Electronic Supplementary Material (ESI) for RSC Advances.

Supporting Information

Chemo-enzymatic synthesis of 3'-*O*,4'-*C*-methylene-linked *α*-L-*arabino*nucleosides

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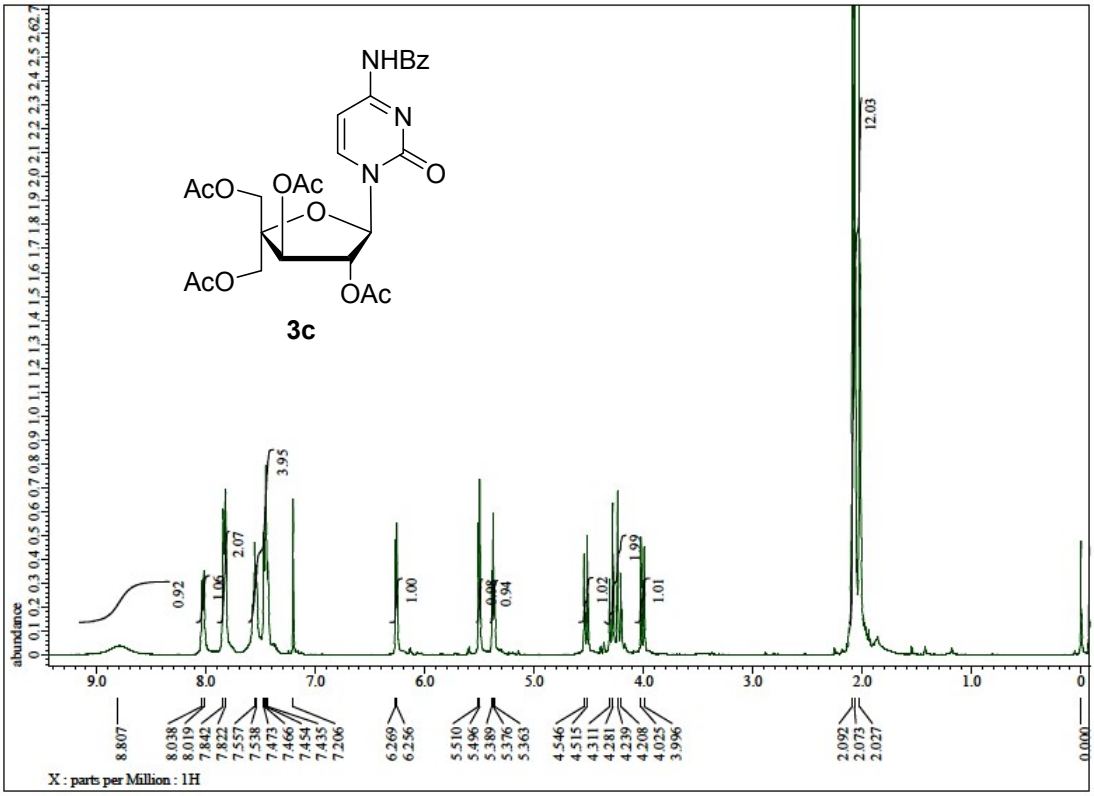
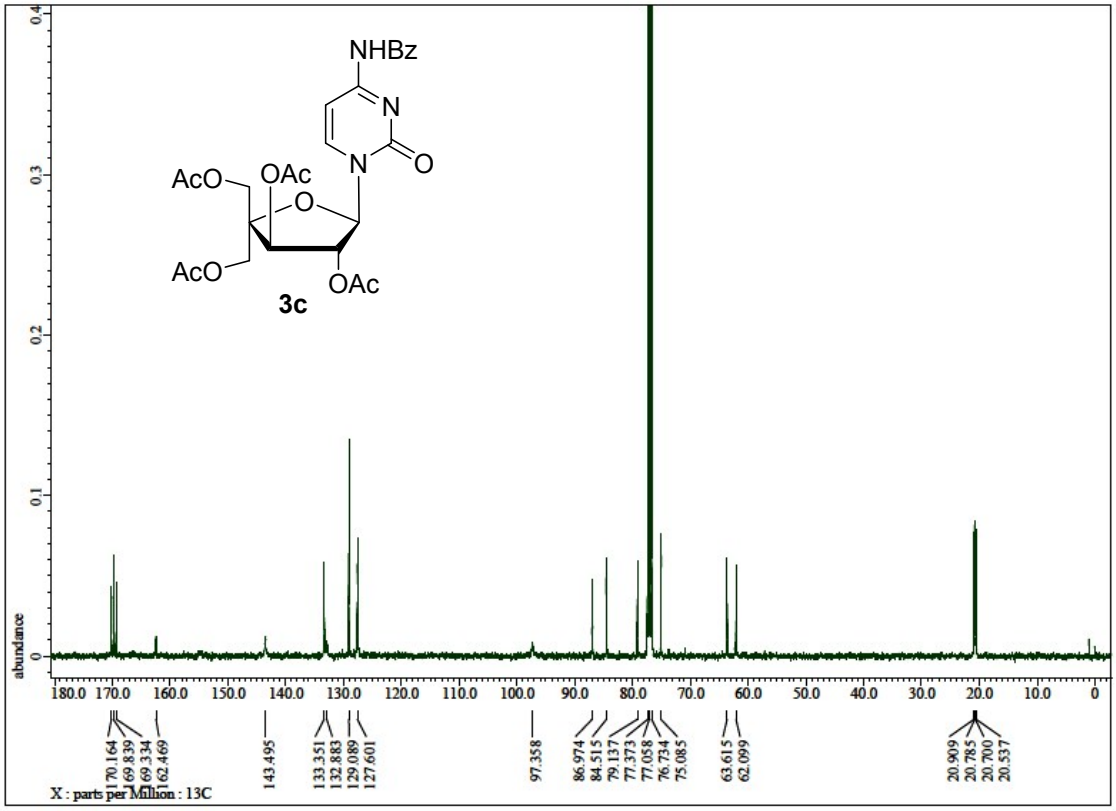
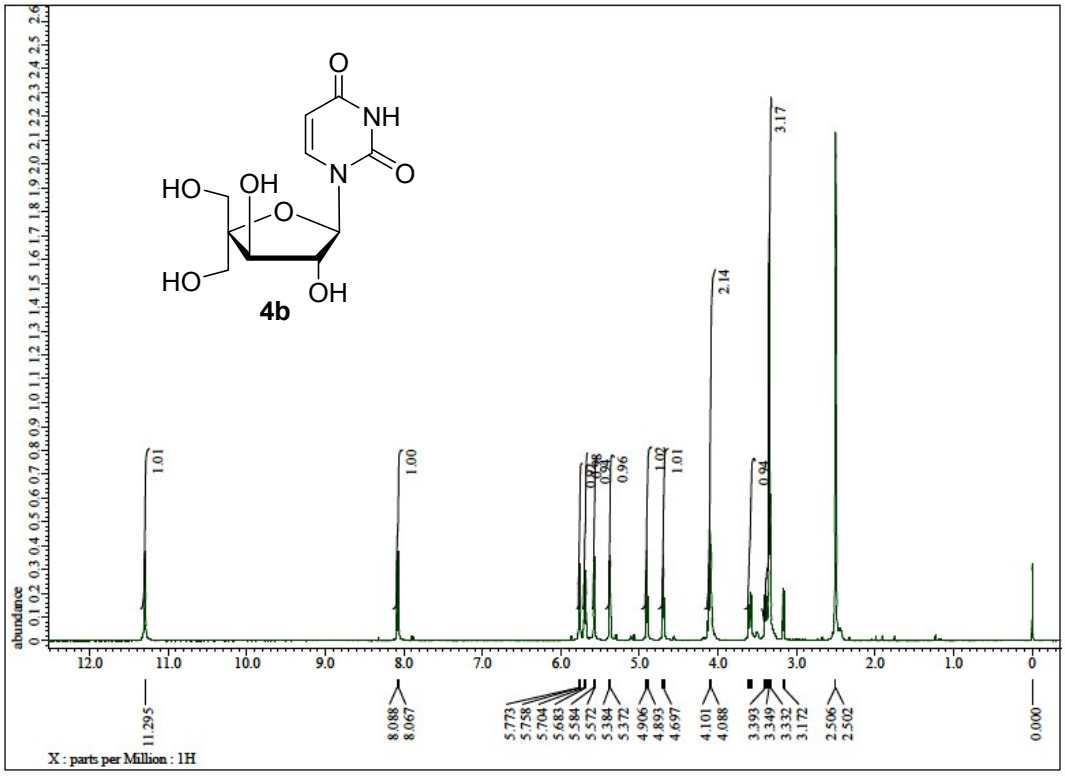
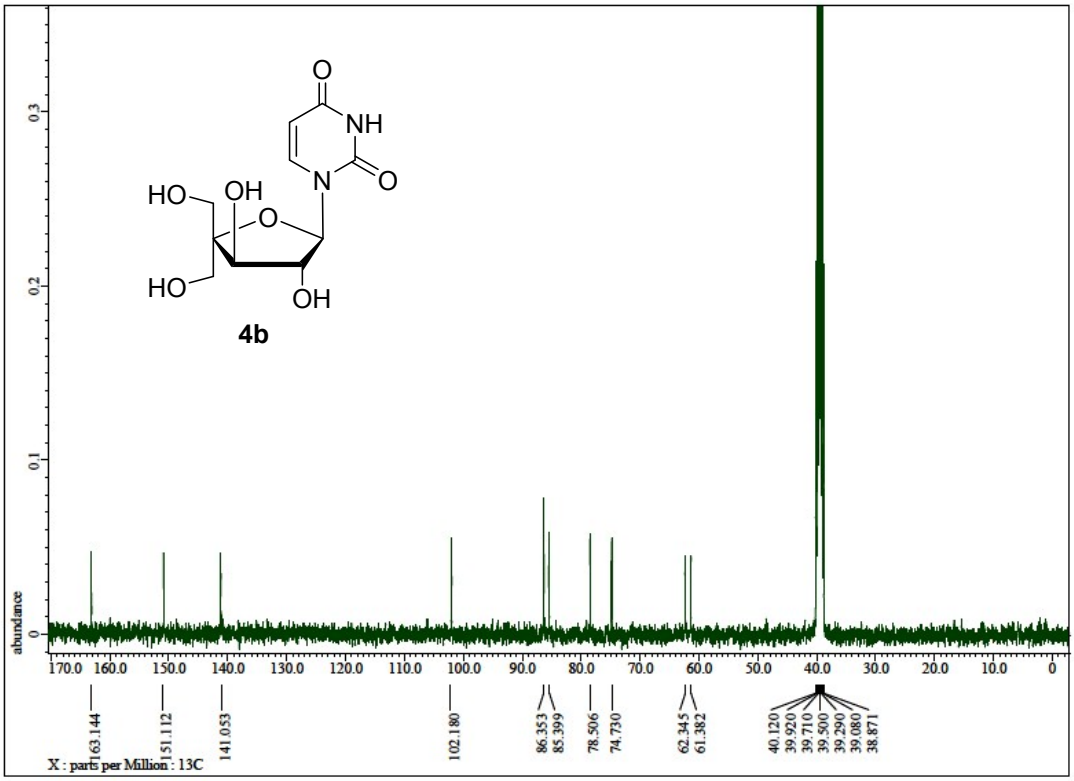
^{1}H- and ^{13}C NMR Spectra of compound 3c



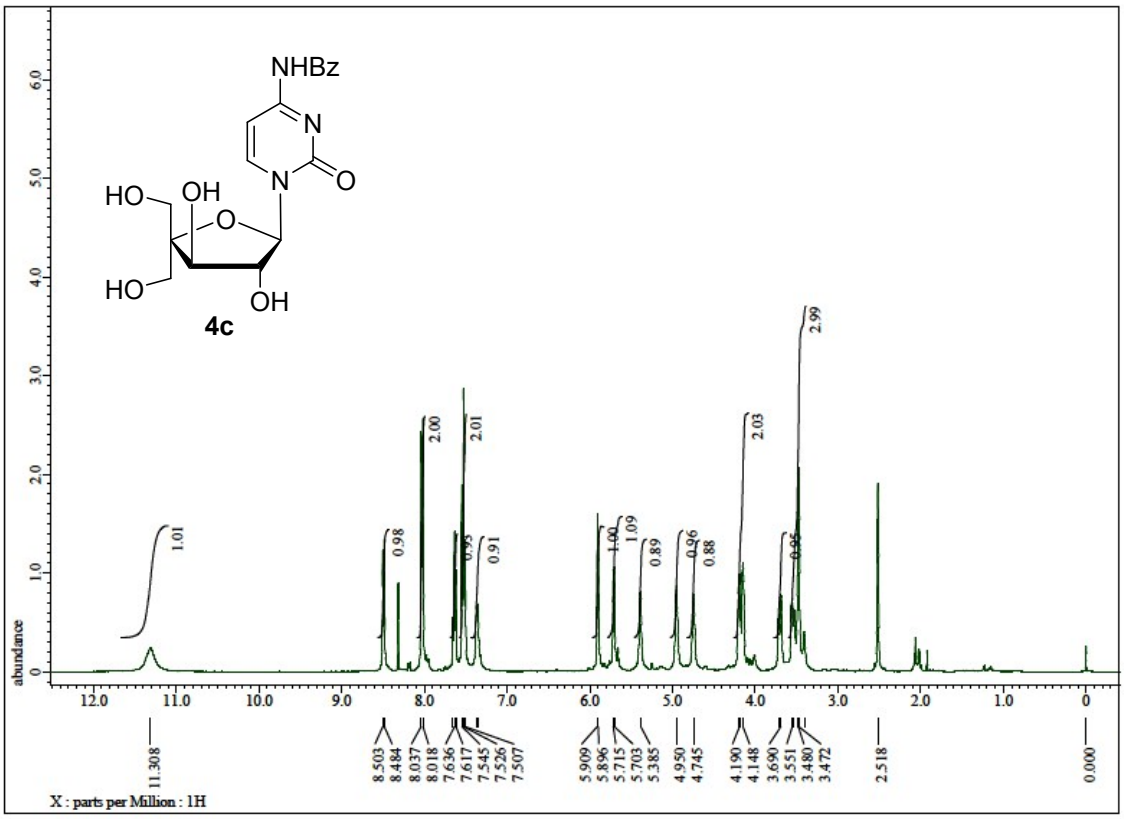


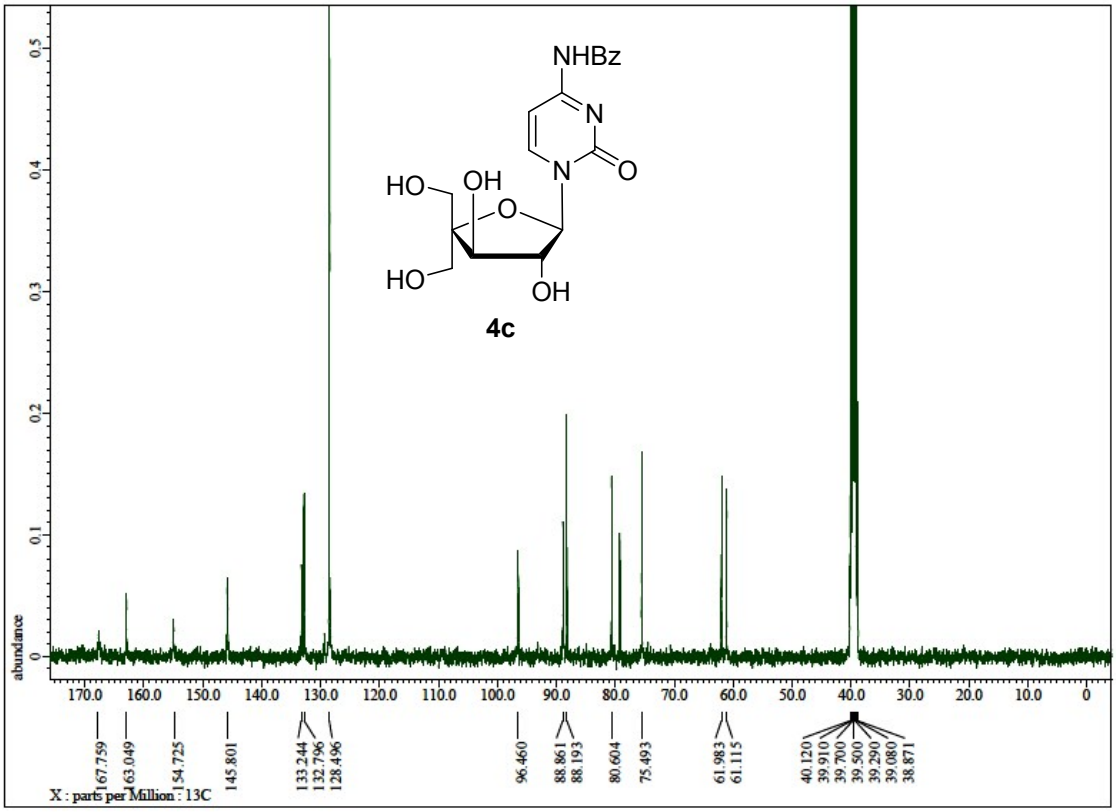
^{1}H- and ^{13}C NMR Spectra of compound 4b



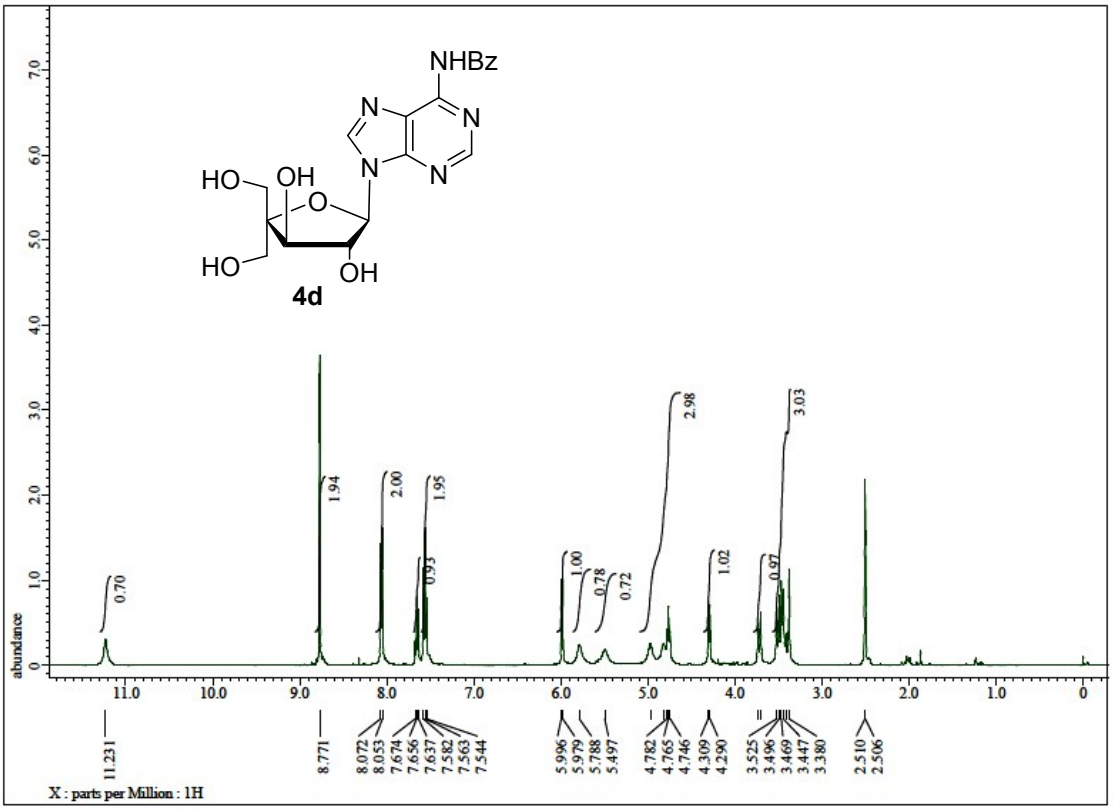


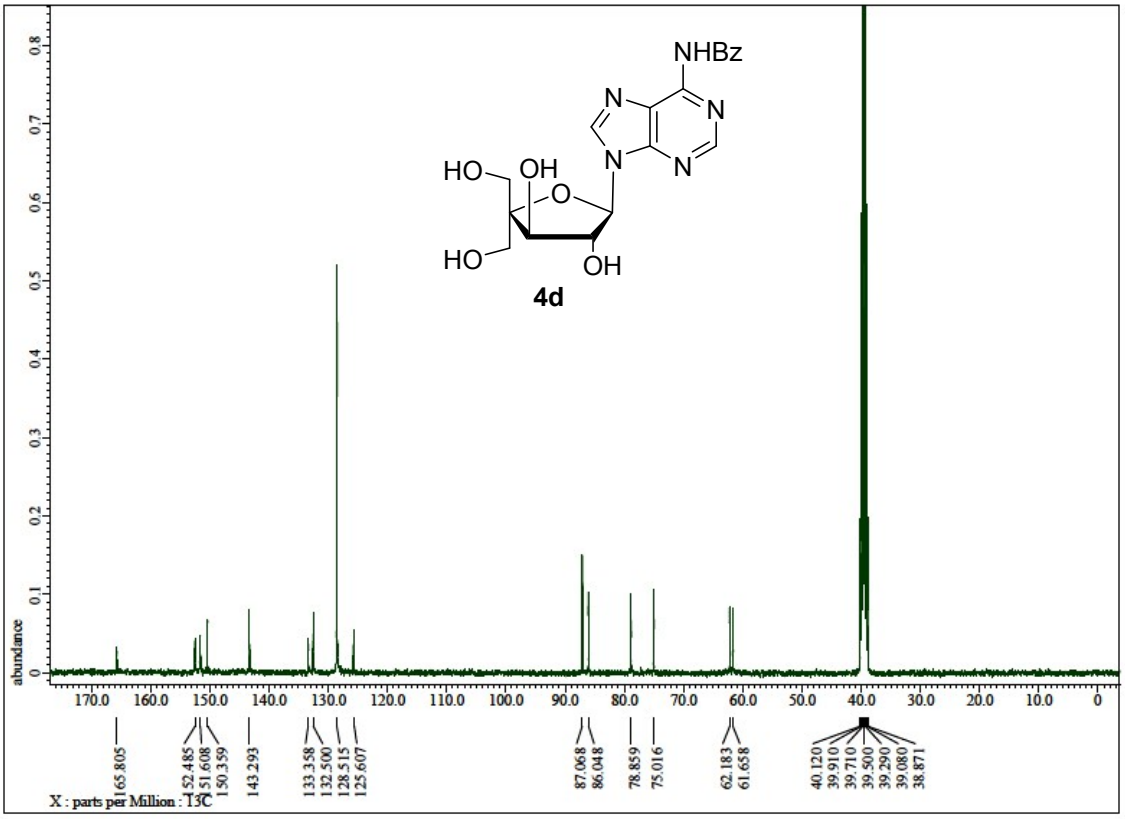
^{1}H- and ^{13}C NMR Spectra of compound 4c



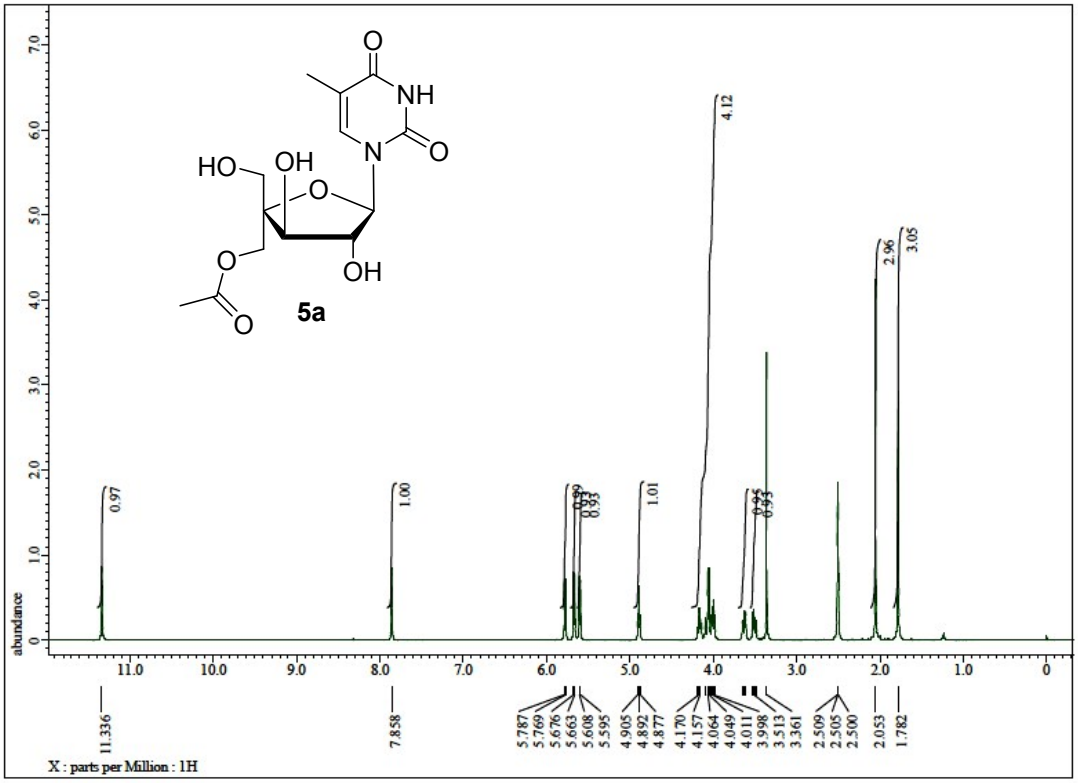


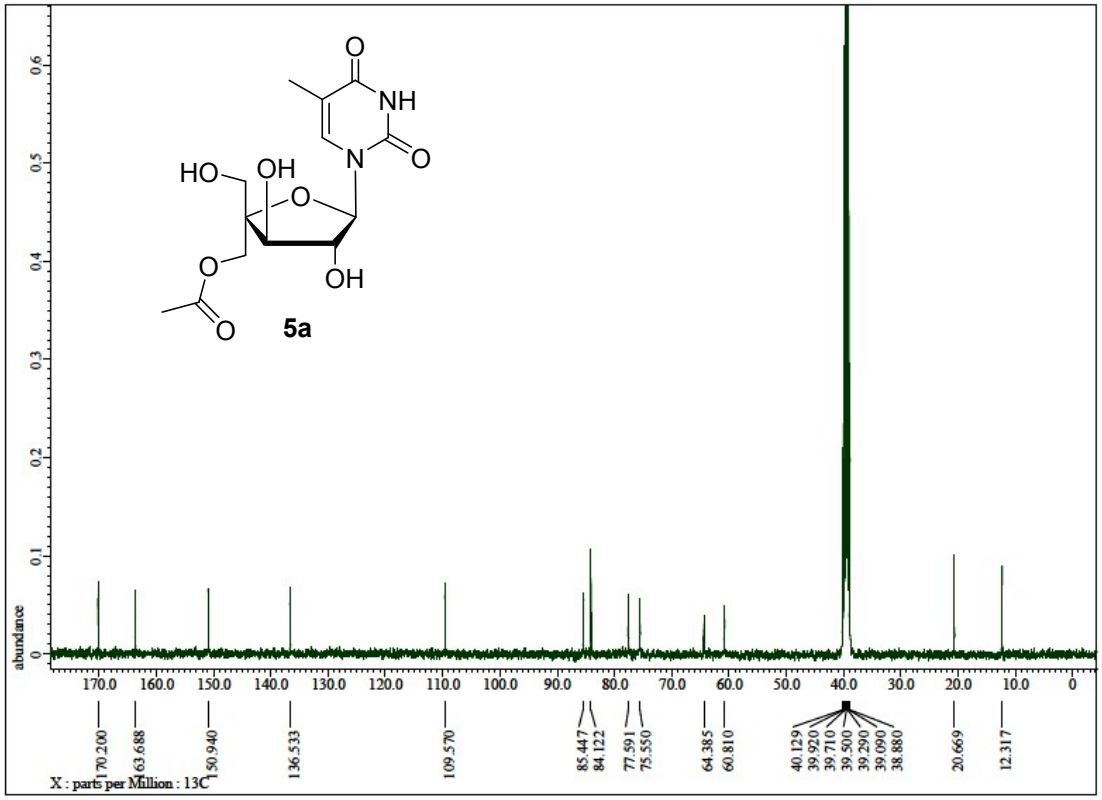
^{1}H- and ^{13}C NMR Spectra of compound 4d



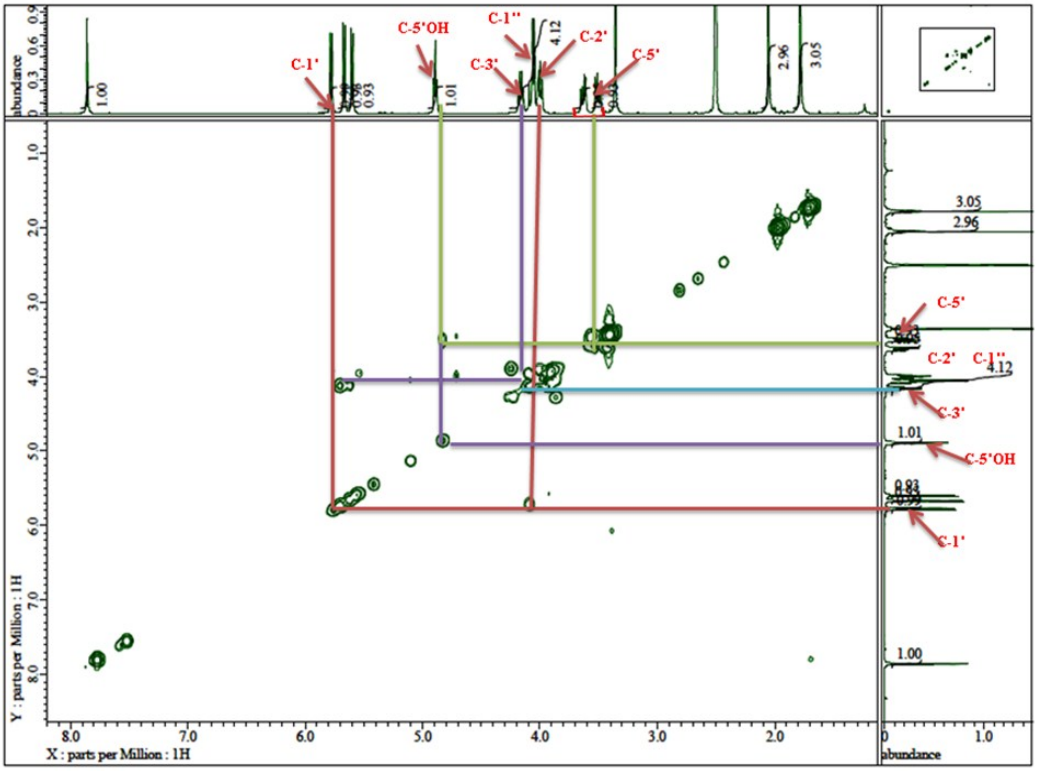


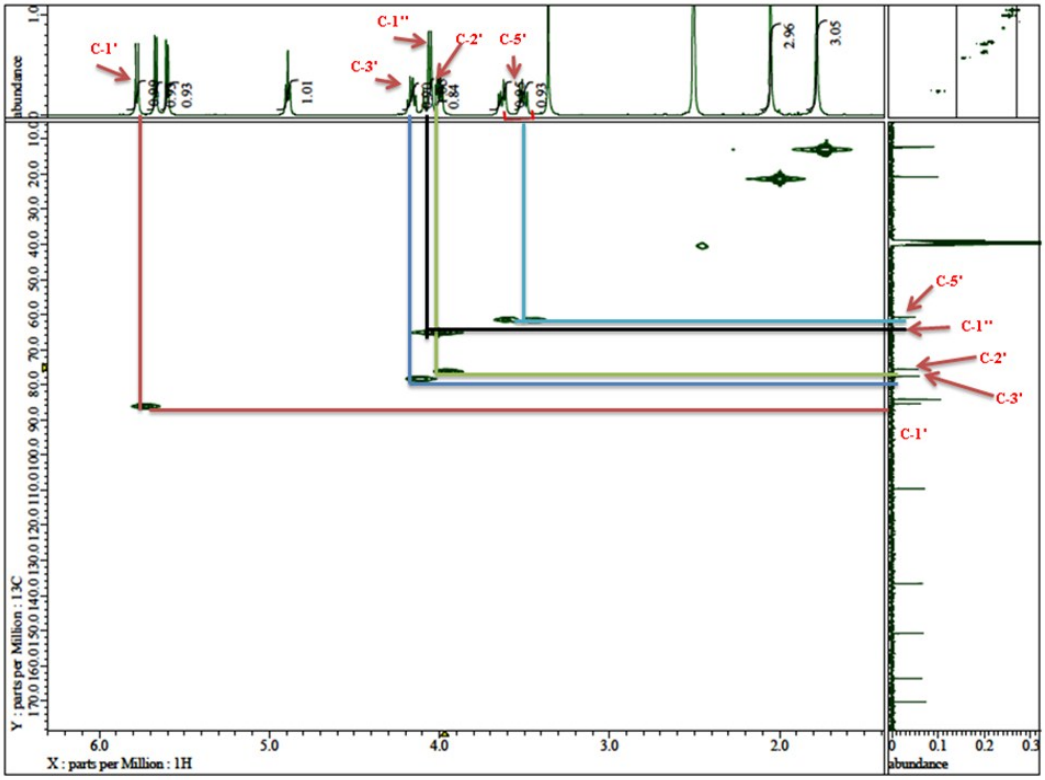
^{1}H- and ^{13}C NMR Spectra of compound 5a





^{1}H- ^{1}H COSY and ^{1}H-^{13}C HMQC Spectra of compound 5a





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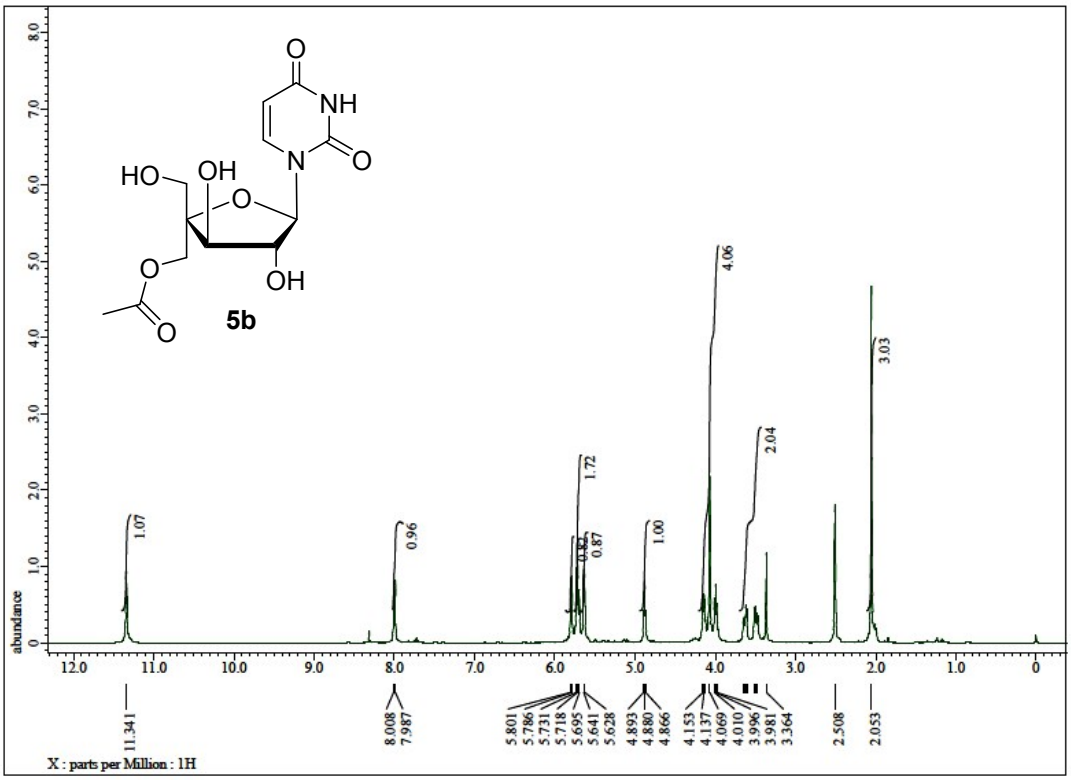
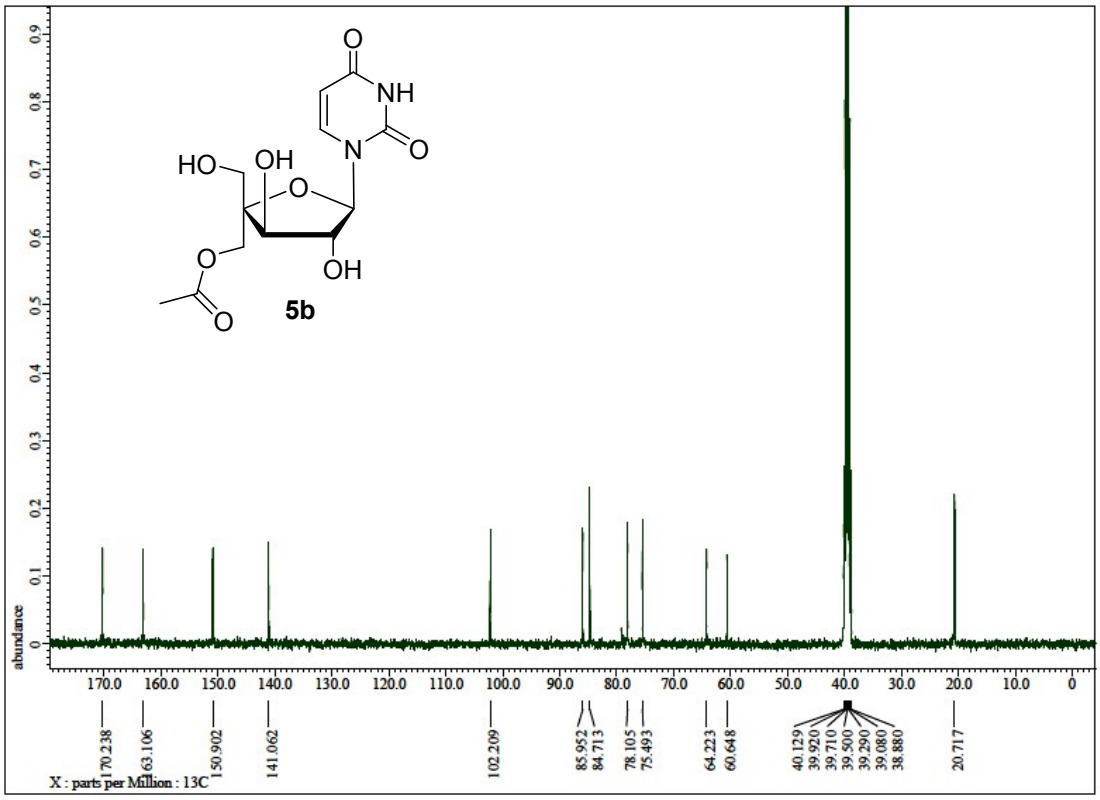
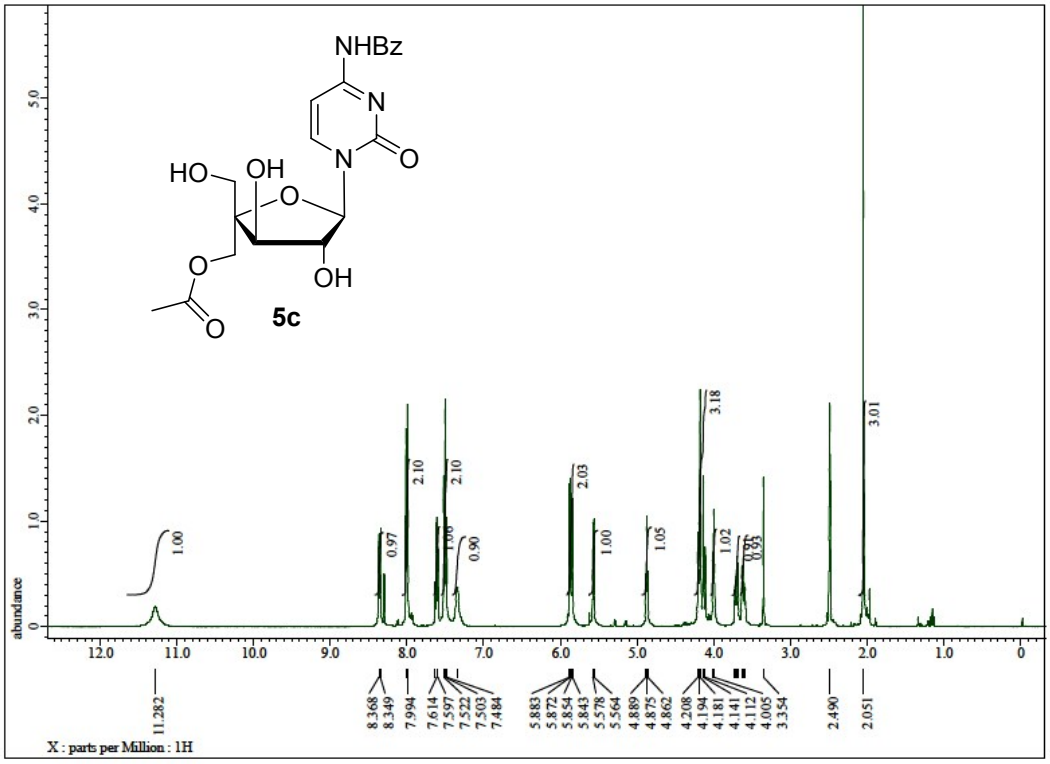
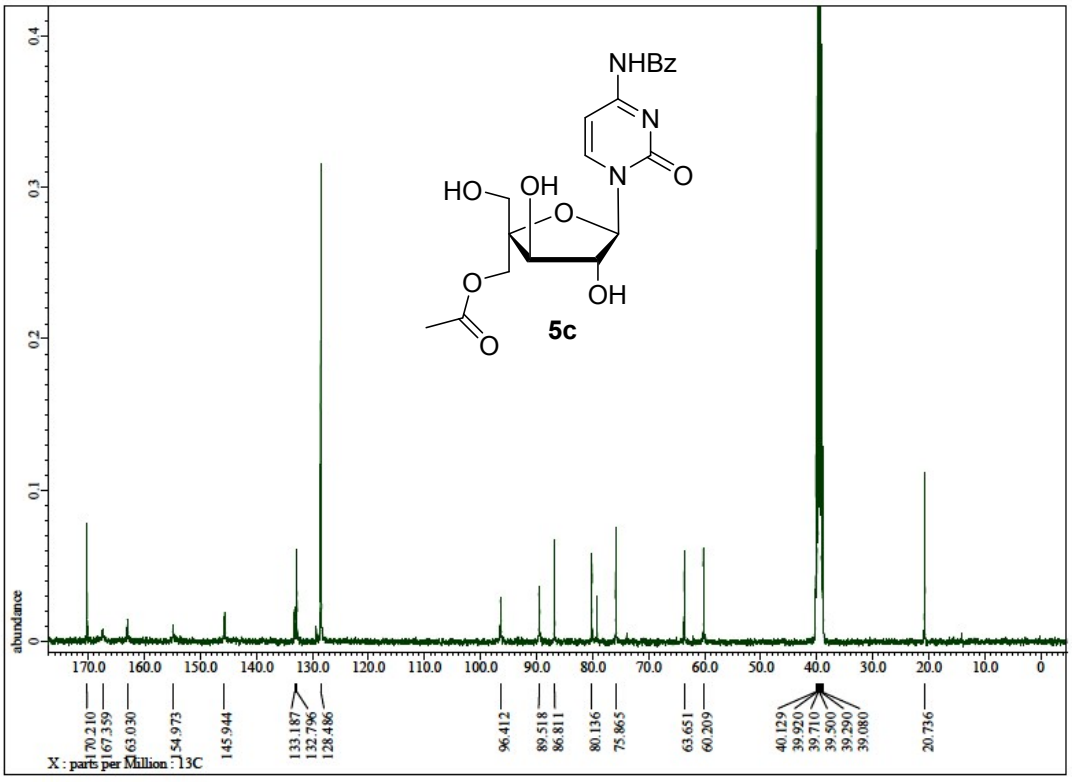


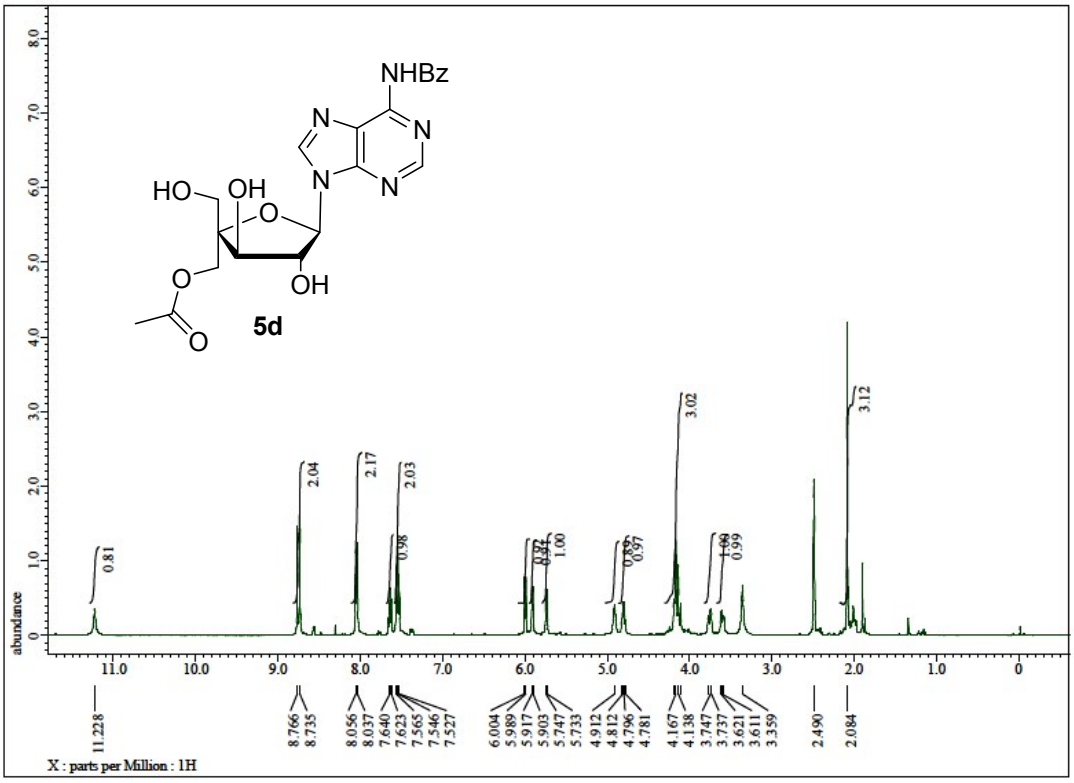


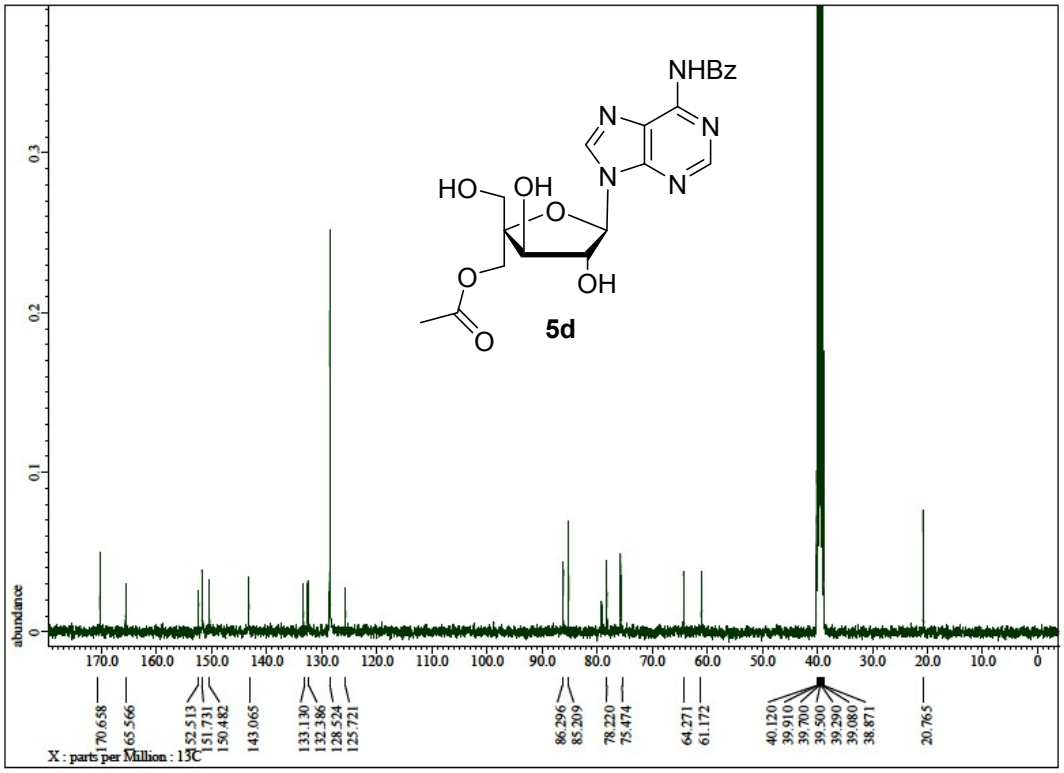
^{1}H- and ^{13}C NMR Spectra of compound 5c



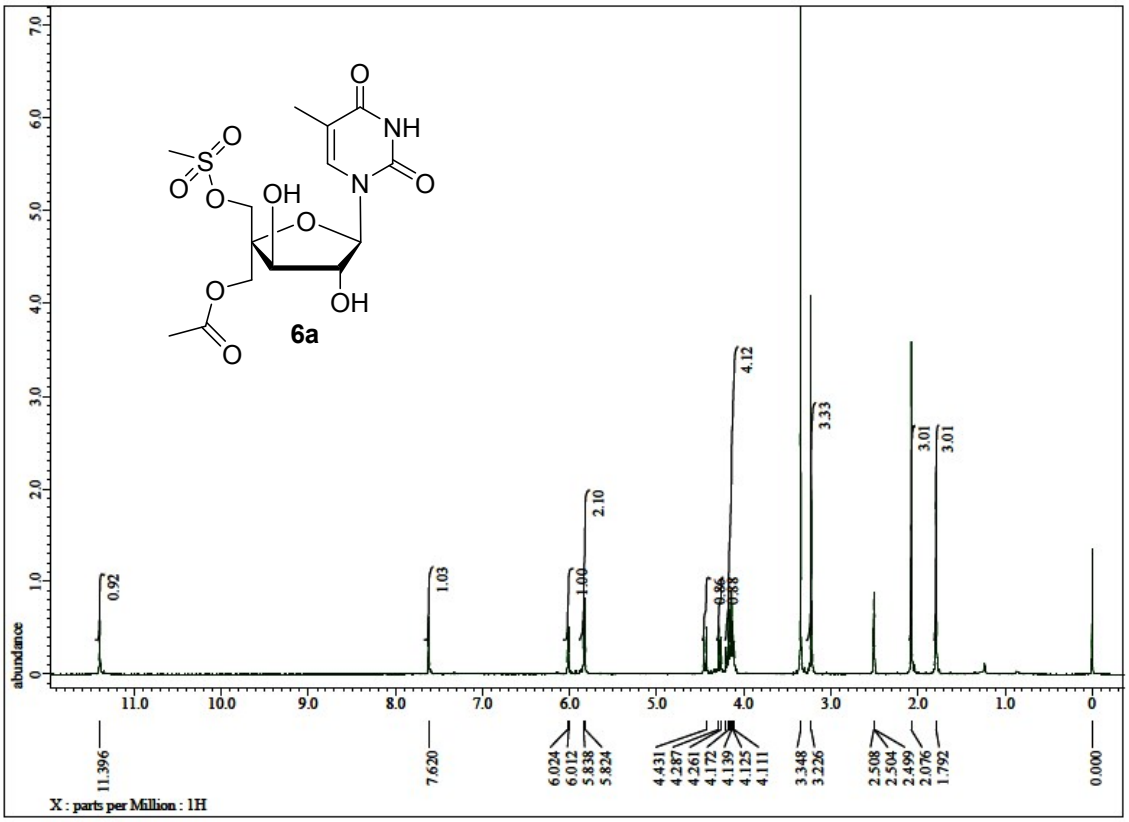


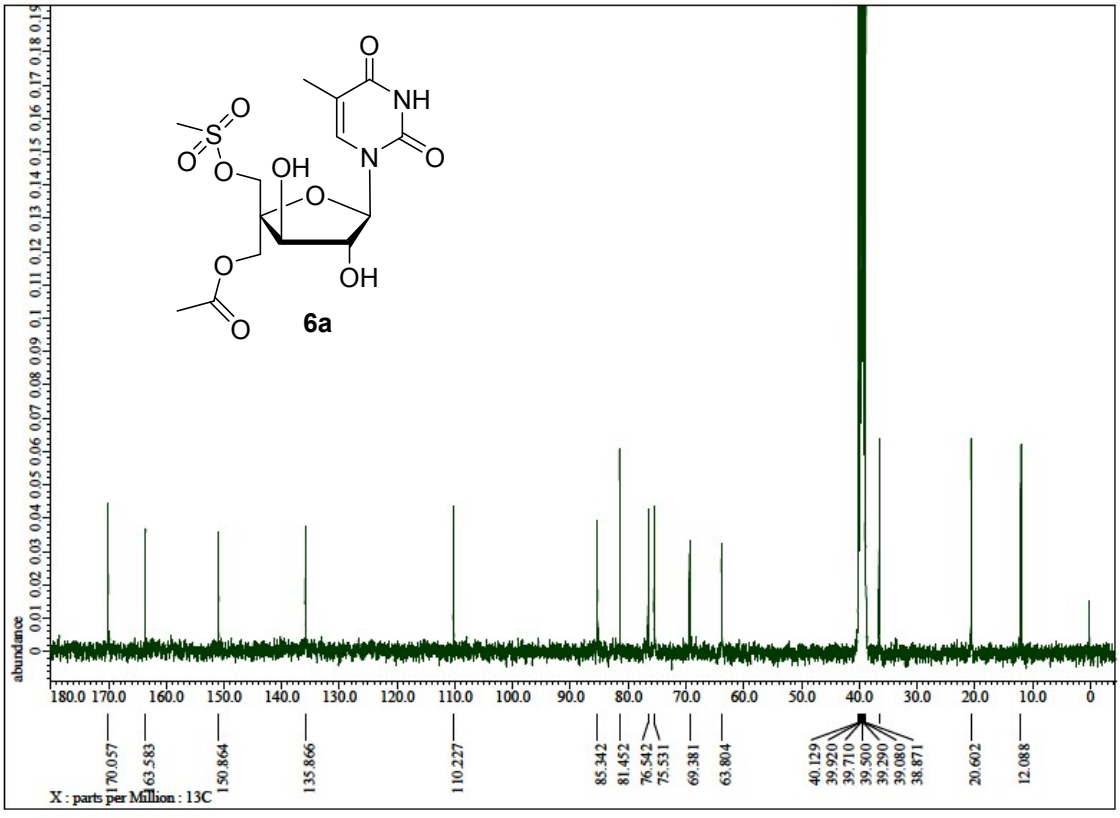
^{1}H- and ^{13}C NMR Spectra of compound 5d



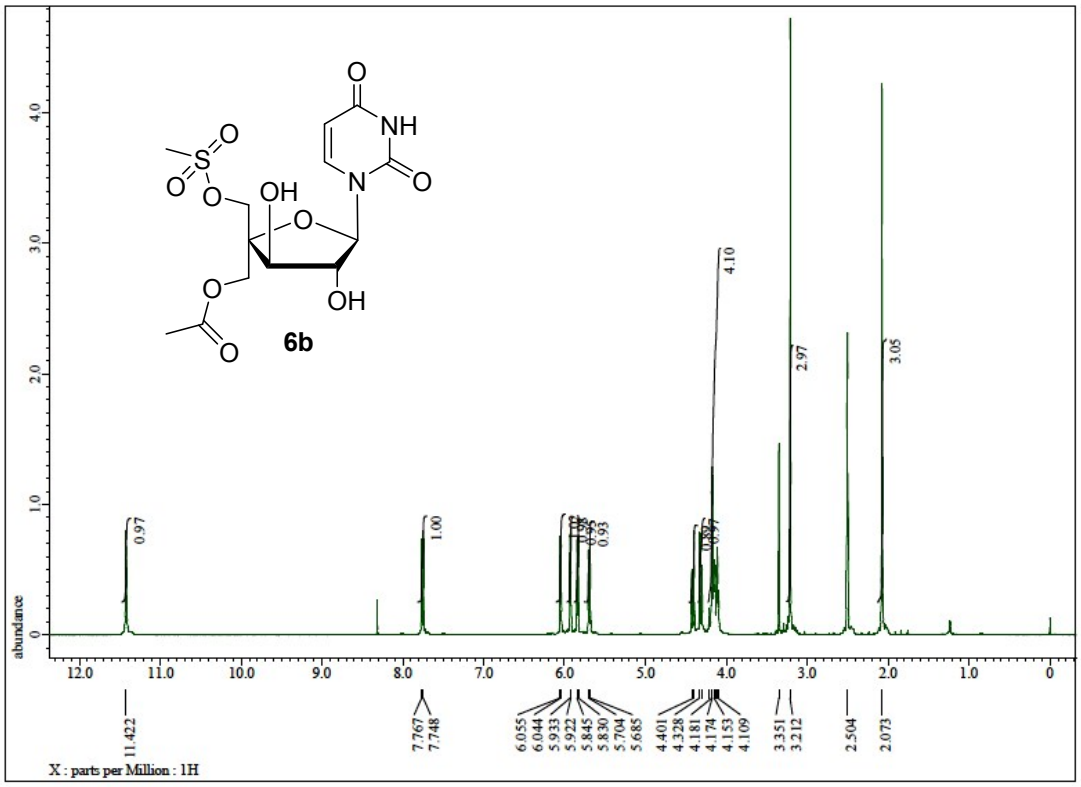


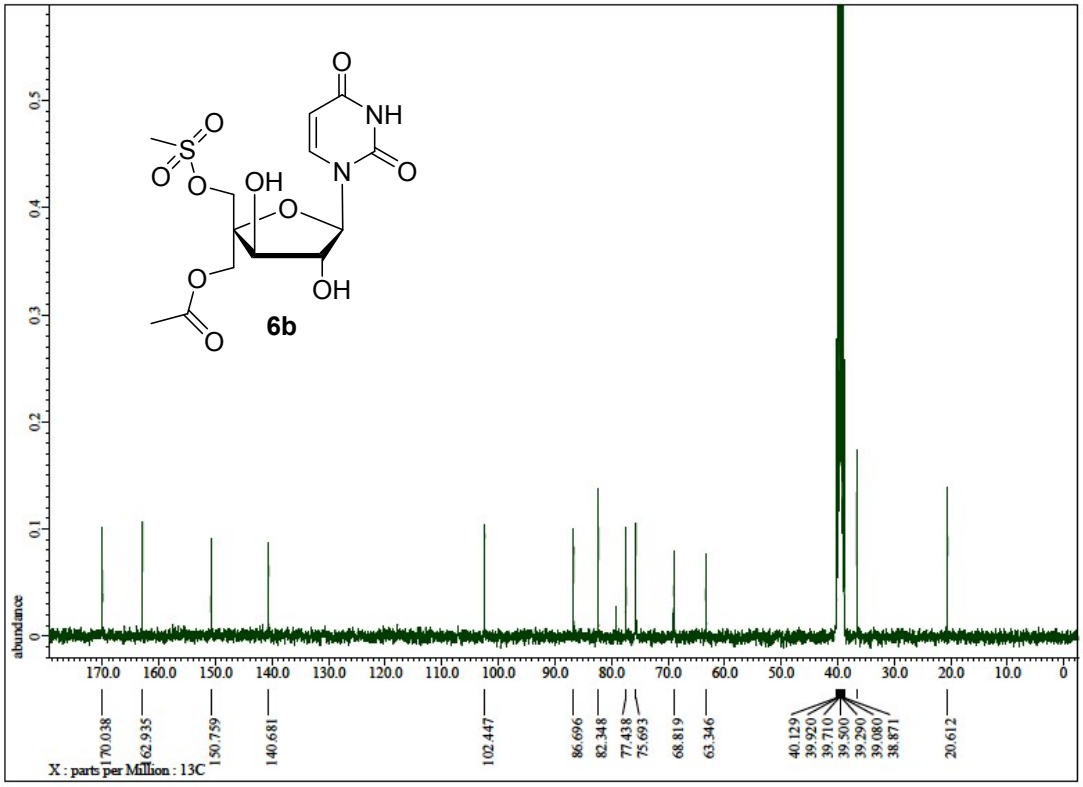
^{1}H- and ^{13}C NMR Spectra of compound 6a





^{1}H- and ^{13}C NMR Spectra of compound 6b





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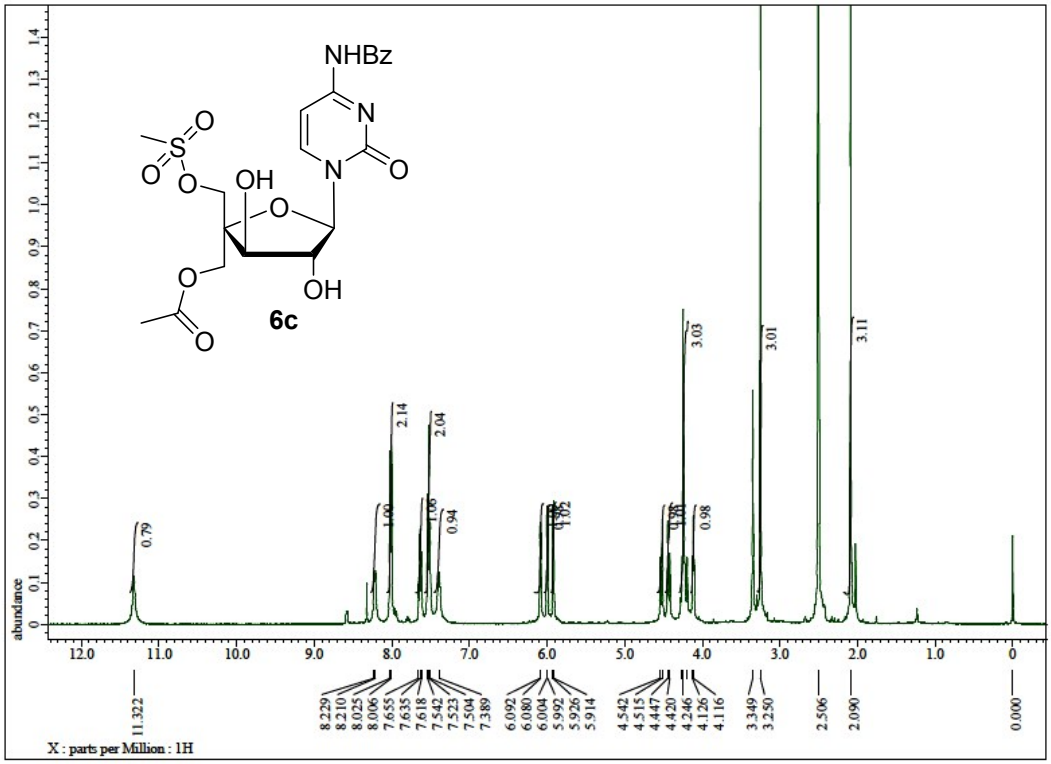
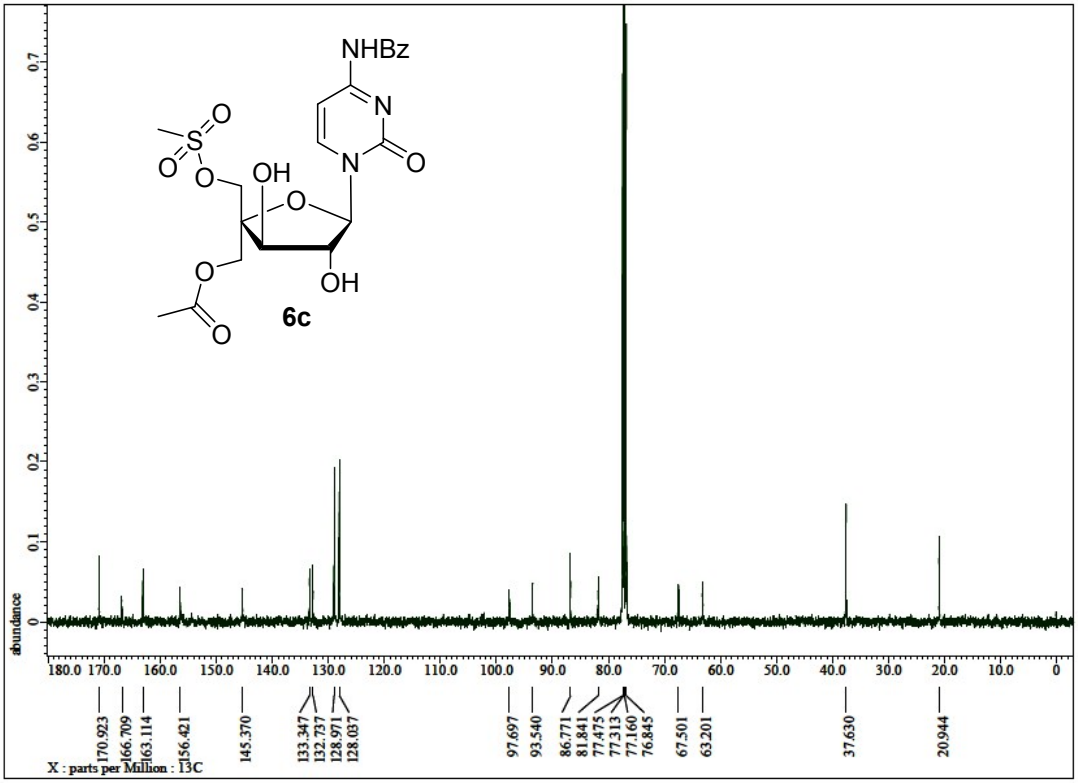
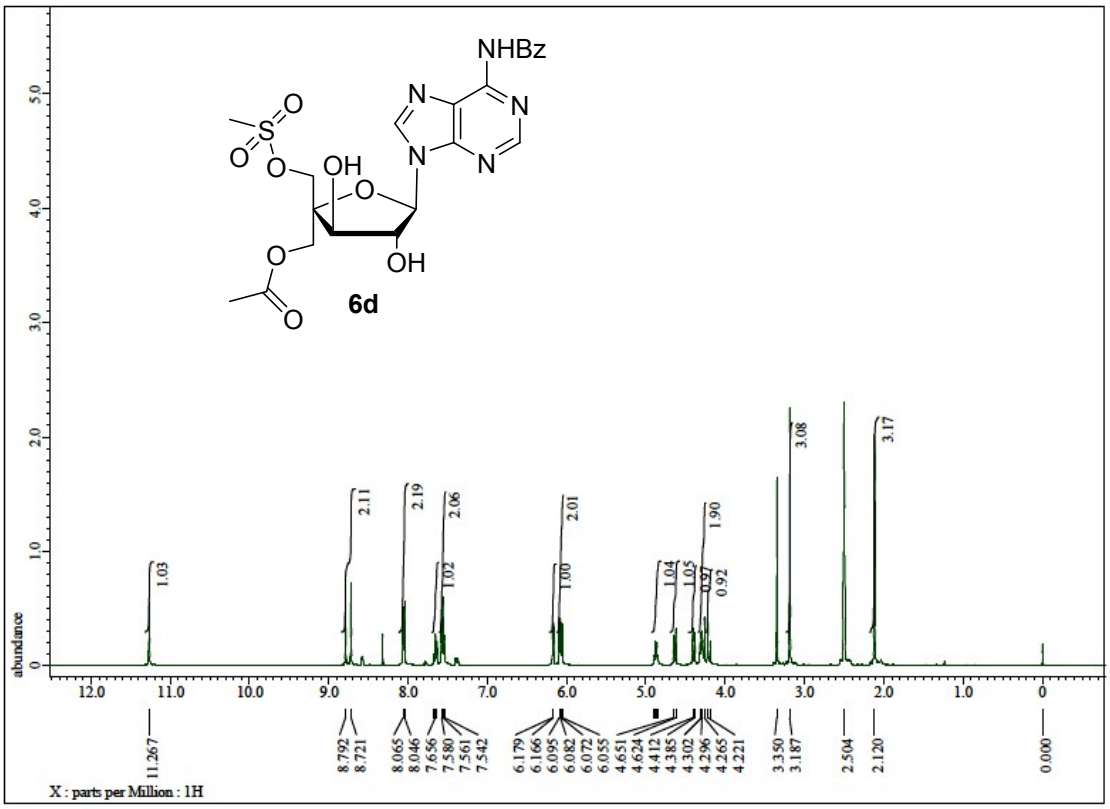
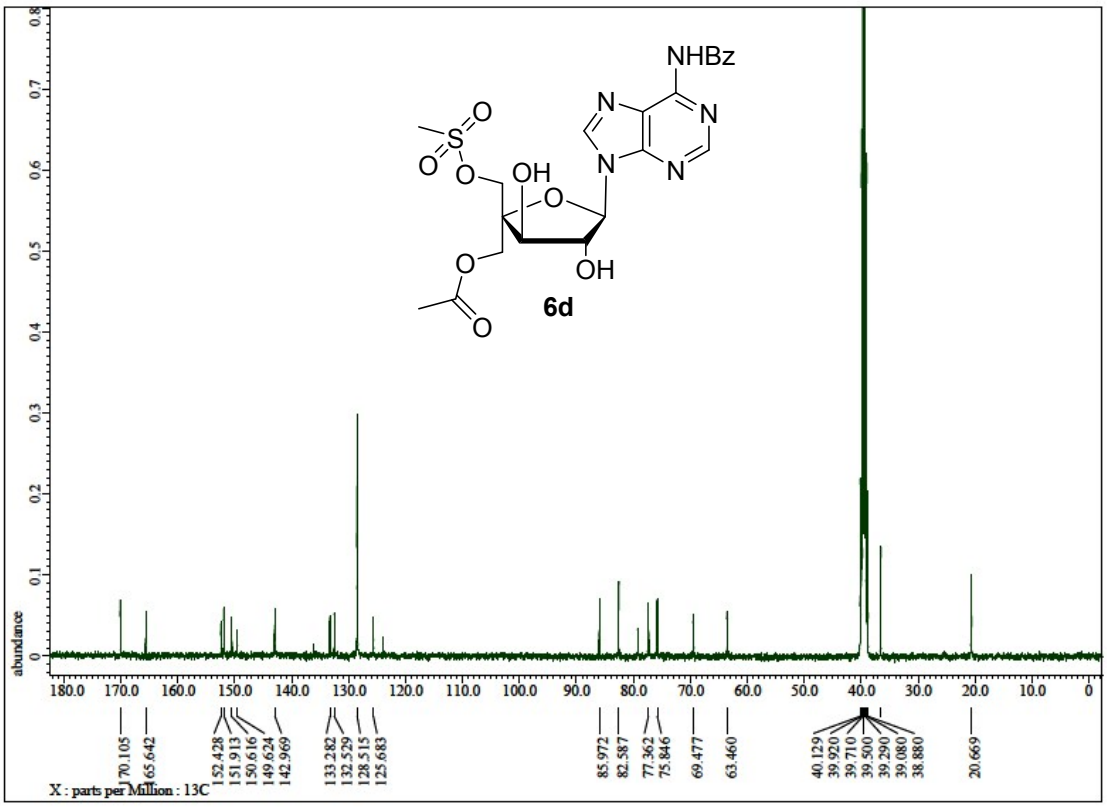


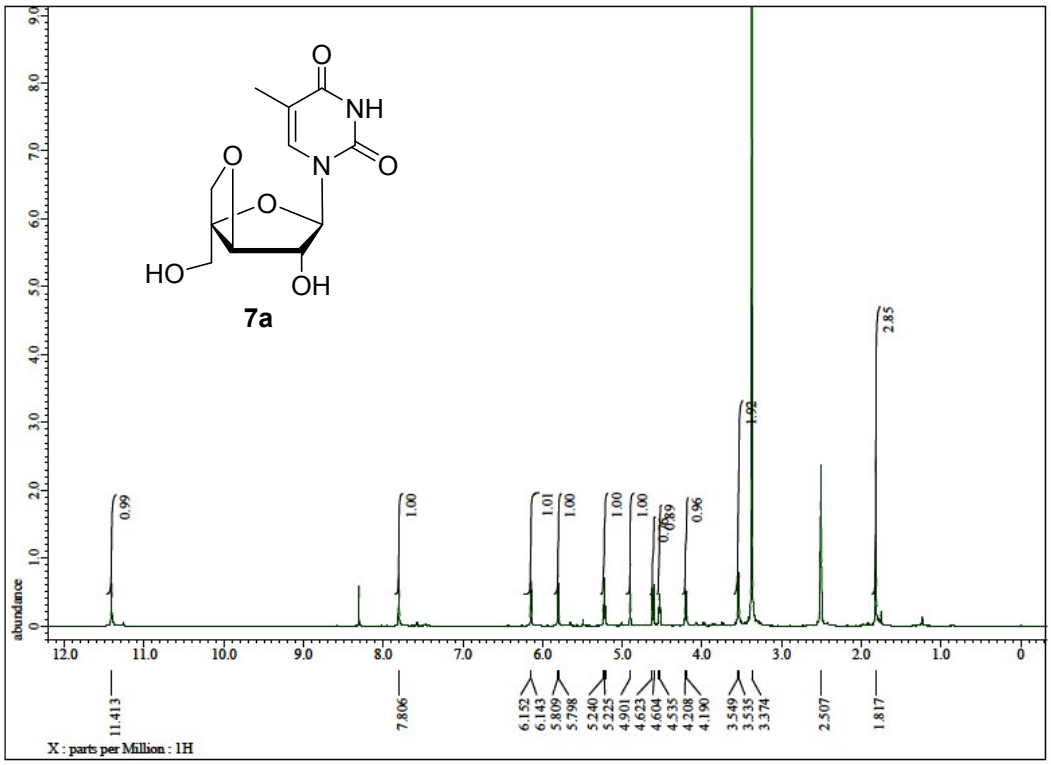


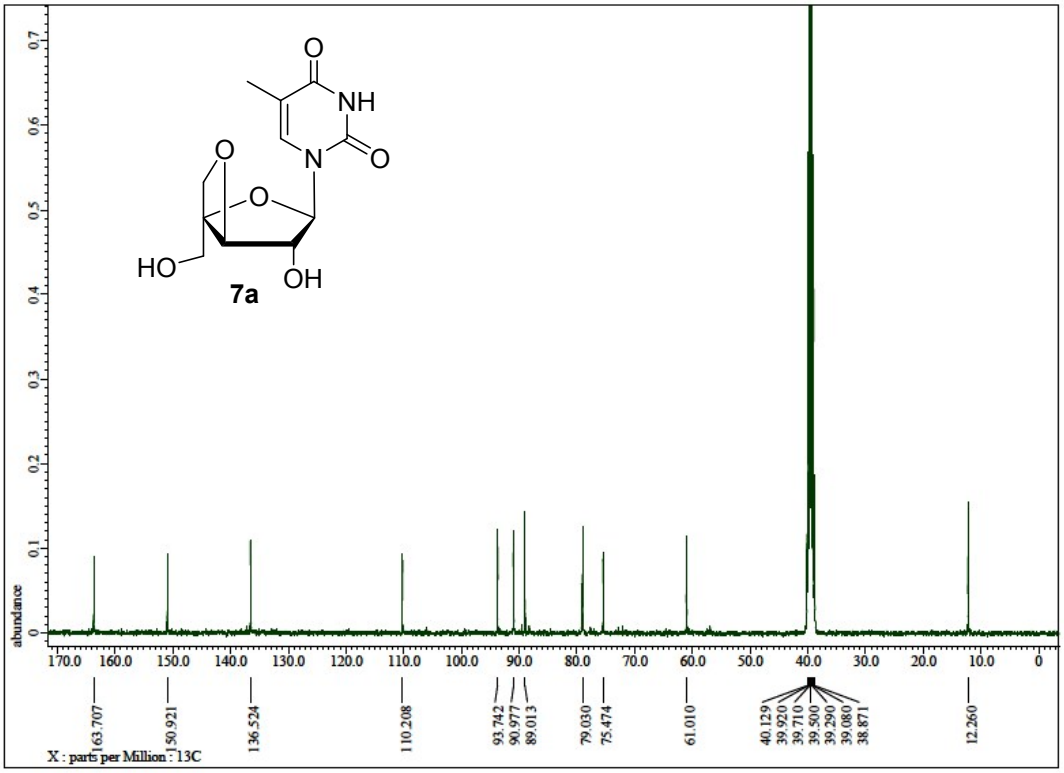
^{1}H- and ^{13}C NMR Spectra of compound 6d



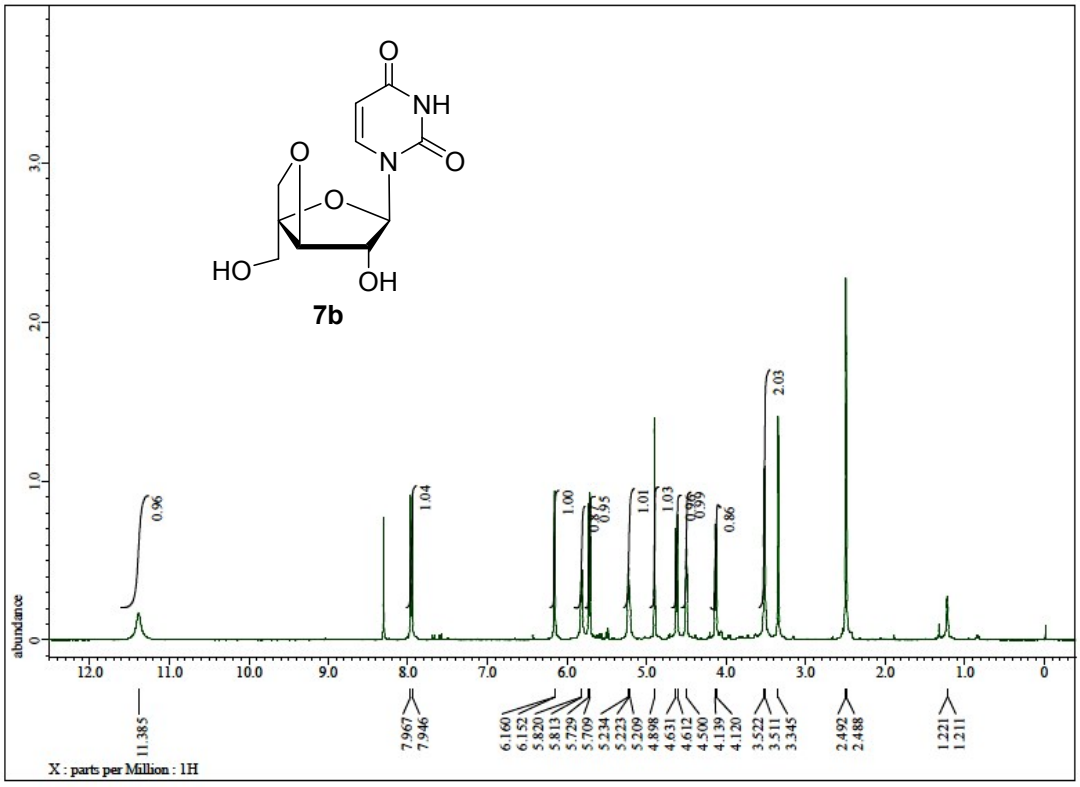


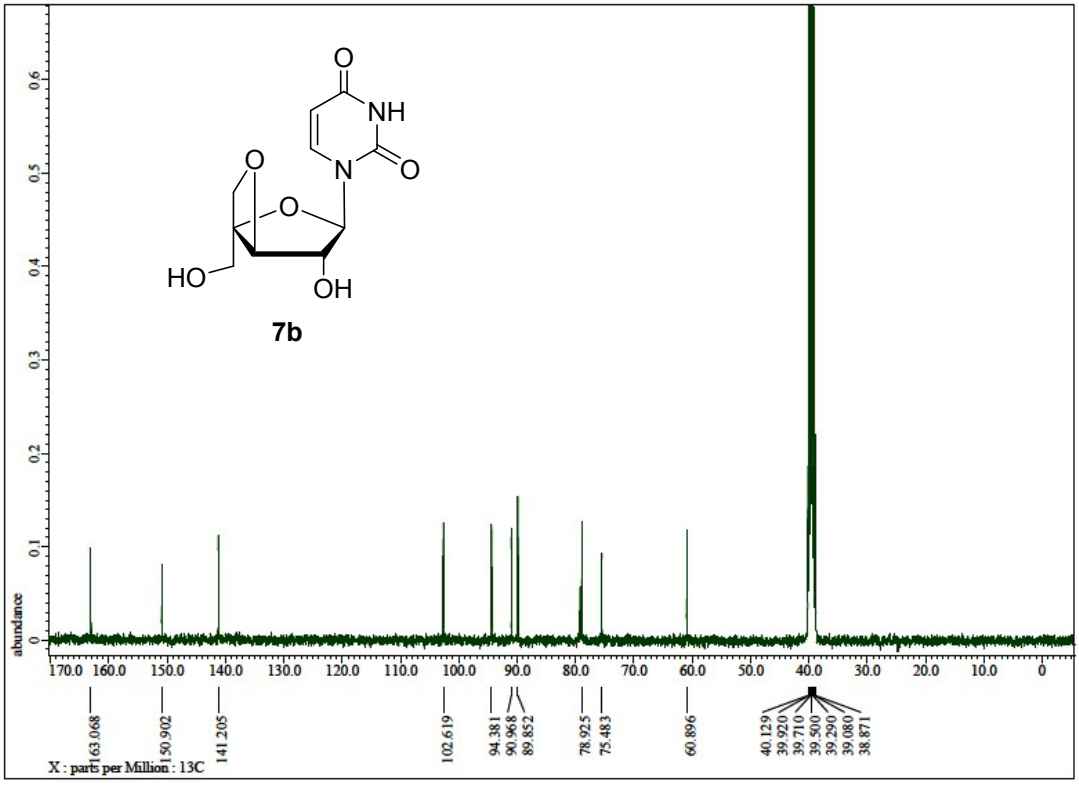
^{1}H- and ^{13}C NMR Spectra of compound 7a



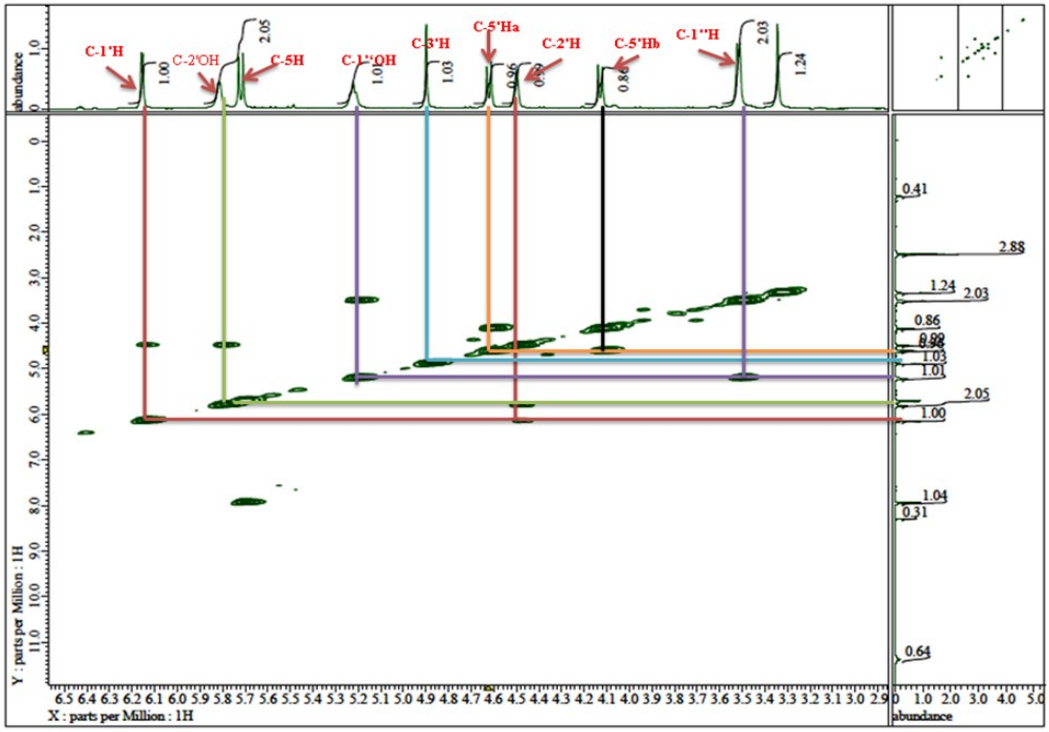


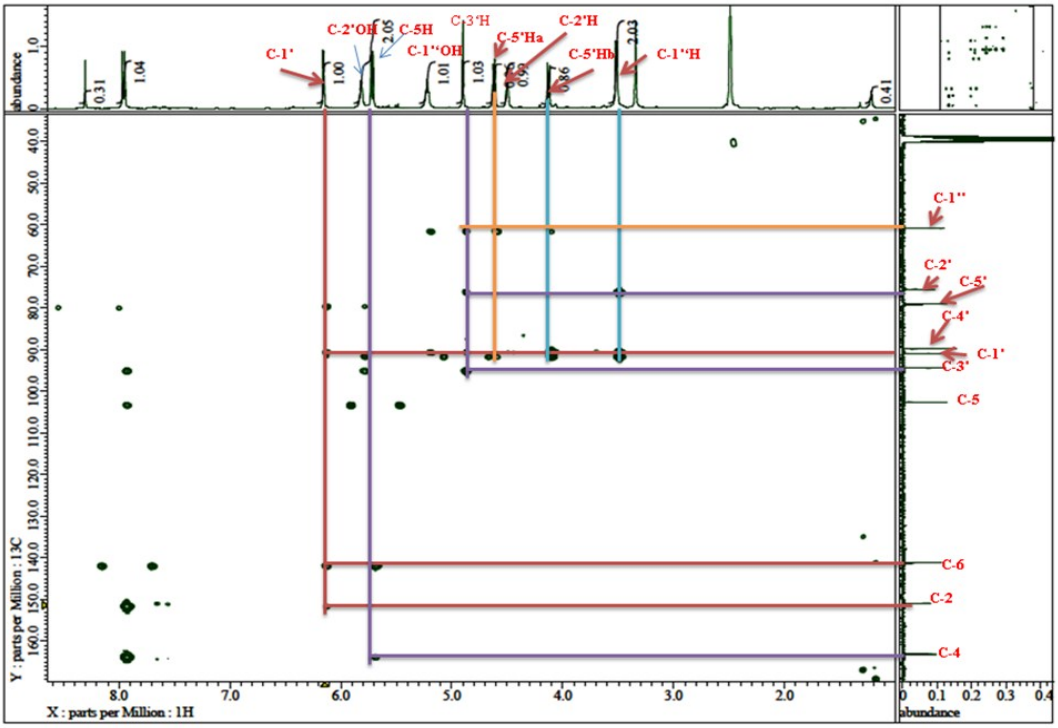
^{1}H- and ^{13}C NMR Spectra of compound 7b



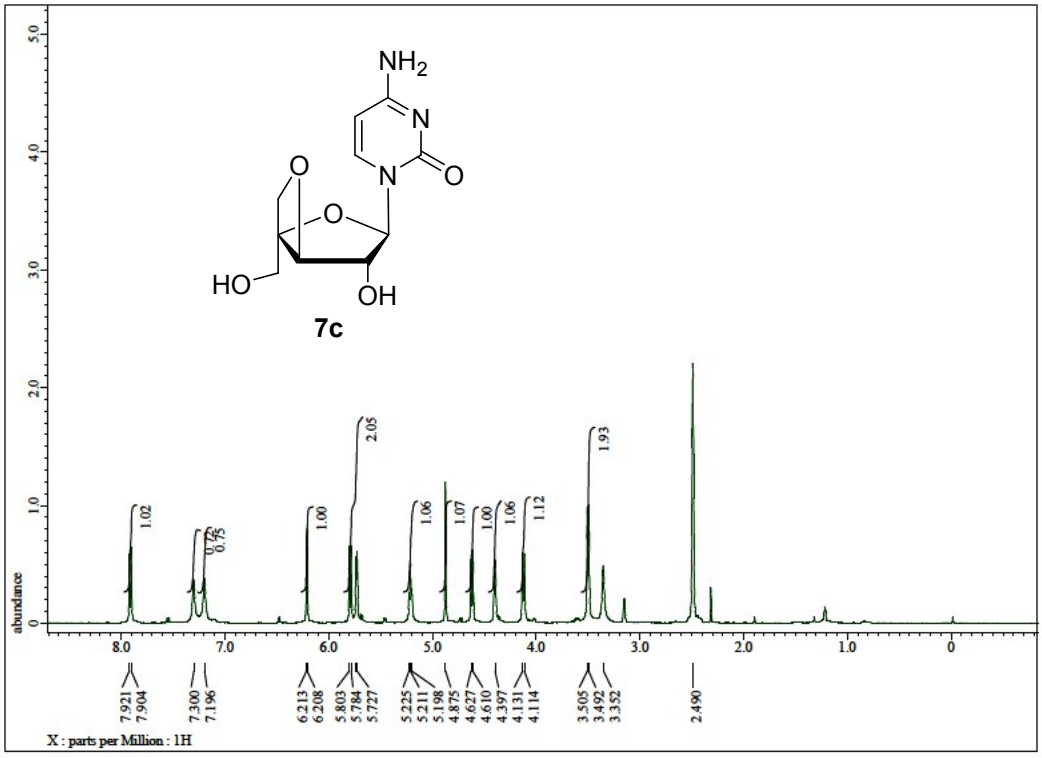


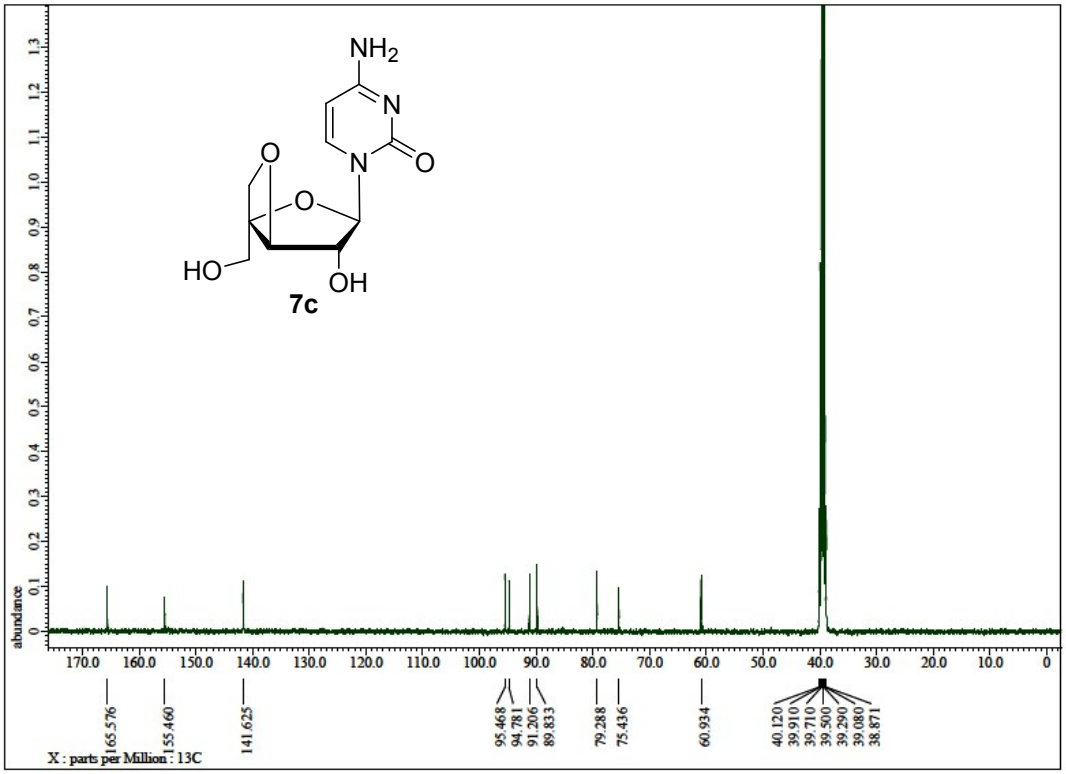
^{1}H-^{1}H COSY and ^{1}H-^{13}C HMBC Spectra of compound 7b



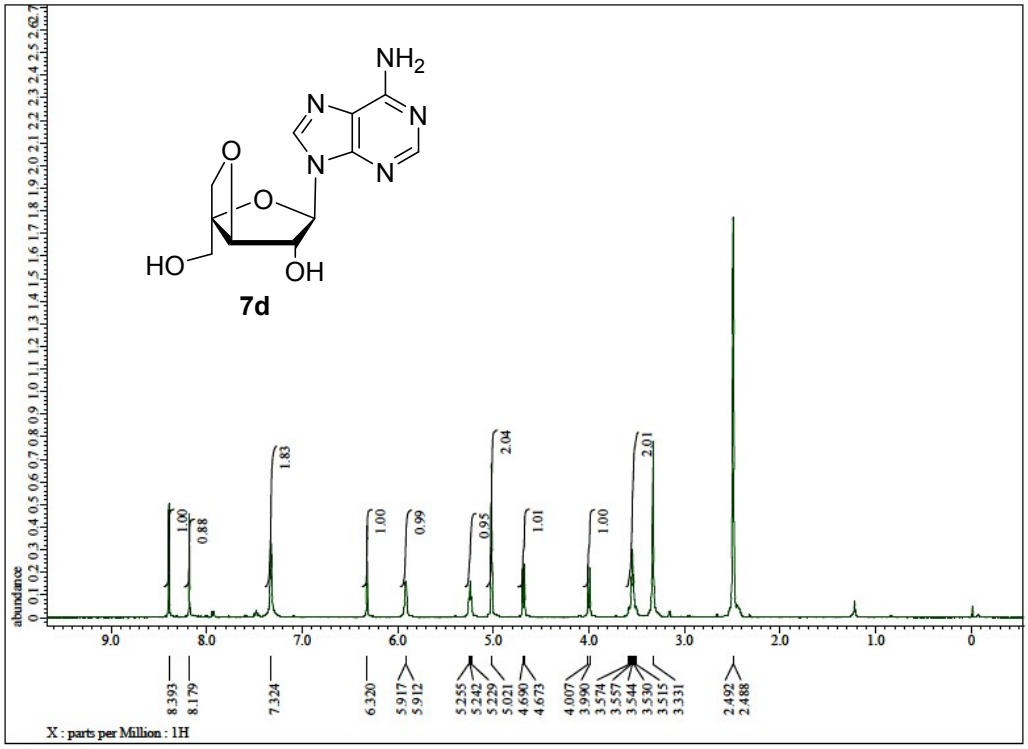


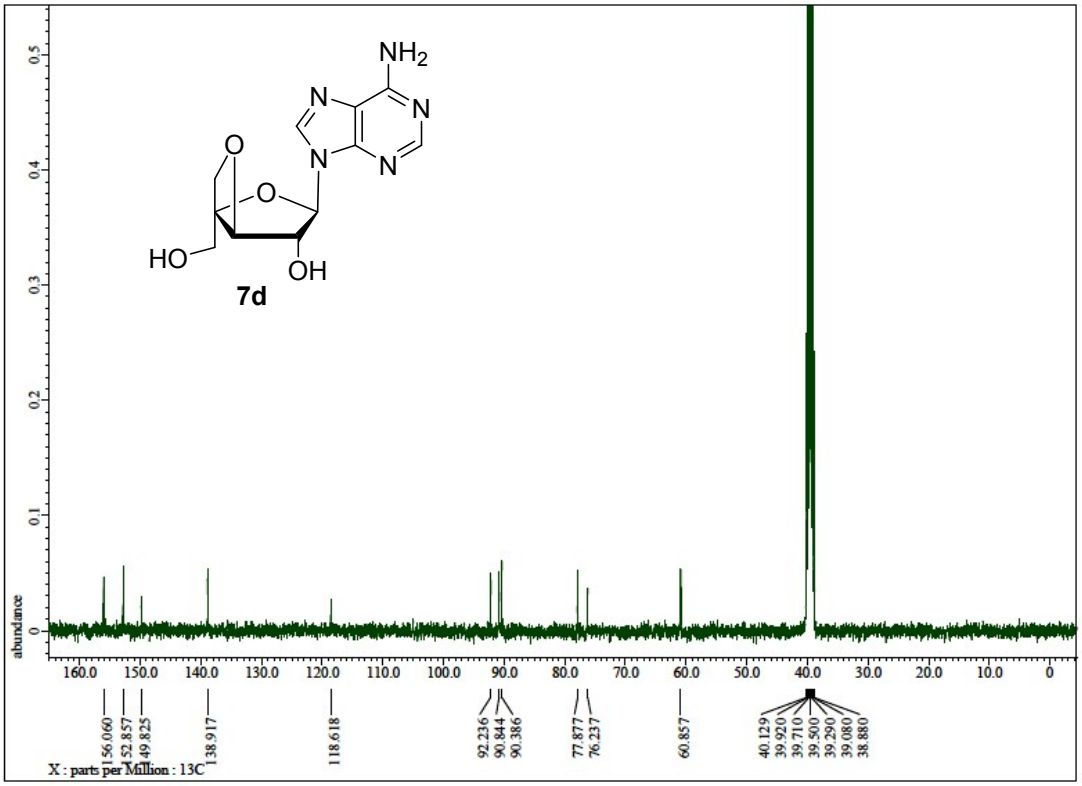
^{1}H- and ^{13}C NMR Spectra of compound 7c



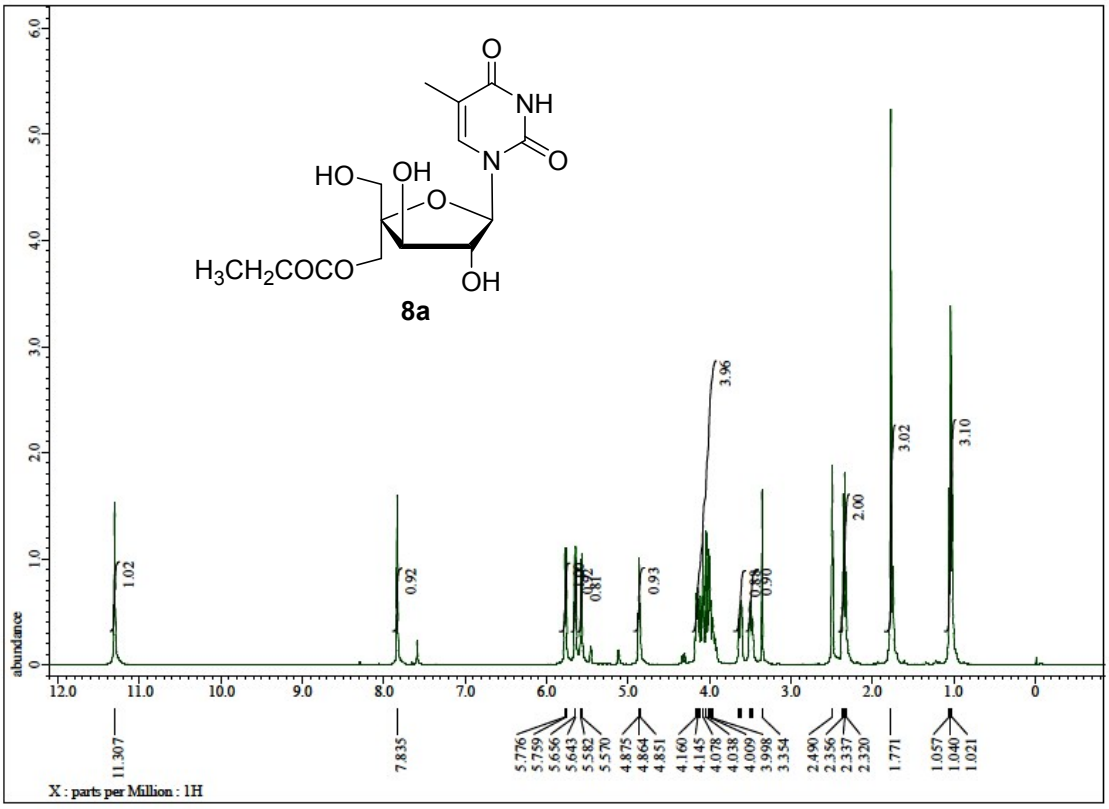


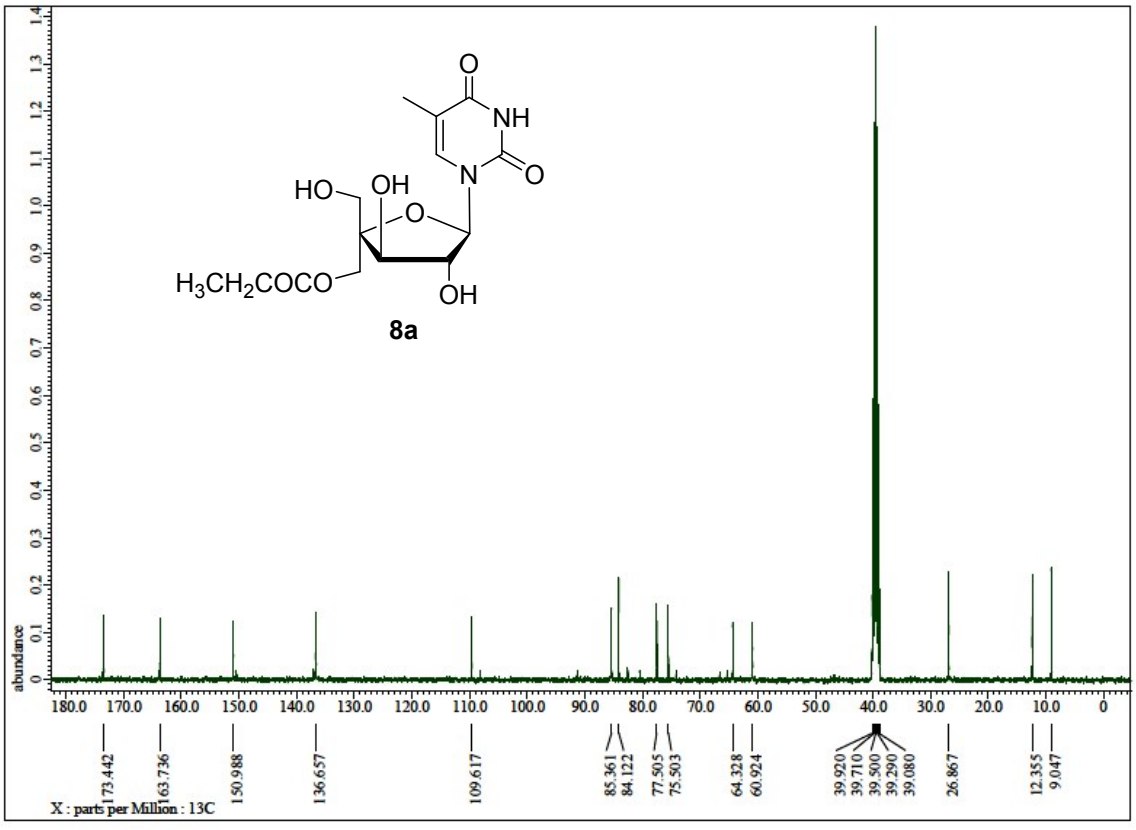
^{1}H- and ^{13}C NMR Spectra of compound 7d



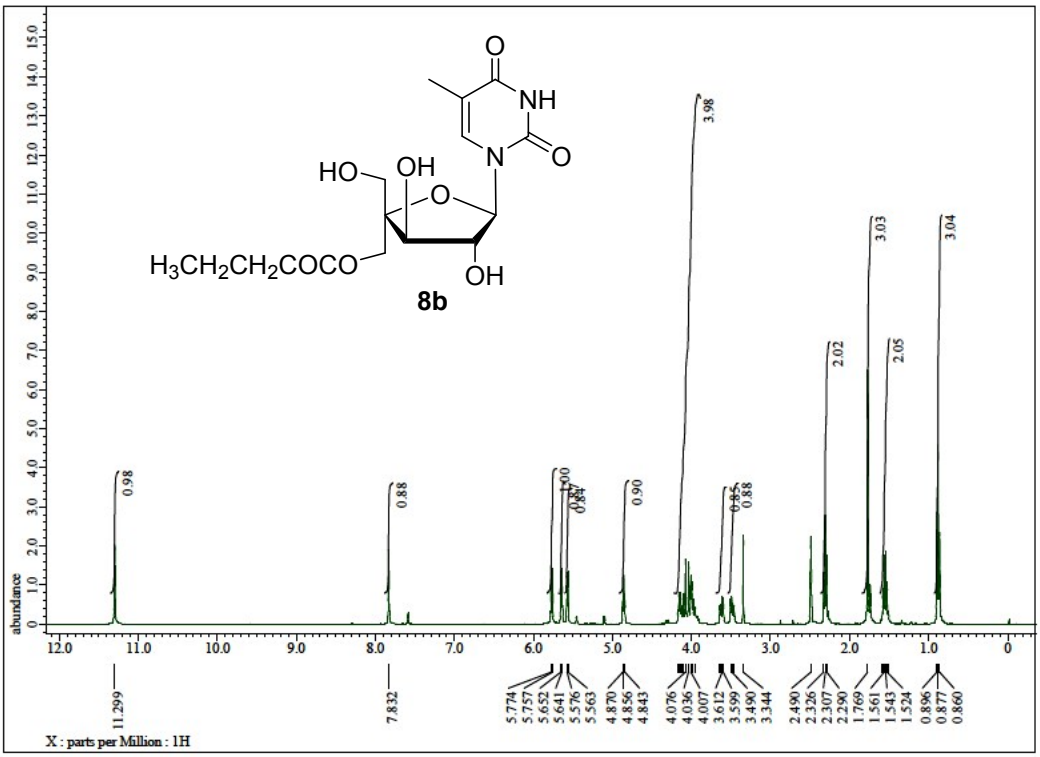


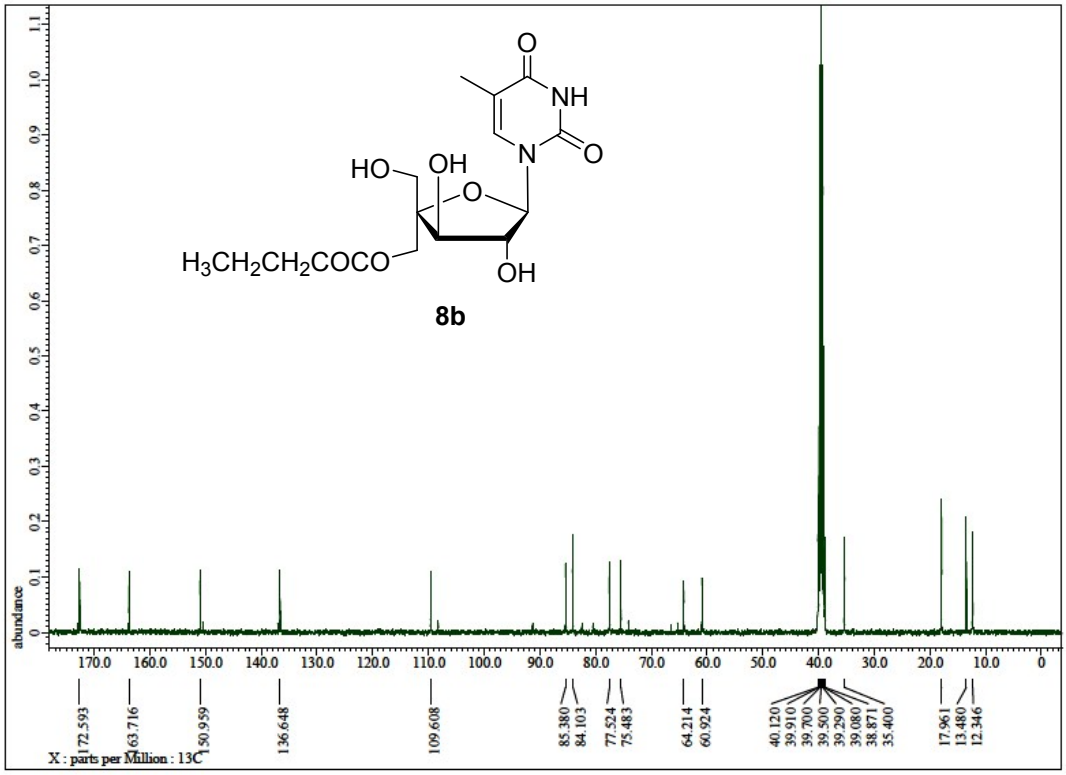
^{1}H- and ^{13}C NMR Spectra of compound 8a



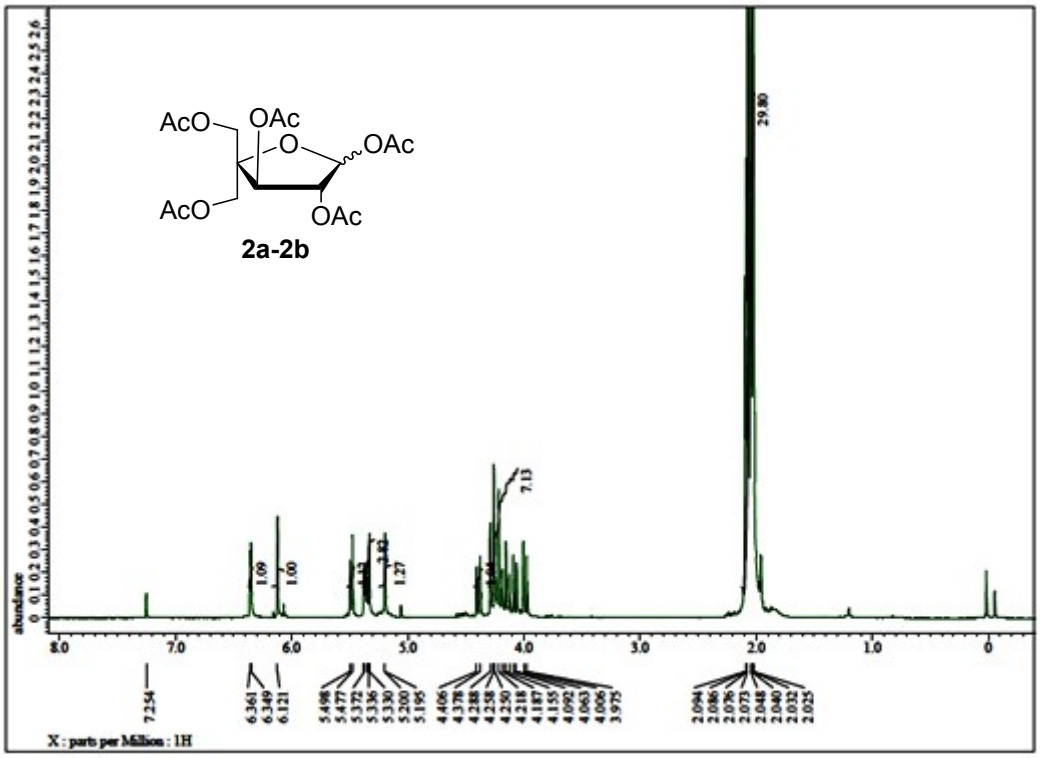


^{1}H- and ^{13}C NMR Spectra of compound 8b





^{1}H- and ^{13}C NMR Spectra of compound 2a-2b



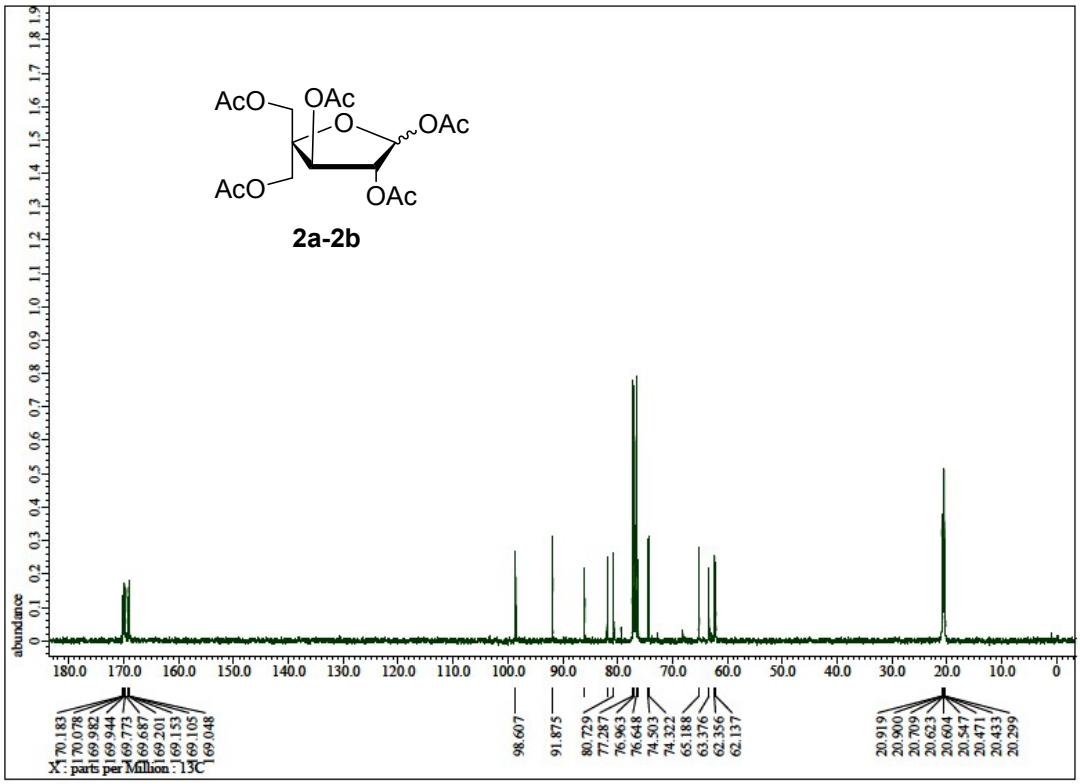


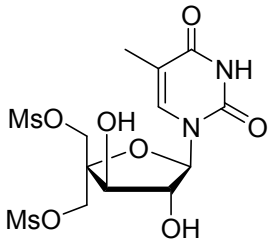
Table: Optimisation of reaction condition for biocatalytic transformation of tetrahydroxy nucleosides 4a-d to monoacetylated products 5a-d

Entry	Substrates	Acylating agents	Lipases	Solvents	Time (h)	Temp. (°C)	Product	yield
1.	4a	Vinyl acetate	Lipozyme® TL IM	THF	12	40/ 45¶	5a	95
2.	4a	Vinyl acetate	Lipozyme® TL IM	MeCN	12	40/ 45¶	5a	72
3.	4a	Vinyl acetate	Lipozyme® TL IM	DIPE	24	40/45/50*	No reaction	_
4.	4a	Vinyl acetate	Lipozyme® TL IM	DMSO	24	40/45/50*	No reaction	_
5.	4a	Vinyl acetate	Lipozyme® TL IM	DMF	24	40/45/50*	No reaction	_
6.	4a	Acetic anhydride	Lipozyme® TL IM	THF	12	45	mixture	90
7.	4a	Acetic anhydride	Lipozyme® TL IM	MeCN	12	45	mixture	82
8.	4a	Vinyl acetate	Novozyme®-435	THF	12	45	mixture	89
9.	4a	Vinyl acetate	Novozyme®-435	MeCN	12	45	mixture	76
10.	4a	Acetic anhydride	Novozyme®-435	THF	12	45	mixture	92
11.	4a	Acetic anhydride	Novozyme®-435	MeCN	12	45	mixture	74
12.	4b	Vinyl acetate	Lipozyme® TL IM	THF	13	45	5b	89
13.	4c	Vinyl acetate	Lipozyme® TL IM	THF	14	45	5c	90
14.	4d	Vinyl acetate	Lipozyme® TL IM	THF	16	45	5d	88

¶ These reactions were carried out at both 40 and 45 °C, better result was obtained at 45 °C.

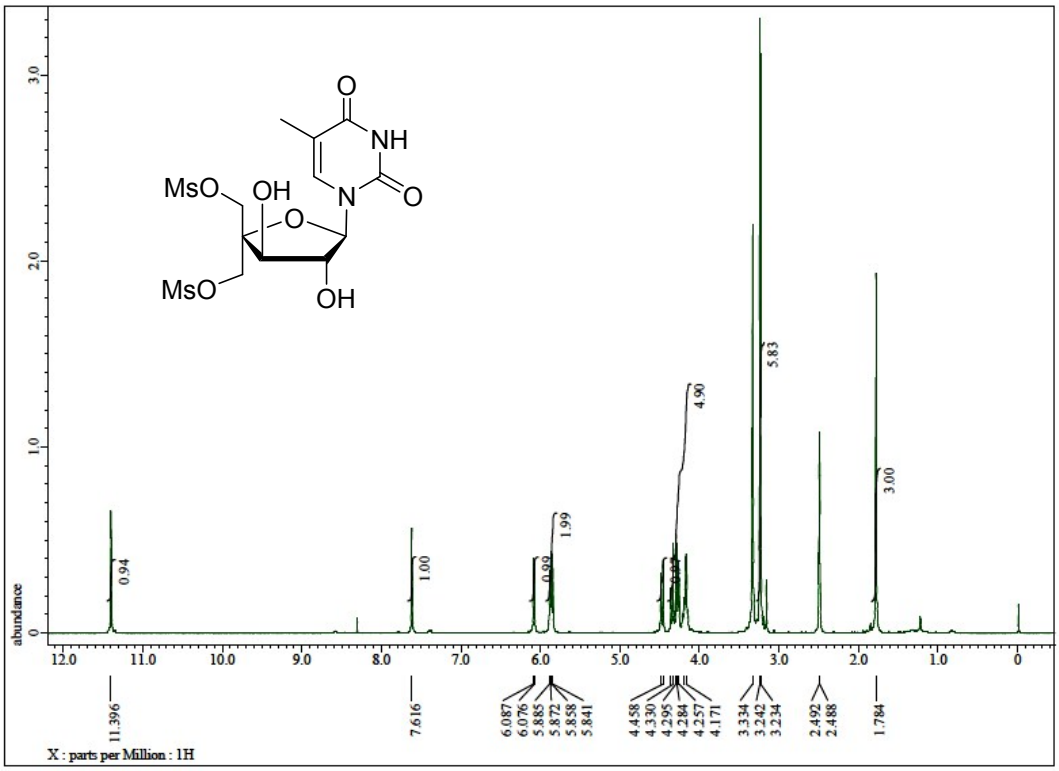
* The reaction was carried out at 40, 45 and 50 °C. None of the reaction led to formation of product.

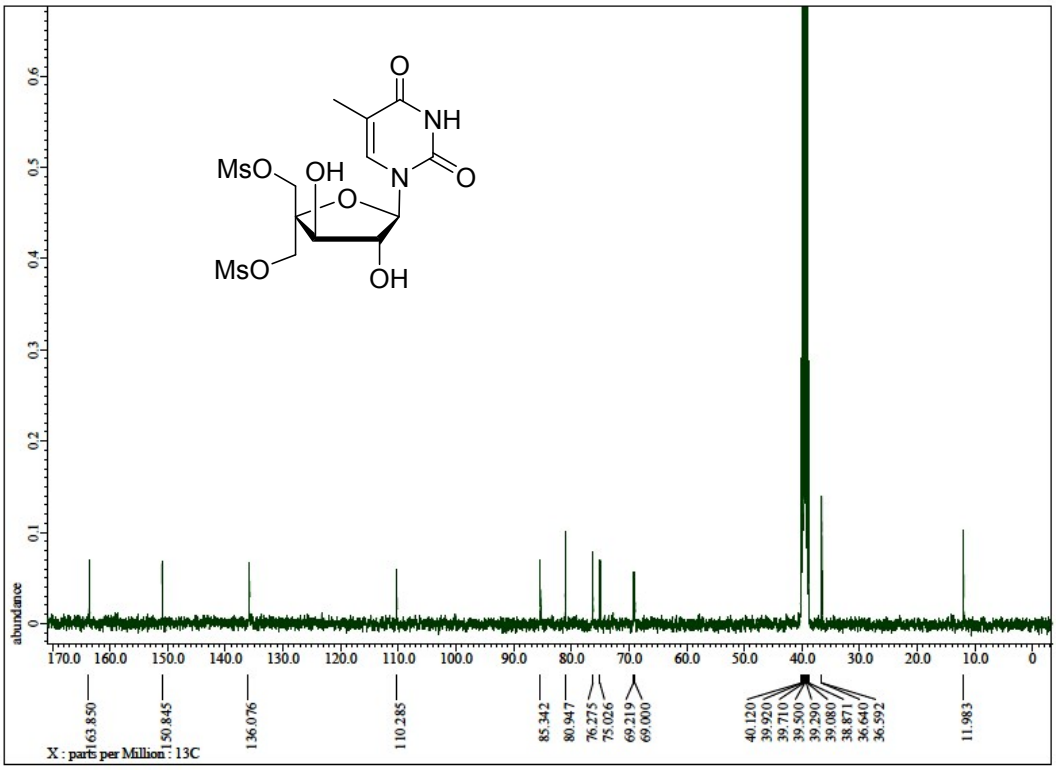
Synthesis of 5'-*O*-methanesulfonyl-4'-*C*-methanesulfonyloxymethyl-*β*-D-*xylo*furanosylthymidine



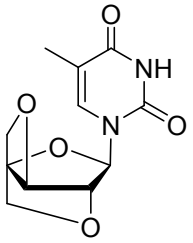
A solution of nucleoside **4a** (1.0 mmol) and methanesulfonyl chloride (2.2 mmol) in anhydrous pyridine (10 mL) was stirred at -10 °C under nitrogen atmosphere for 4 h. On completion, the reaction mixture was poured over ice-cold 10 % aqueous hydrochloric acid solution (50 mL) and the product was extracted with EtOAc (3 x 50 mL). The combined organic phase was washed with saturated $NaHCO_3$ (2 x 100 mL) solution and dried over anhydrous Na_2SO_4. The solvent was removed under reduced pressure and residue thus obtained was purified by silica gel column chromatography using MeOH in $CHCl_3$ as gradient solvent to afford the 5'-*O*-methanesulfonyl-4'-*C*-methanesulfonyloxymethyl-*β*-D-*xylo*furanosylthymidine in 70 % as white sticky solid. R_f = 0.5 (10 % MeOH in $CHCl_3$); ^{1}H NMR (DMSO-d_6, 400 MHz): δ 11.40 (1H, brs), 7.62 (1H, s), 6.08 (1H, d, J = 4.4 Hz), 5.88 (1H, d, J = 5.2 Hz), 5.85 (1H, d, J = 6.8 Hz), 4.47 (1H, d, J = 11.2 Hz), 4.36-4.16 (5H, m), 3.24 (3H, s), 3.23 (3H, s), 1.78 (3H, s); ^{13}C NMR (DMSO-d_6, 100.6 MHz): δ 163.85, 150.84, 136.08, 110.28, 85.34, 80.95, 76.27, 75.03, 69.22, 69.00, 36.64, 36.59, 11.98; HRMS (ESI): found m/z 467.0388 ($[M+Na]^+$), calcd. for $[C_{13}H_{20}N_2O_{11}S_2+Na]^+$ 467.0401.

^{1}H- and ^{13}C NMR Spectra of dimesylatednucleoside





Synthesis of tricyclic nucleoside



A solution of 5'-*O*-methanesulfonyl-4'-*C*-methanesulfonyloxymethyl-*β*-D-*xylo*furanosylthymidine (1.0 mmol) and 2M NaOH in dioxane/water mixture (1:1, 15 mL) was stirred at 0-25 °C for 1 h. On completion of the reaction (analytical TLC), the solvents were removed under reduced pressure. The residue thus obtained was purified by silica gel column chromatography using MeOH in $CHCl_3$ as a gradient solvent to afford tricyclic nucleoside as white sticky solid in 57 % yield. R_f = 0.6 (10 % MeOH in $CHCl_3$); ^{1}H NMR (DMSO-d_6, 400 MHz): δ 11.40 (1H, brs), 7.90 (1H, s), 6.13 (1H, d, J = 3.6 Hz), 4.88 (1H, s), 4.59 (1H, d, J = 7.6 Hz), 4.52 (1H, d, J = 4.0 Hz), 4.18 (1H, d, J = 7.6 Hz), 3.52 (2H, s), 1.80 (3H, s); ^{13}C NMR (DMSO-d_6, 100.6 MHz): δ 163.69, 150.91, 136.52, 110.20, 93.71, 90.96, 88.99, 79.02, 75.45, 60.99, 12.26; HRMS (ESI): found m/z 253.0816 ($[M+H]^+$), calcd. for $[C_{11}H_{12}N_2O_5+H]^+$ 253.0819.

^{1}H- and ^{13}C NMR Spectra of tricyclic nucleoside