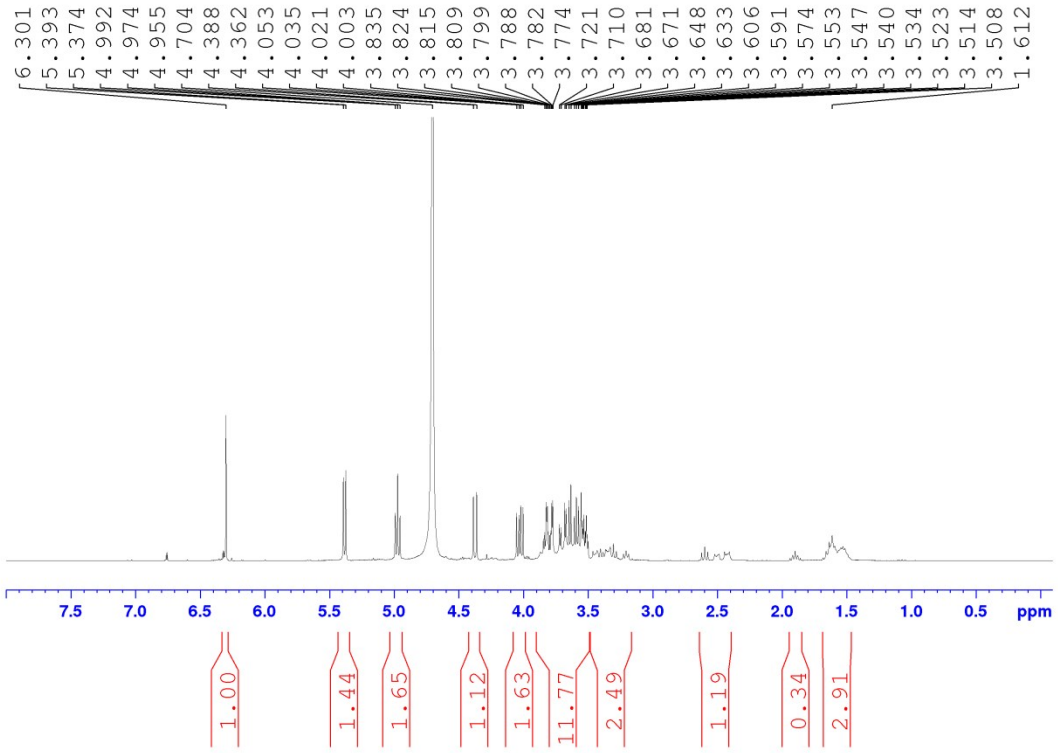
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 120 m



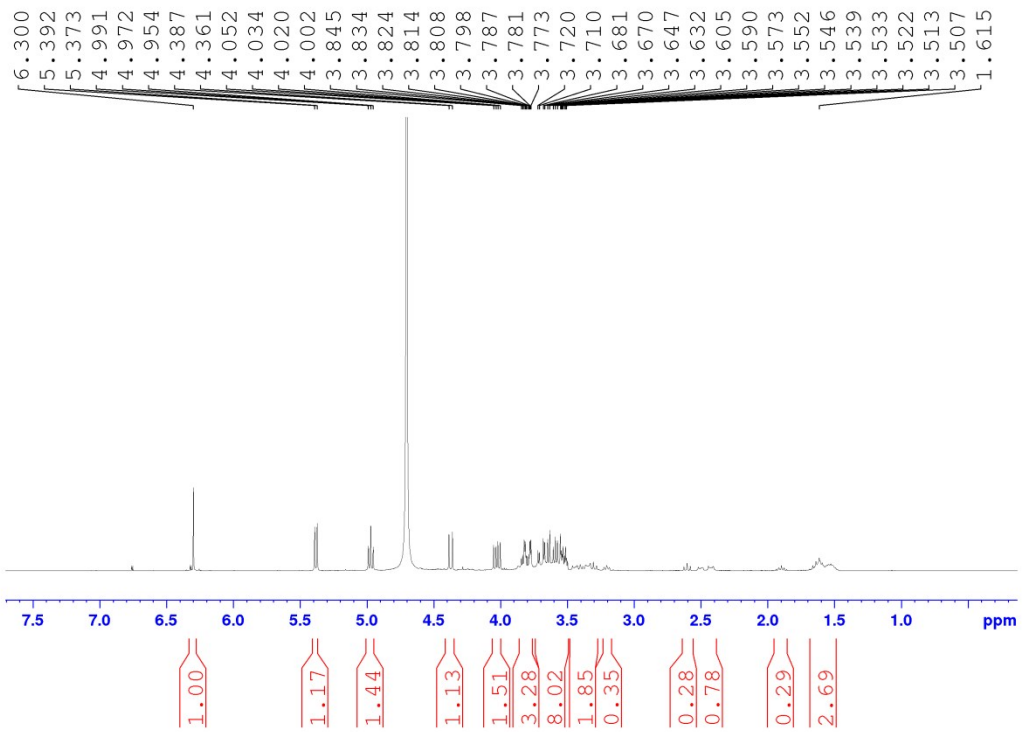
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 140 minutes



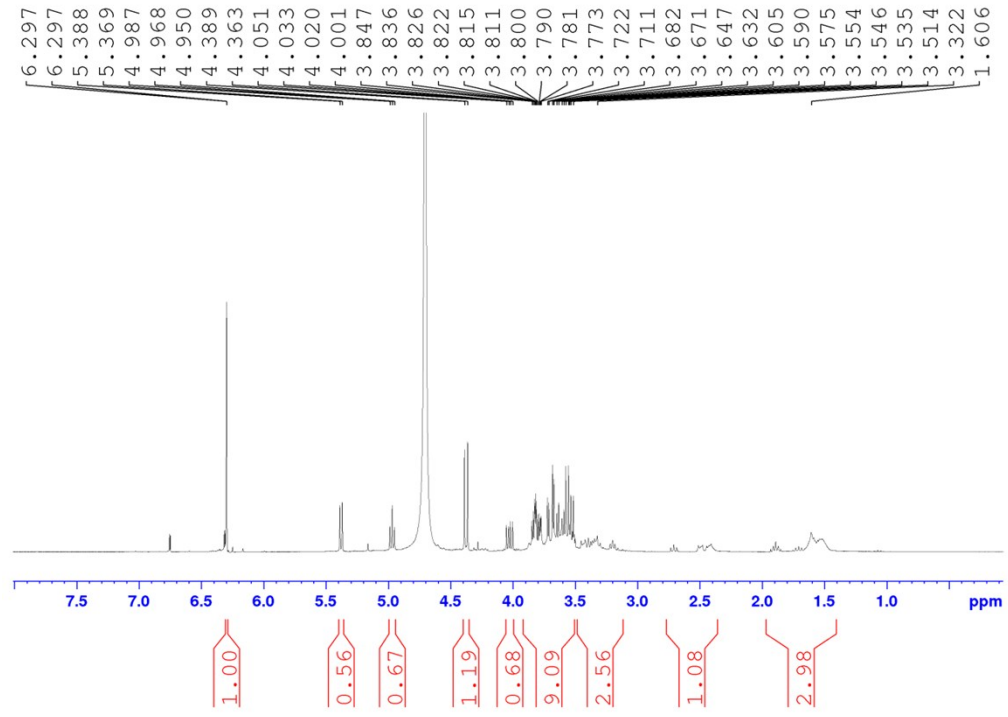
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 160 m



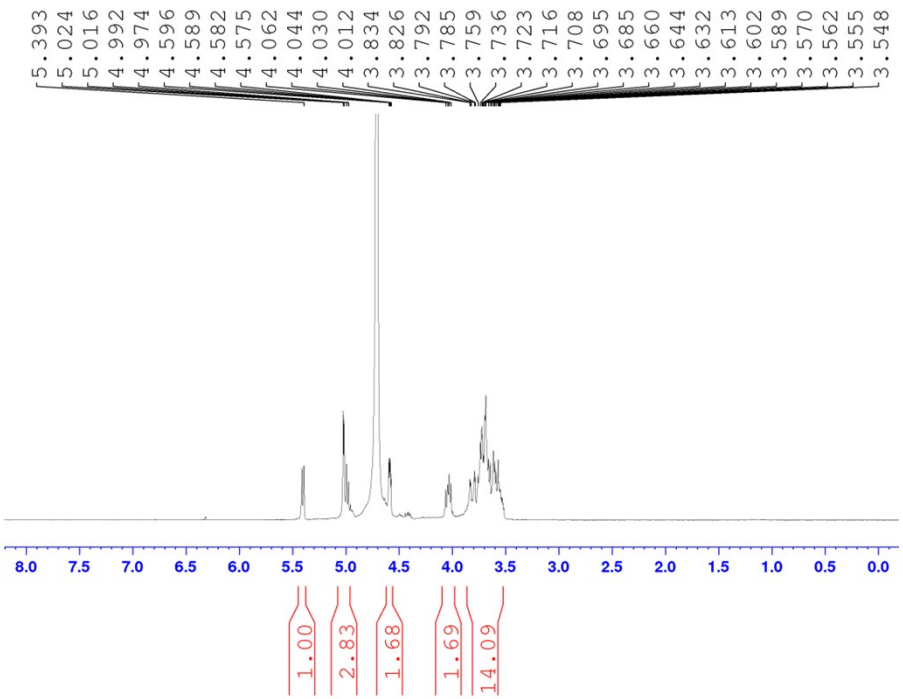
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 180 m



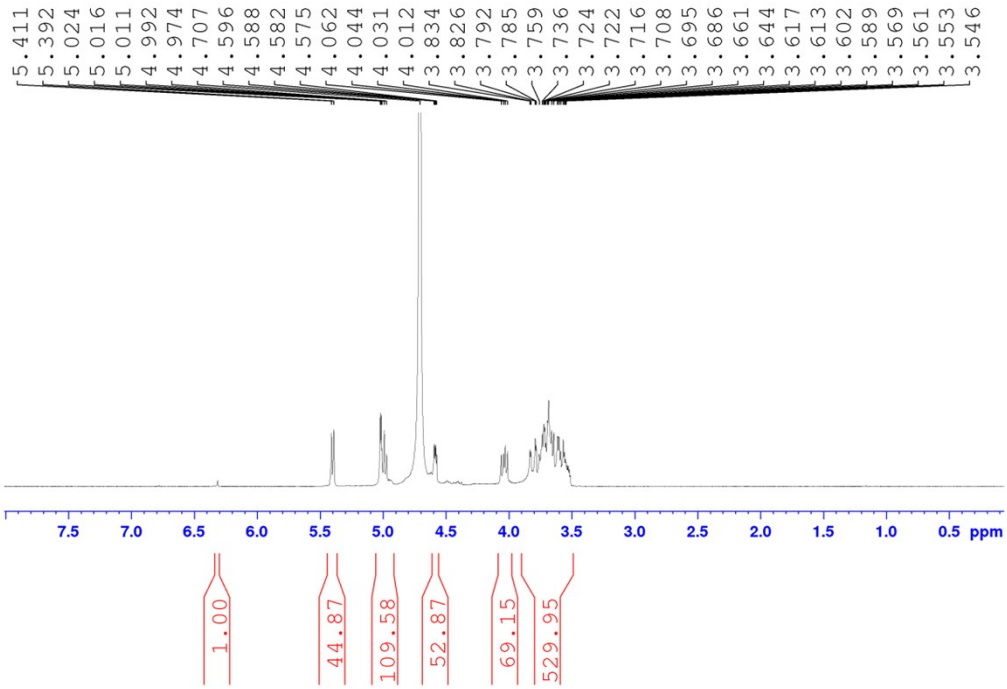
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with DBU (15 mol%) in D_2O after 4 h



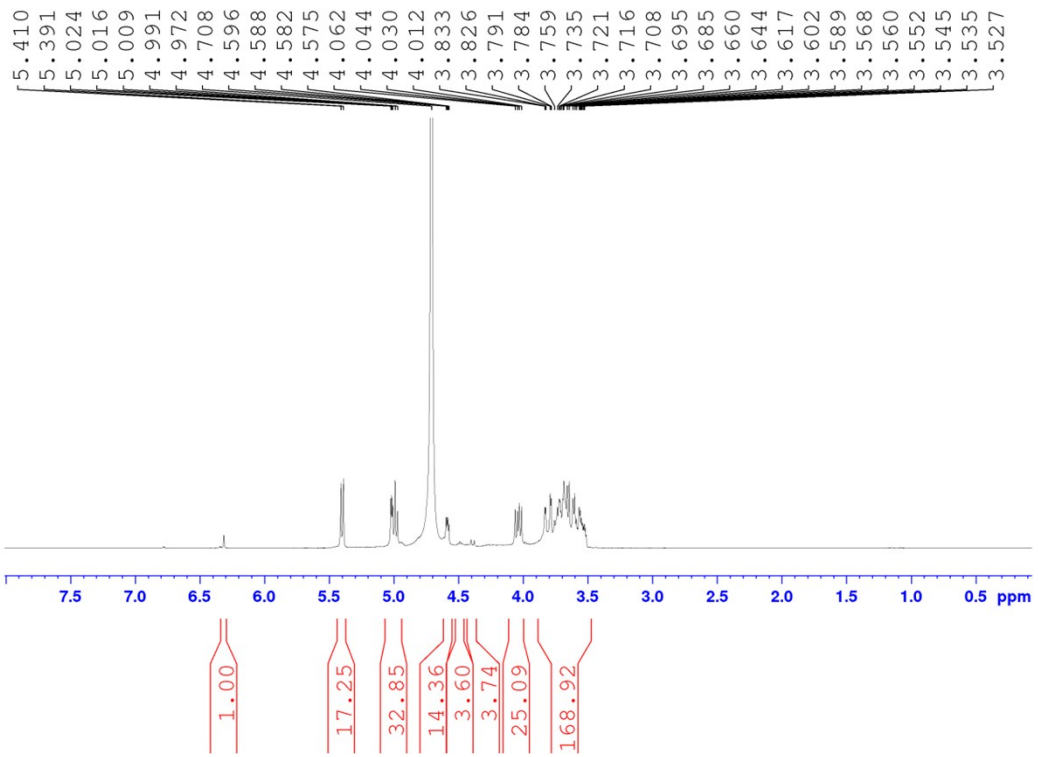
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after 20 minutus



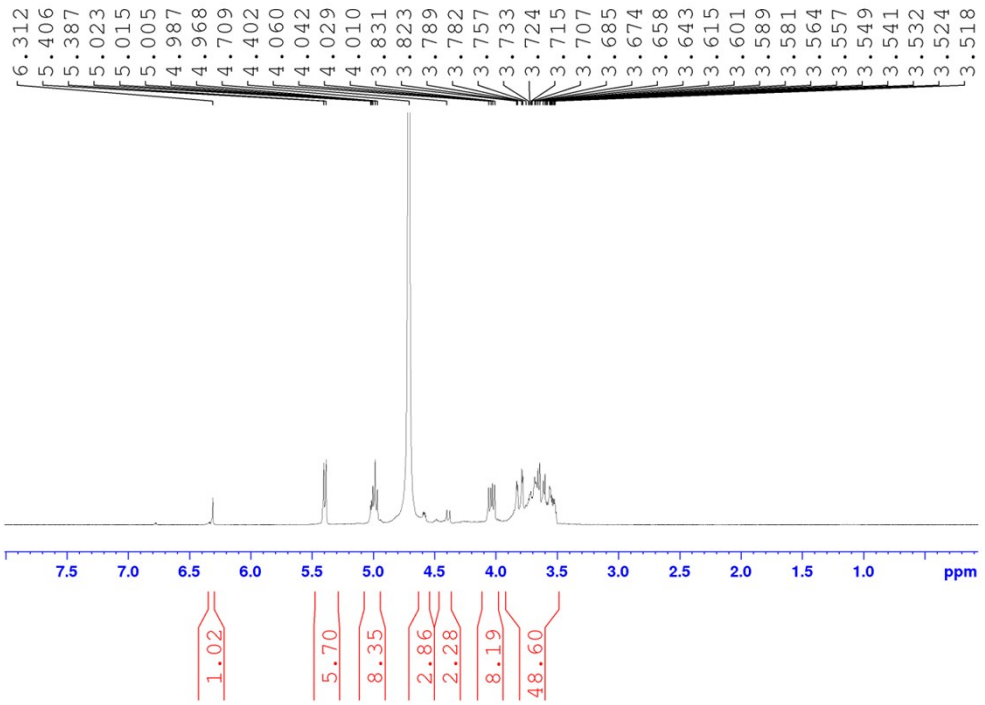
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after 40 minutus



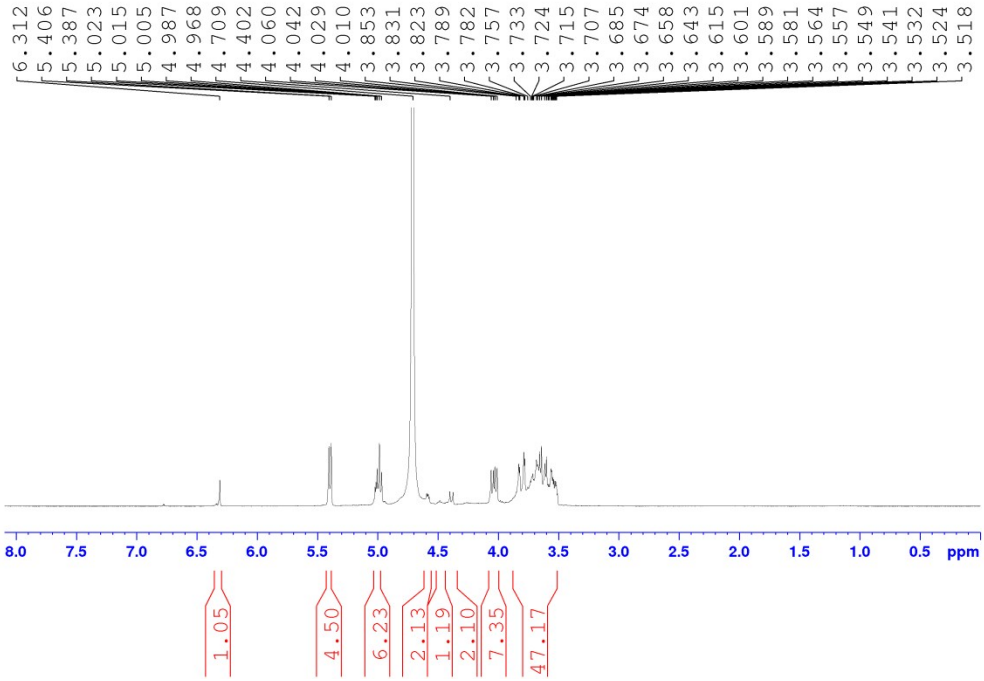
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after 60 minutus



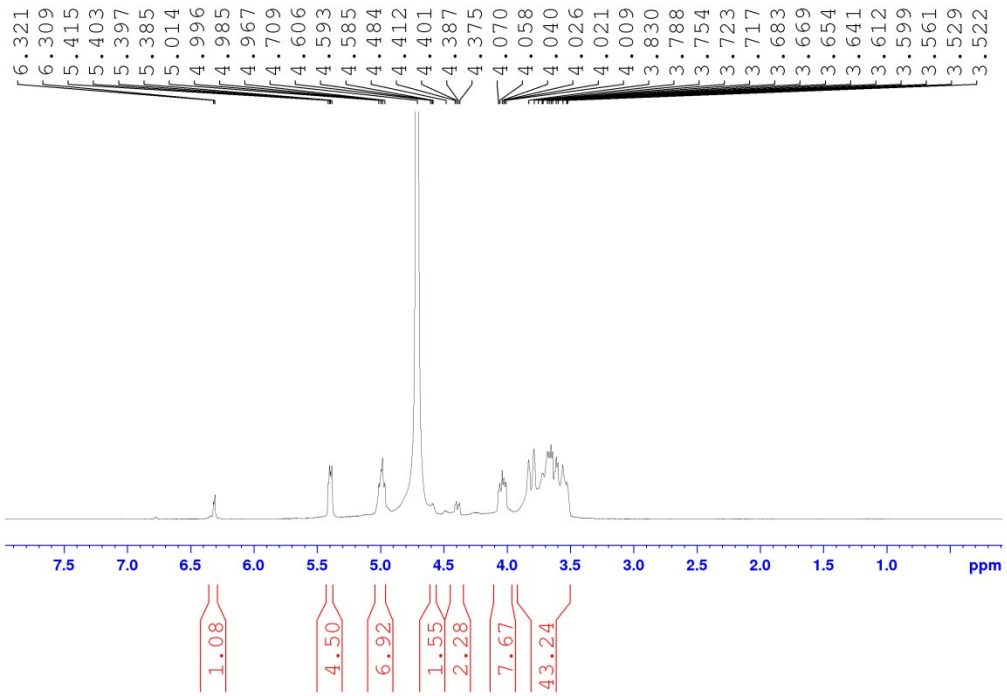
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after 80 minutus



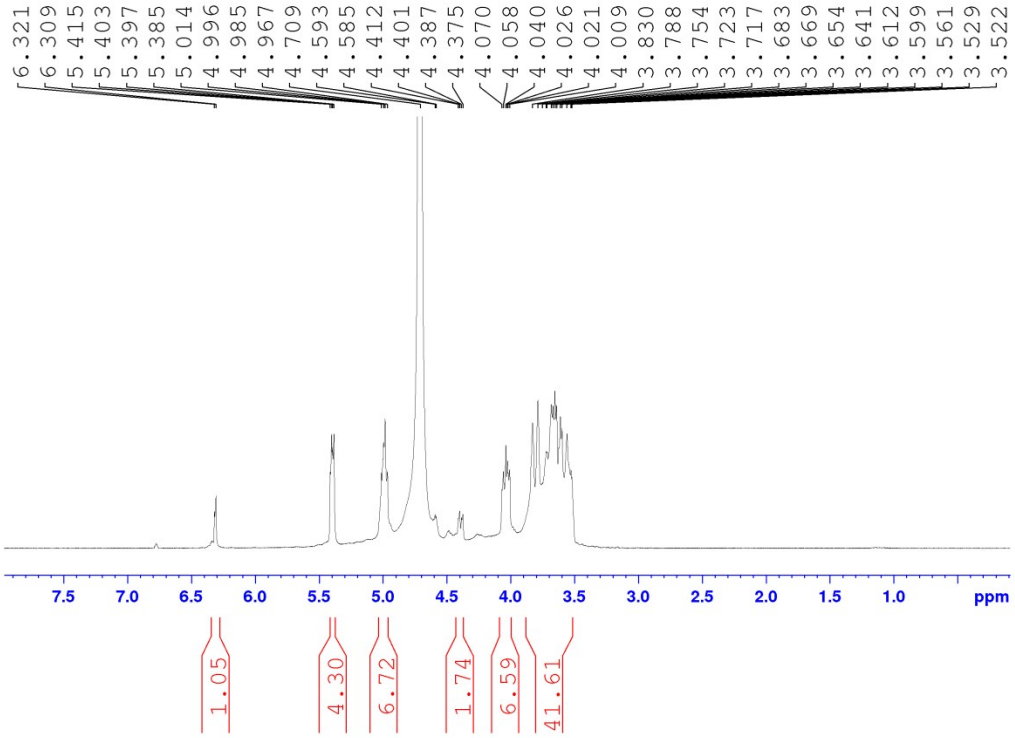
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after100 minutus



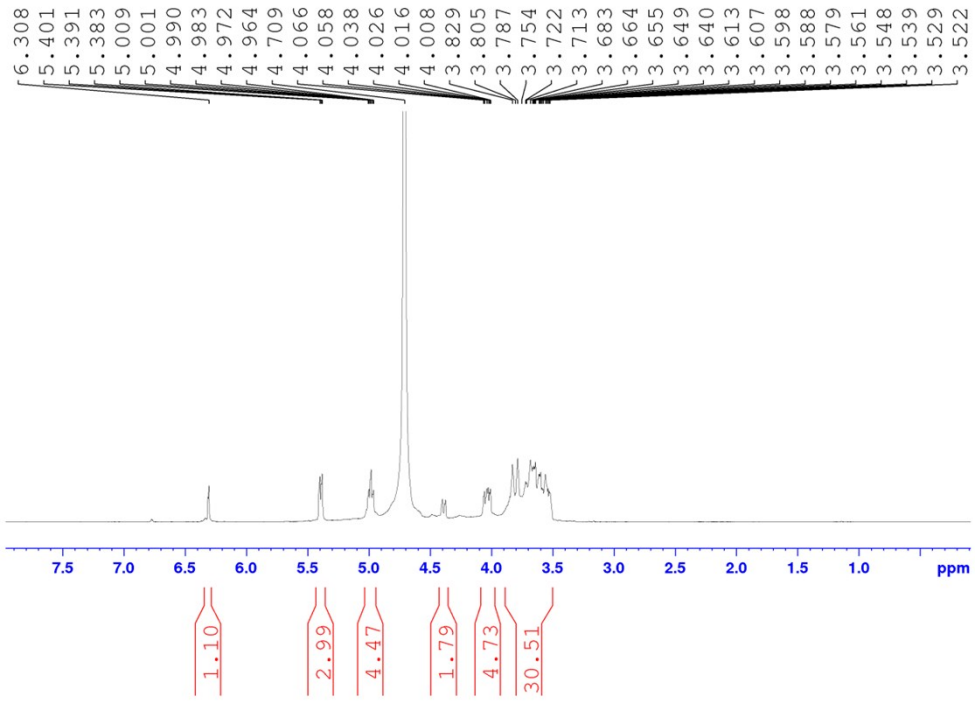
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after120 minutes



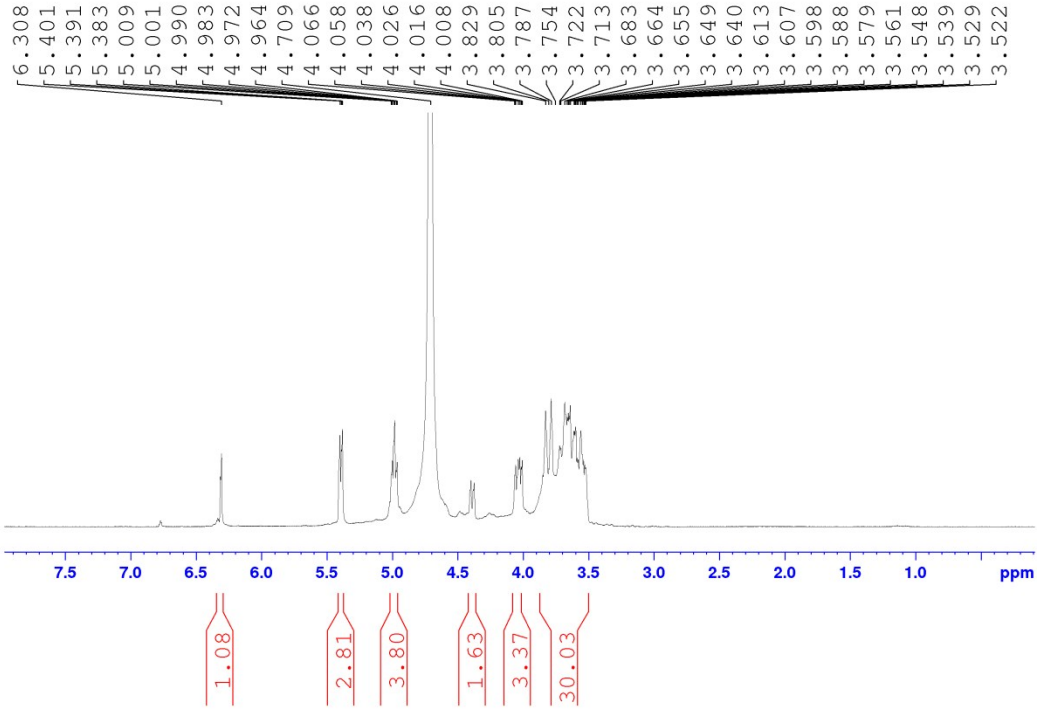
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after140 minutes



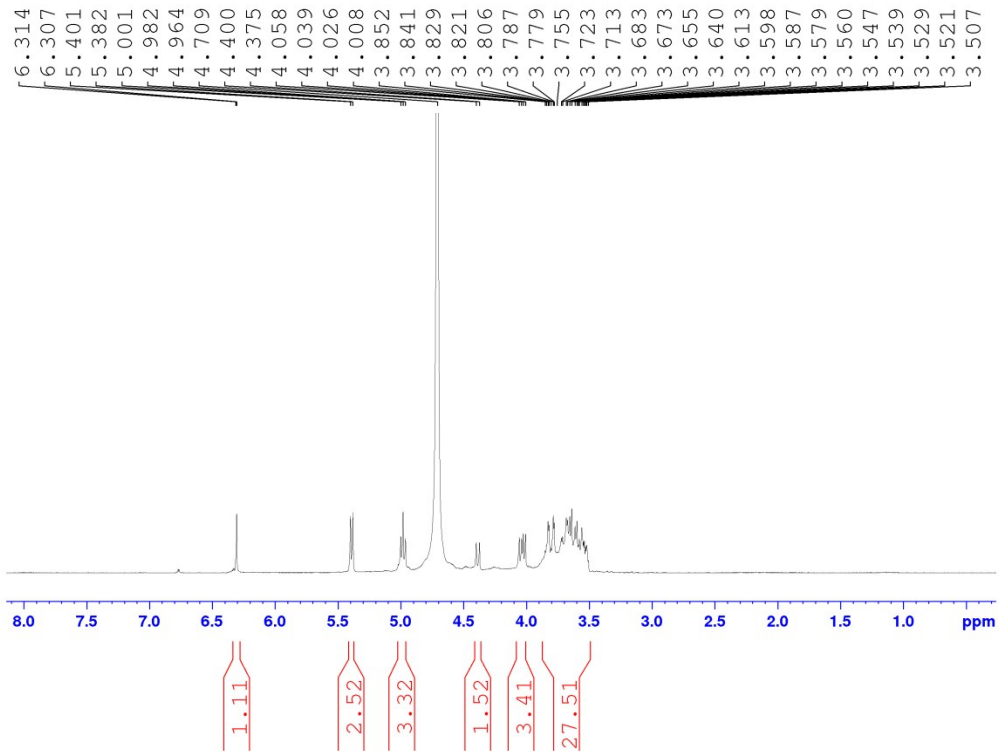
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after160 minutes



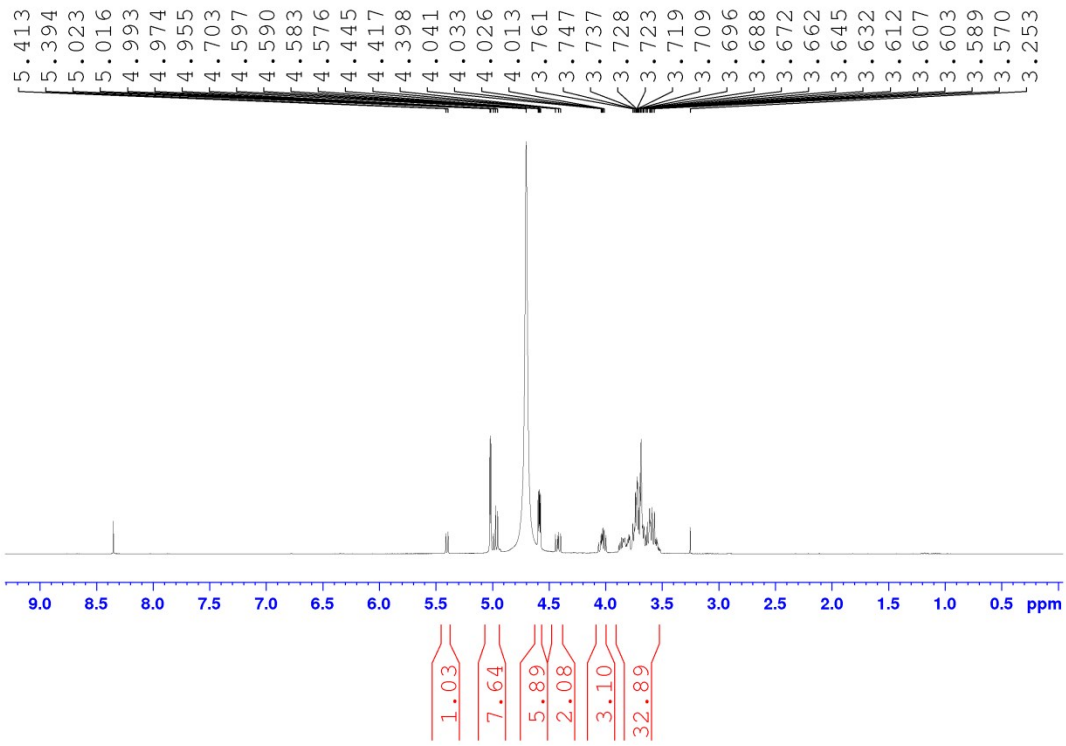
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after180 minutes



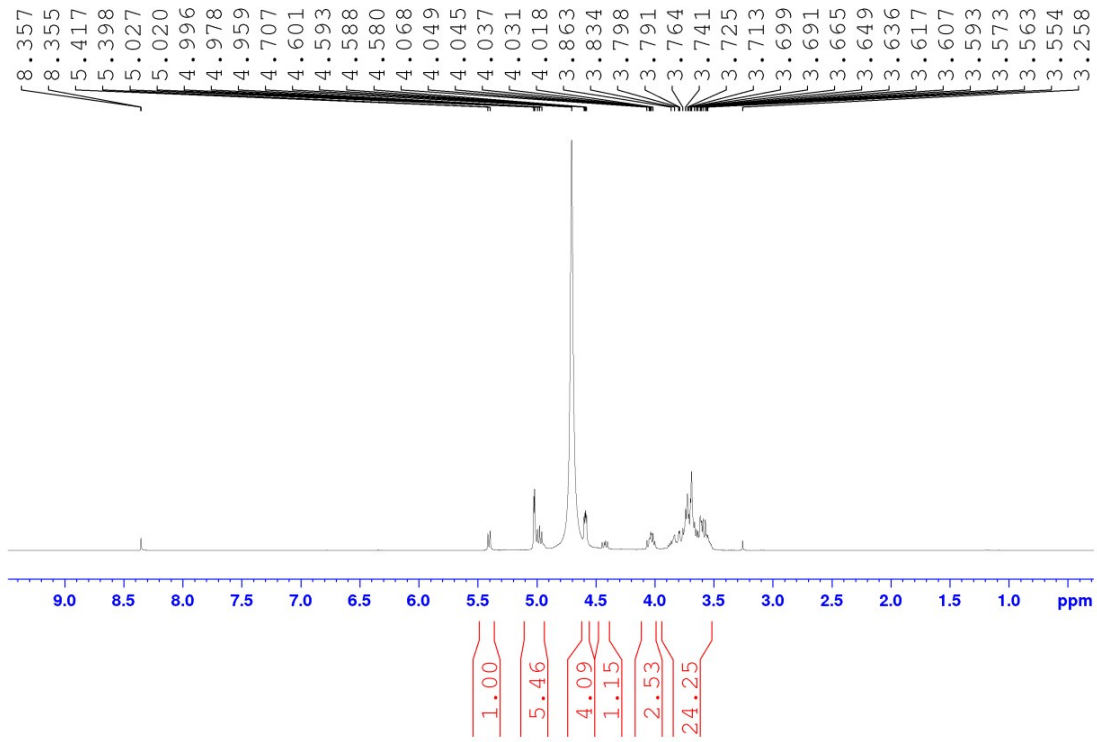
^{1}H NMR of the recation between D-(+)- ribose, malononitrile with K_2CO_3 (15 mol%) in D_2O after 4h



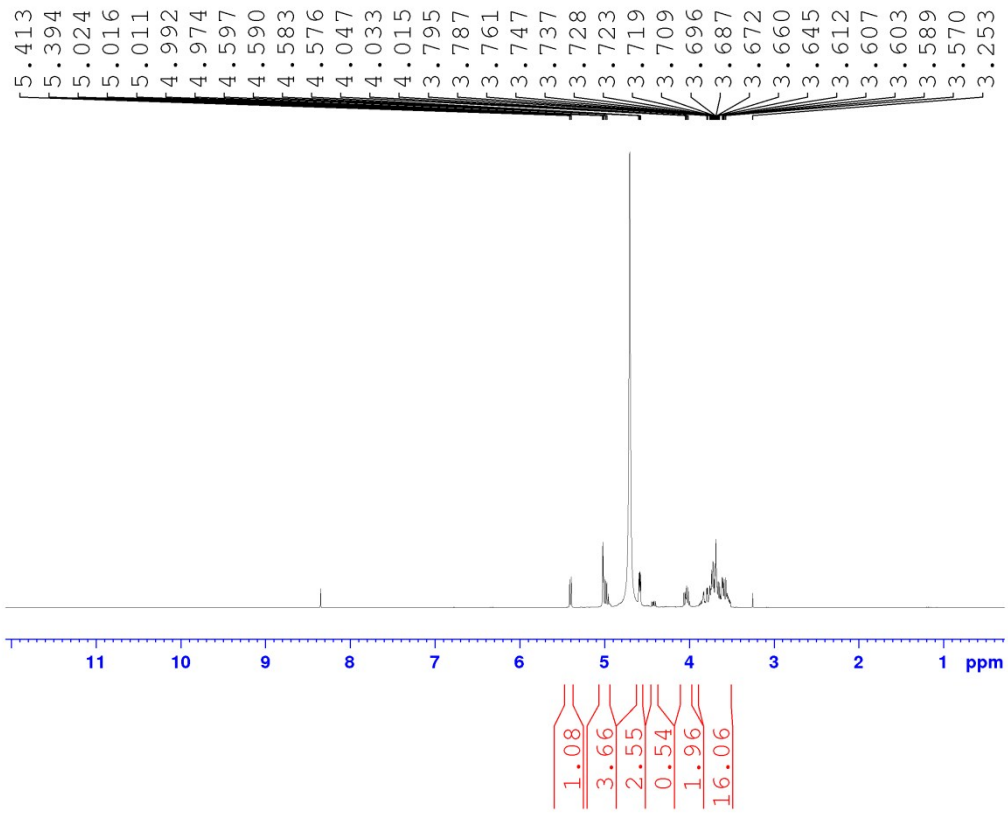
^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 20 m



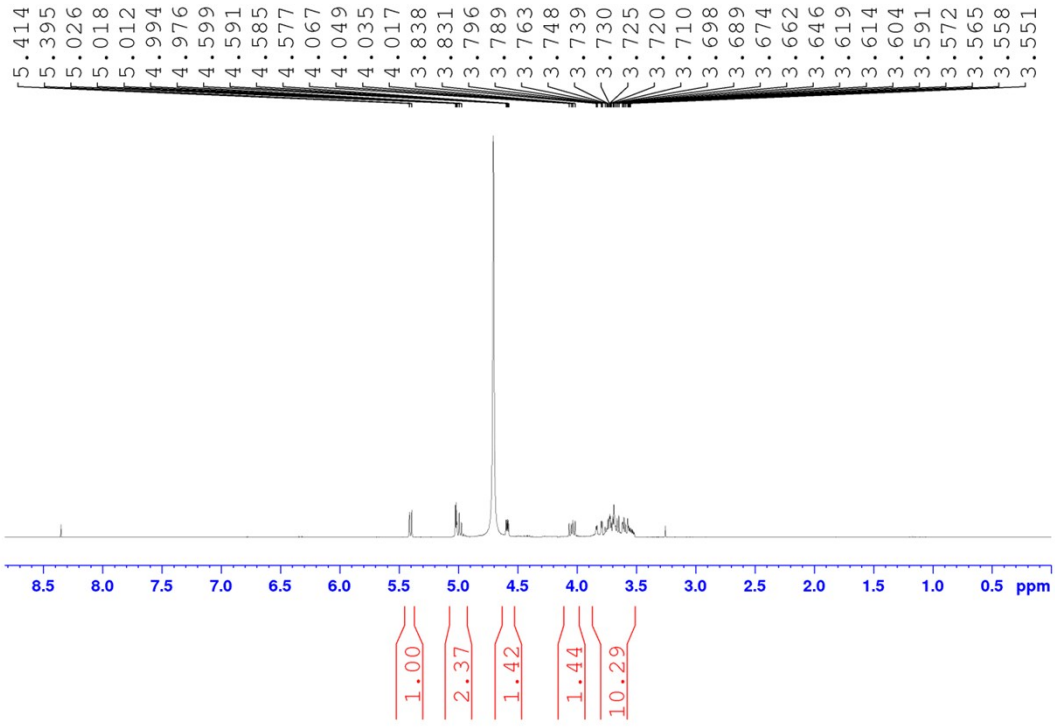
^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 40 m



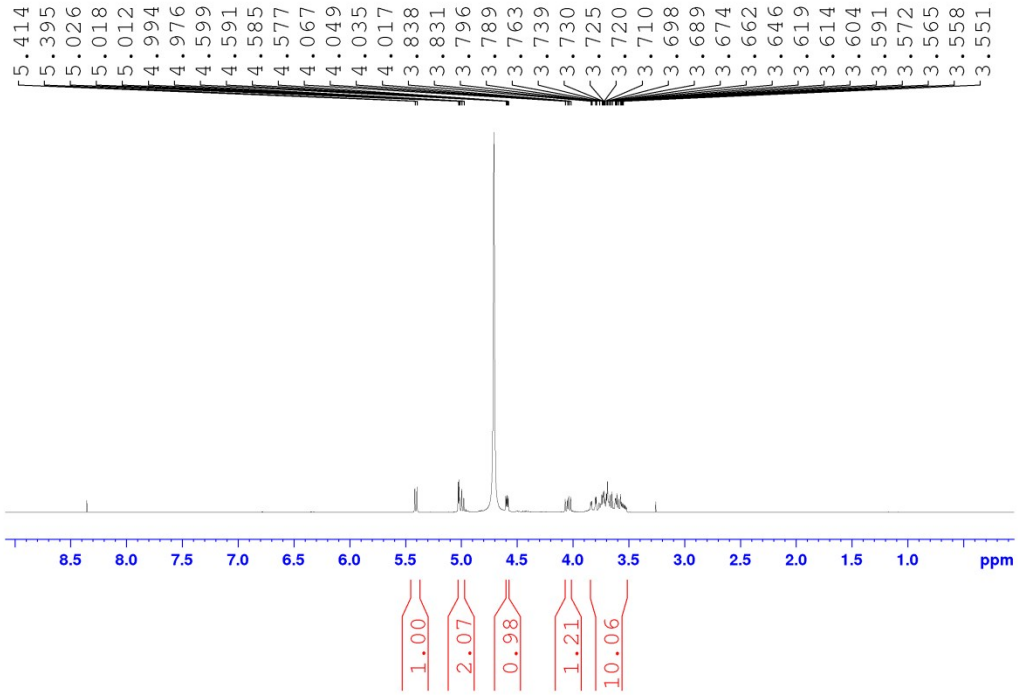
^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 60 m



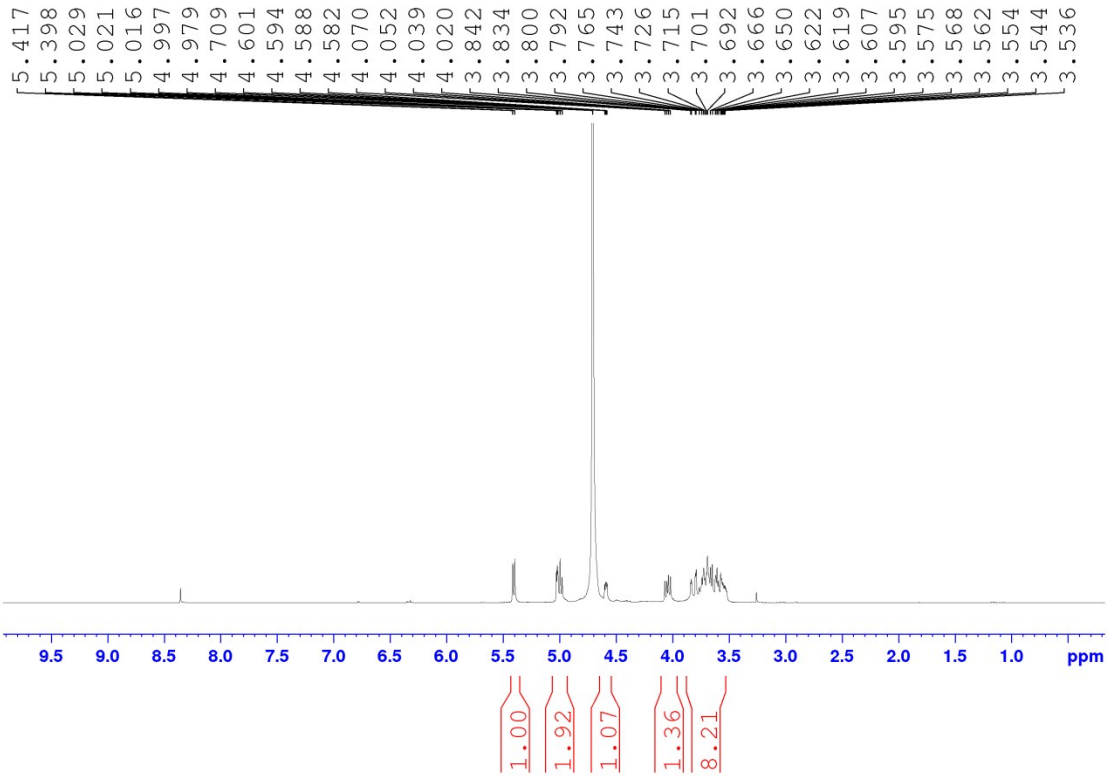
^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 80 m



^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 100 m



^{1}H NMR of the recation between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 120 m



^{1}H NMR spectrum of between D-(+)-ribose, malononitrile with NaOMe (15 mol%) in D_2O after 140 m