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Supplementary Information

Nano-2-(dimethylamino)-*N*-(silica-*n*-propyl)-*N,N*-dimethylethanaminium chloride as a novel basic catalyst for the efficient synthesis of pyrido[2,3-*d*:6,5-*d'*]dipyrimidines

Abdolkarim Zare^{*a}, Alireza Kohzadian^a, Zahra Abshirini^a, Seyed Sajad Sajadikhah^a, Joshua Phipps^{b,c}, Mourad Benamara^d and M. Hassan Beyzavi^{*b,c,d}

^a *Department of Chemistry, Payame Noor University, PO Box 19395-3697 Tehran, Iran*

^b *Department of Chemistry and Biochemistry, University of Arkansas, Fayetteville, AR 72701, USA*

^c *Cell and Molecular Biology Program, University of Arkansas, Fayetteville, Arkansas 72701, USA*

^d *Institute for Nano Science and Engineering, University of Arkansas, Fayetteville, Arkansas 72701, USA*

* Corresponding authors. *E-mail*: abdolkarimzare@pnu.ac.ir (A. Zare); beyzavi@uark.edu (M. H. Beyzavi)

This Supplementary Information includes: (i) selected spectral data of pyrido[2,3-*d*:6,5-*d'*]dipyrimidines, (ii) the SEM images of the catalyst, and (iii) the original spectrums of pyrido[2,3-*d*:6,5-*d'*]dipyrimidines.

Selected spectral data of the pyrido[2,3-*d*:6,5-*d'*]dipyrimidines

Product 2. IR (KBr): 3448 (NH), 3105 (C-H, aromatic), 2980 (C-H, aliphatic), 1601 (C=O), 1515 and 1435 (C=C), 1296 and 1106 (C=S) cm^{-1} (Fig. S2); ^1H NMR (500 MHz, DMSO- d_6): δ (ppm) 3.63 (s, 3H, CH_3), 5.91 (s, 1H, methine CH), 6.49 (s, 1H, H_{Ar}), 6.57 (d, $J=7.7$ Hz, 1H, H_{Ar}), 6.63 (dd, $J=8.1, 2.3$ Hz, H_{Ar}), 7.07 (a broad peak and a triplet, $J=7.9$ Hz, 2H, H_{Ar} and NH), (br., 1H, NH), 11.54 (m, 4H, NH) (Fig. S3); ^{13}C NMR (125 MHz, DMSO- d_6): δ (ppm) 31.0, 55.4, 96.4, 109.9, 113.8, 119.8, 129.3, 145.4, 159.6, 163.3, 172.9, 173.4 (Fig. S4).

Product 3. ^1H NMR (500 MHz, DMSO- d_6): δ (ppm) 3.60 (s, 3H, CH_3), 5.83 (s, 1H, methine CH), 6.67 (d, $J=8.5$ Hz, 2H, H_{Ar}), 6.83 (d, $J=8.4$ Hz, 2H, H_{Ar}), 7.02 (br., 1H, NH), 11.44-11.58 (br., 4H, NH) (Fig. S5); ^{13}C NMR (125 MHz, DMSO- d_6): δ (ppm) 30.3, 55.5, 96.7, 113.7, 128.1, 135.3, 157.4, 163.2, 164.3, 173.3 (Fig. S6).

Product 6. IR (KBr): 3451 (NH), 3123 (C-H, aromatic), 2888 (C-H, methine), 1616 (C=O), 1547 and 1432 (C=C), 1401, 1305 and 1142 (C=S), 554 (C-Br) cm^{-1} (Fig. S7); ^1H NMR (500 MHz, DMSO- d_6): δ (ppm) 5.63 (s, 1H, methine CH), 6.96 (t, $J=7.2$ Hz, 1H, H_{Ar}), 7.12-7.17 (m, 2H, H_{Ar}), 7.37 (d, $J=7.6$ Hz, 2H, H_{Ar}), 9.37 (br., 5H, NH) (Fig. S8); ^{13}C NMR (125 MHz, DMSO- d_6): δ (ppm) 33.6, 95.7, 123.8, 127.0, 127.9, 130.8, 133.4, 142.9, 163.2, 164.5, 173.4 (Fig. S9); Mass: m/z 436 [M^+], 438 [$\text{M}^+ + 2$].

Product 7. IR (KBr): ν 3535 (NH), 3108 (CH, aromatic), 2972 (C-H, methine), 1614 (C=O), 1554 and 1435 (C=C), 1303 and 1136 (C=S), 554 (C-Br) cm^{-1} (Fig. S10); ^1H NMR (500 MHz, DMSO- d_6): δ (ppm) 5.90 (s, 1H, methine CH), 6.94 (d, $J=7.8$ Hz, 1H, H_{Ar}), 7.02 (s, 1H, H_{Ar}), 7.09 (t, $J=7.8$ Hz, 1H, H_{Ar}), 7.21 (d, $J=7.8$ Hz, 1H, H_{Ar}), 11.51 (s, 5H, NH) (Fig. S11); ^{13}C NMR (125 MHz, DMSO- d_6): δ (ppm) 31.0, 95.9, 121.9, 126.4, 128.5, 129.6, 130.6, 146.9, 163.2, 164.2, 173.5 (Fig. S12); Mass, m/z : 436 [M^+].

Product 9. IR (KBr): 3321 (NH), 3082 (C-H, aromatic), 2913 (CH, methine), 1626 (C=O), 1596 (C=C, alkene), 1535 and 1434 (C=C, aromatic), 1358, 1303 and 1131 (C=S), 659 (C-Cl) cm^{-1} (Fig. S13); ^1H NMR (500 MHz, DMSO- d_6): δ (ppm) 5.91 (s, 1H, methine CH), 6.98 (d, $J=7.9$ Hz, 2H, H_{Ar}), 7.19 (d, $J=8.5$ Hz, 2H, H_{Ar}), 11.53 (br., 5H) (Fig. S14); ^{13}C NMR (125 MHz, DMSO- d_6): δ (ppm) 30.7, 96.1, 128.2, 129.1, 129.96, 142.8, 163.2, 164.2, 173.5 (Fig. S15).

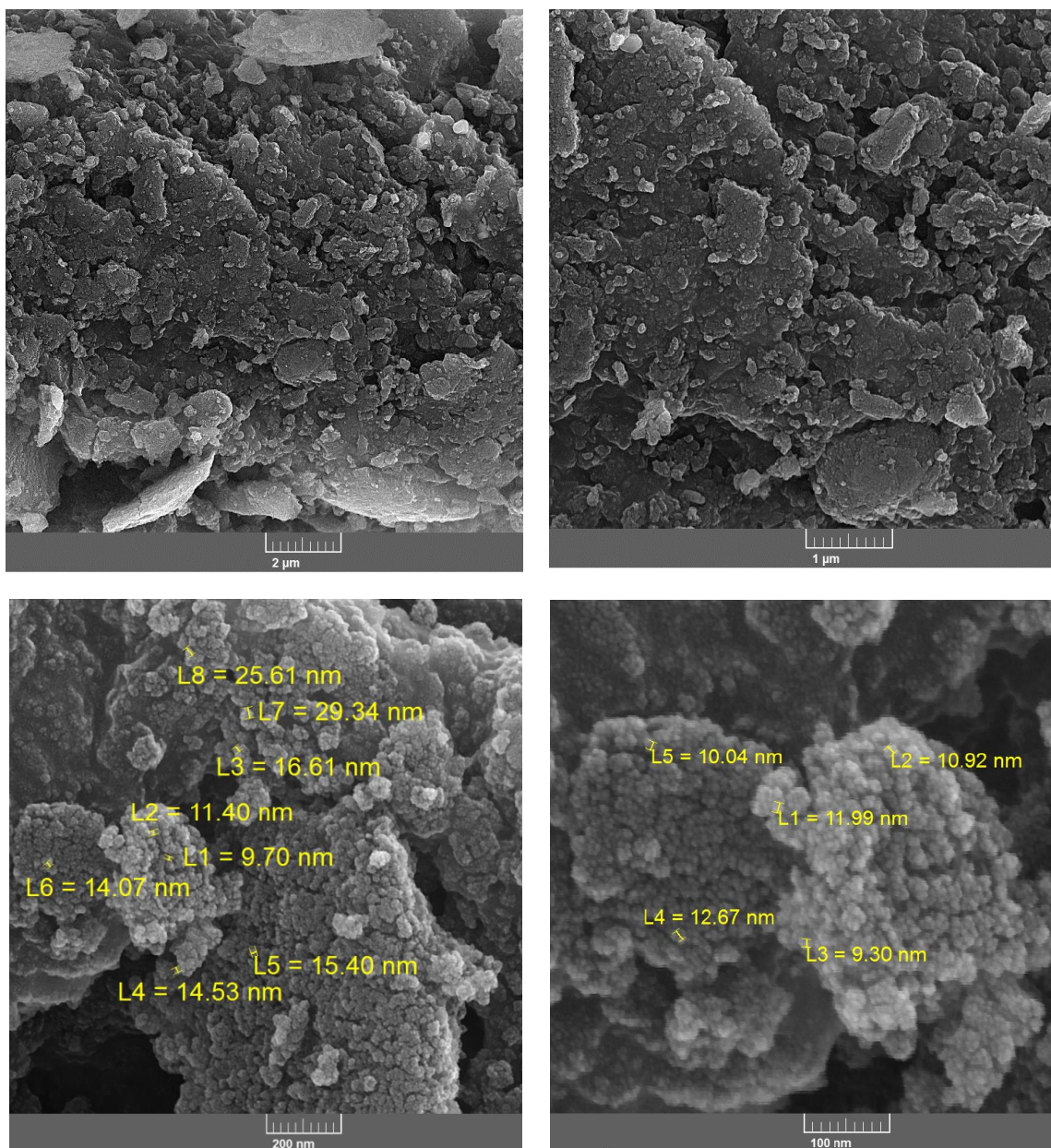


Fig. S1 The SEM micrographs of nano-[DMSPDE][Cl].

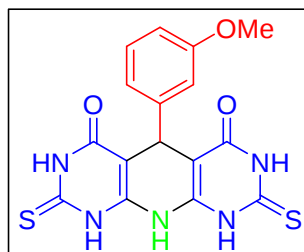
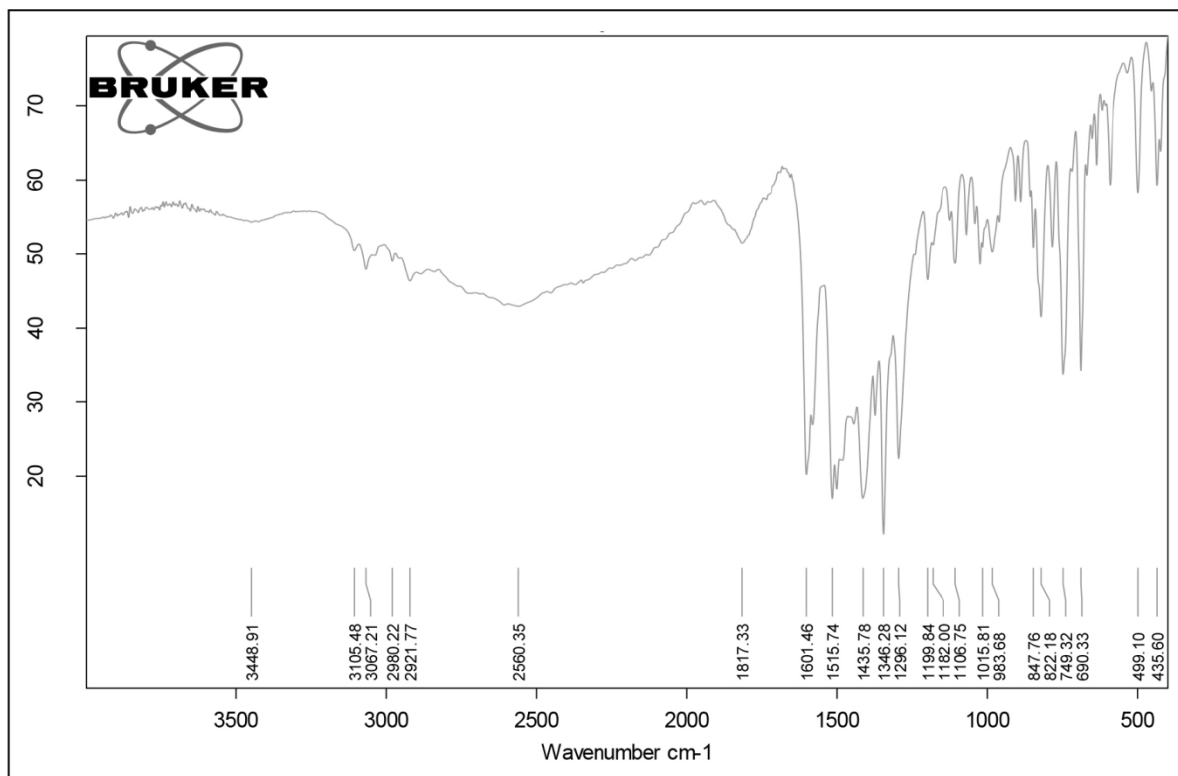


Fig. S2 The structure and FT-IR spectrum of product **2**.

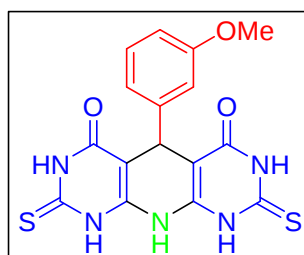
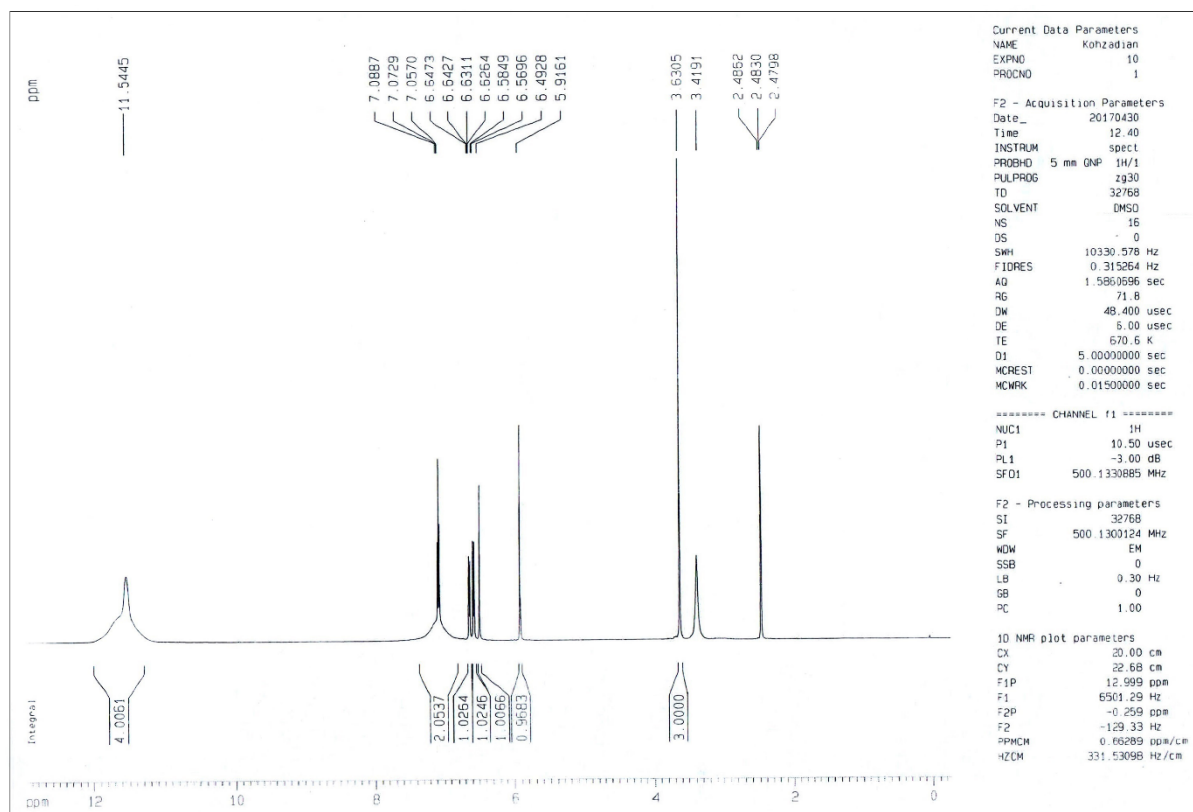


Fig. S3 The structure and ^1H NMR spectrum of product **2**.

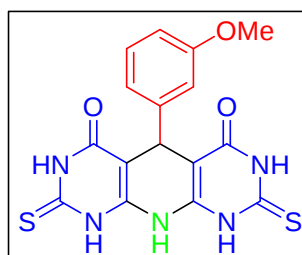
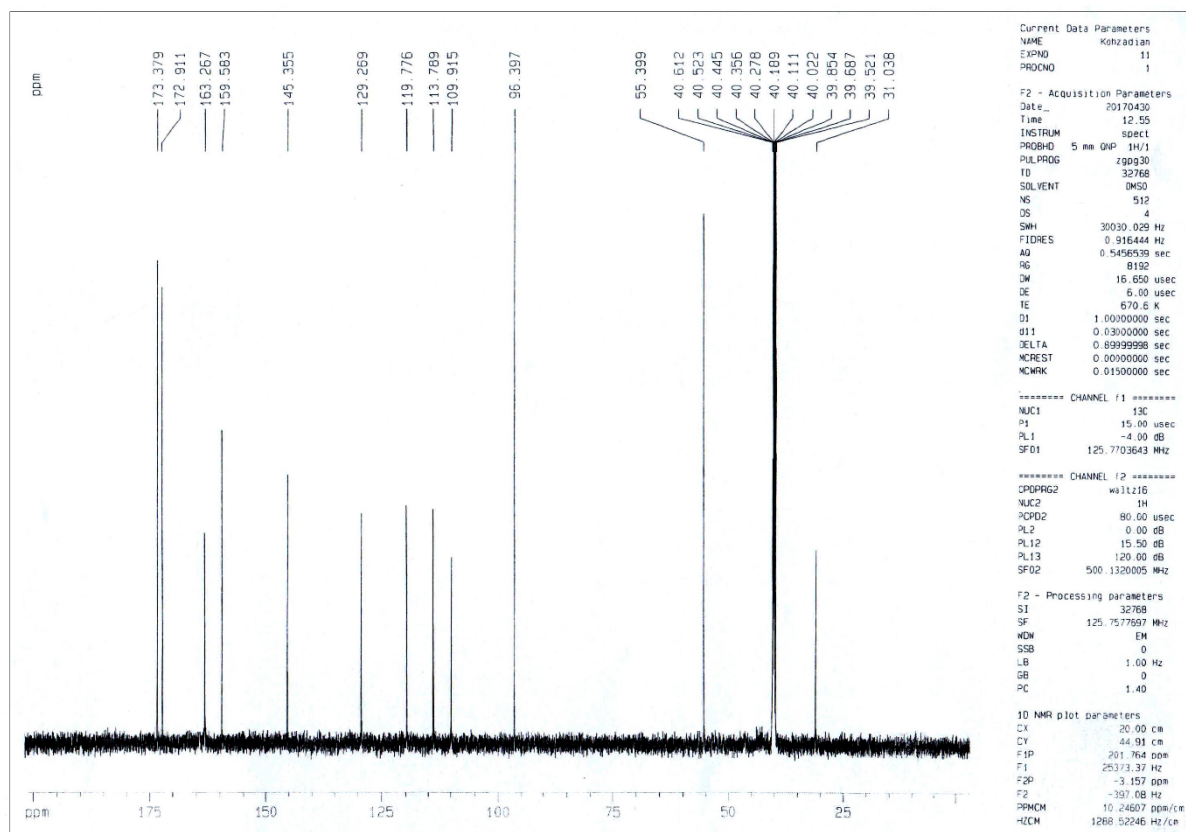


Fig. S4 The structure and ^{13}C NMR spectrum of product **2**.

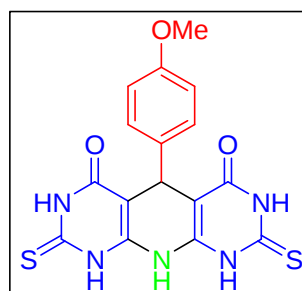
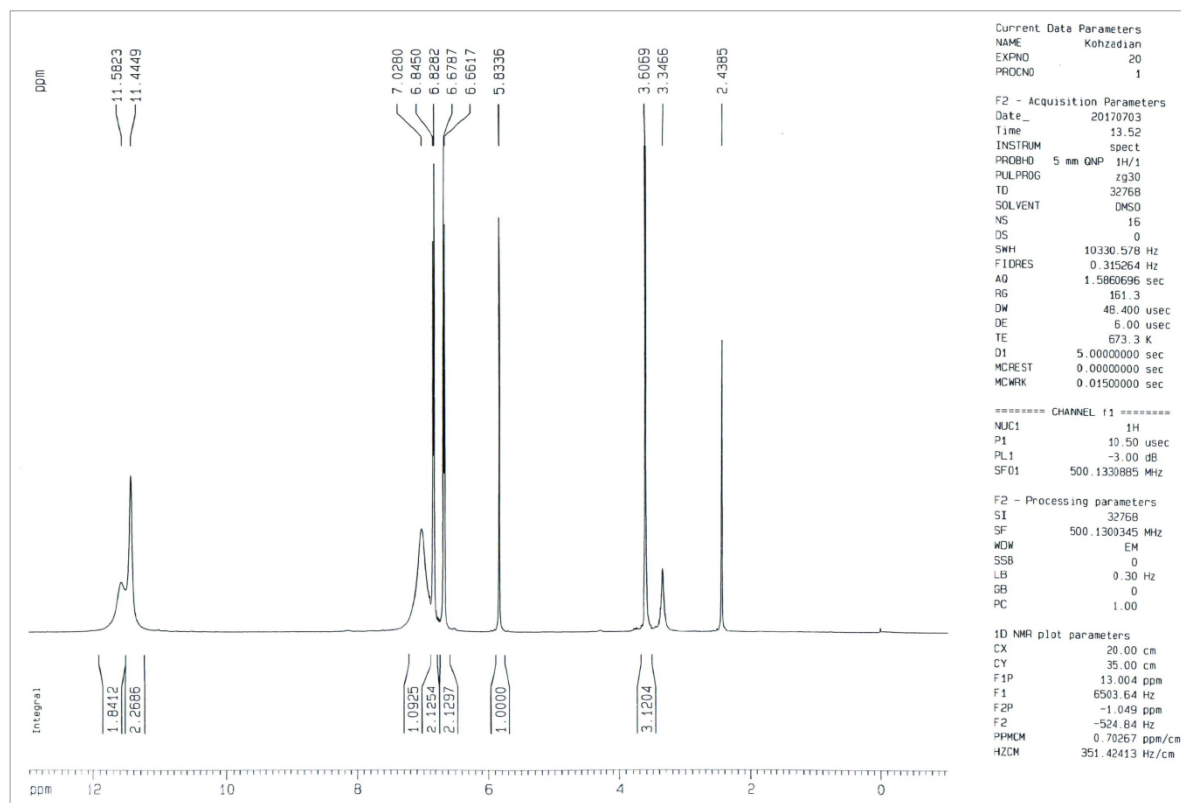


Fig. S5 The structure and ^1H NMR spectrum of product **3**.

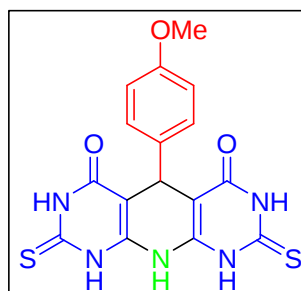
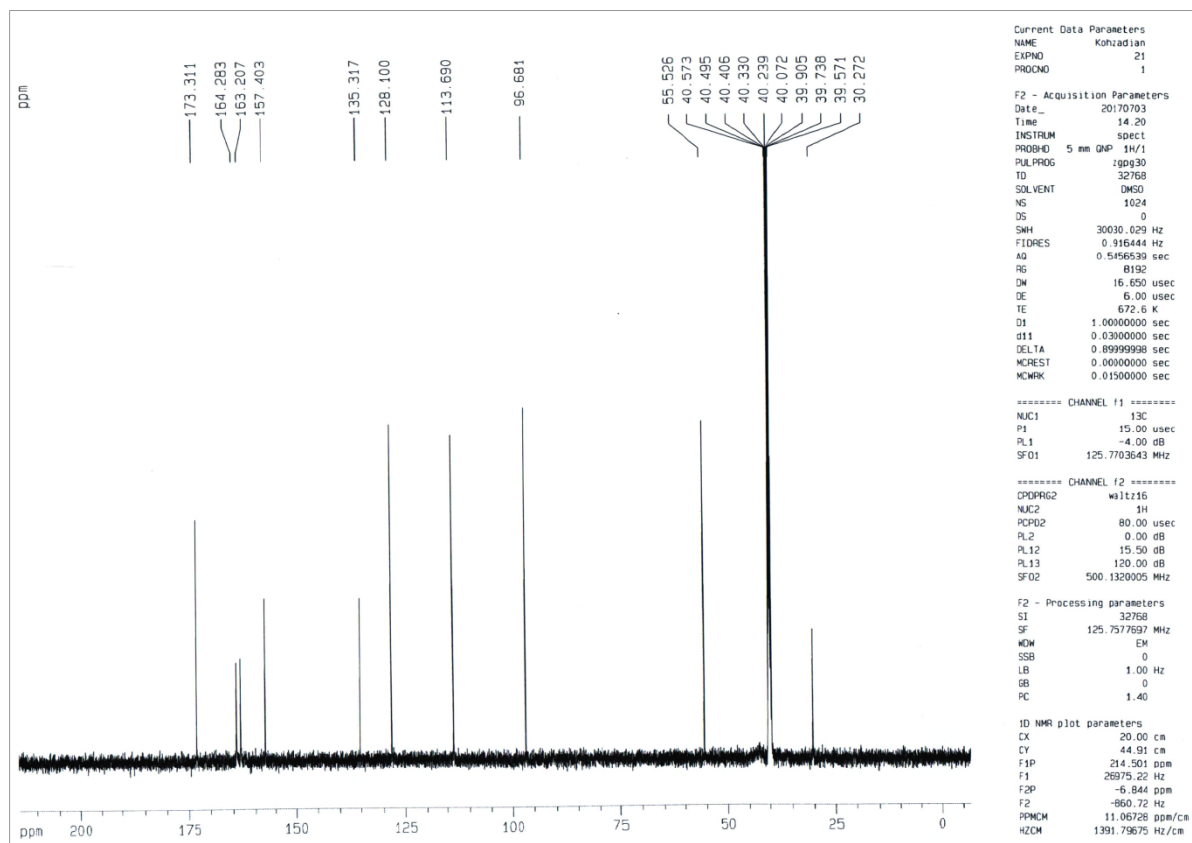


Fig. S6 The structure and ^{13}C NMR spectrum of product **3**.

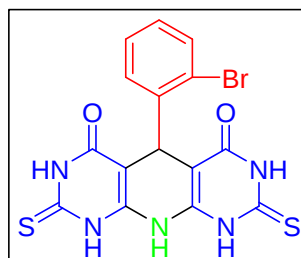
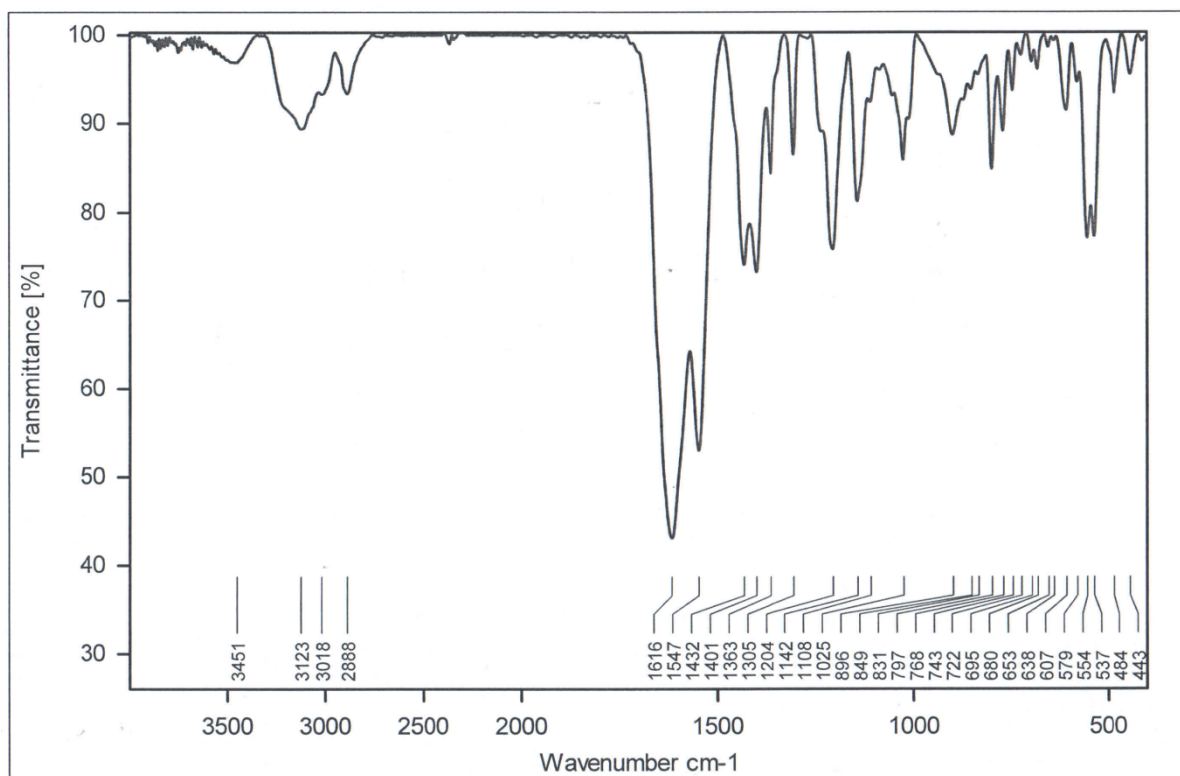


Fig. S7 The structure and FT-IR spectrum of product **6**.

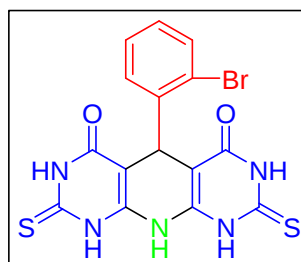
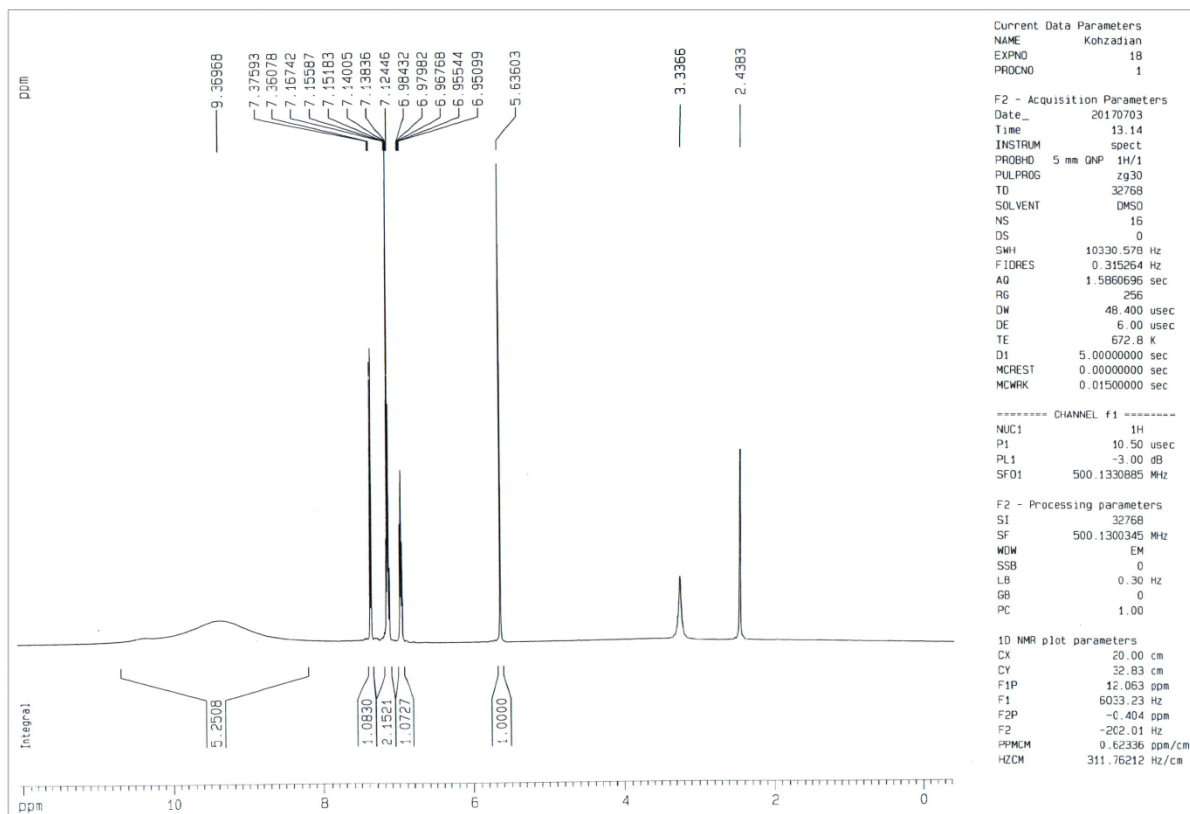


Fig. S8 The structure and ^1H NMR spectrum of product **6**.

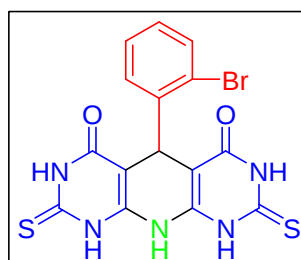
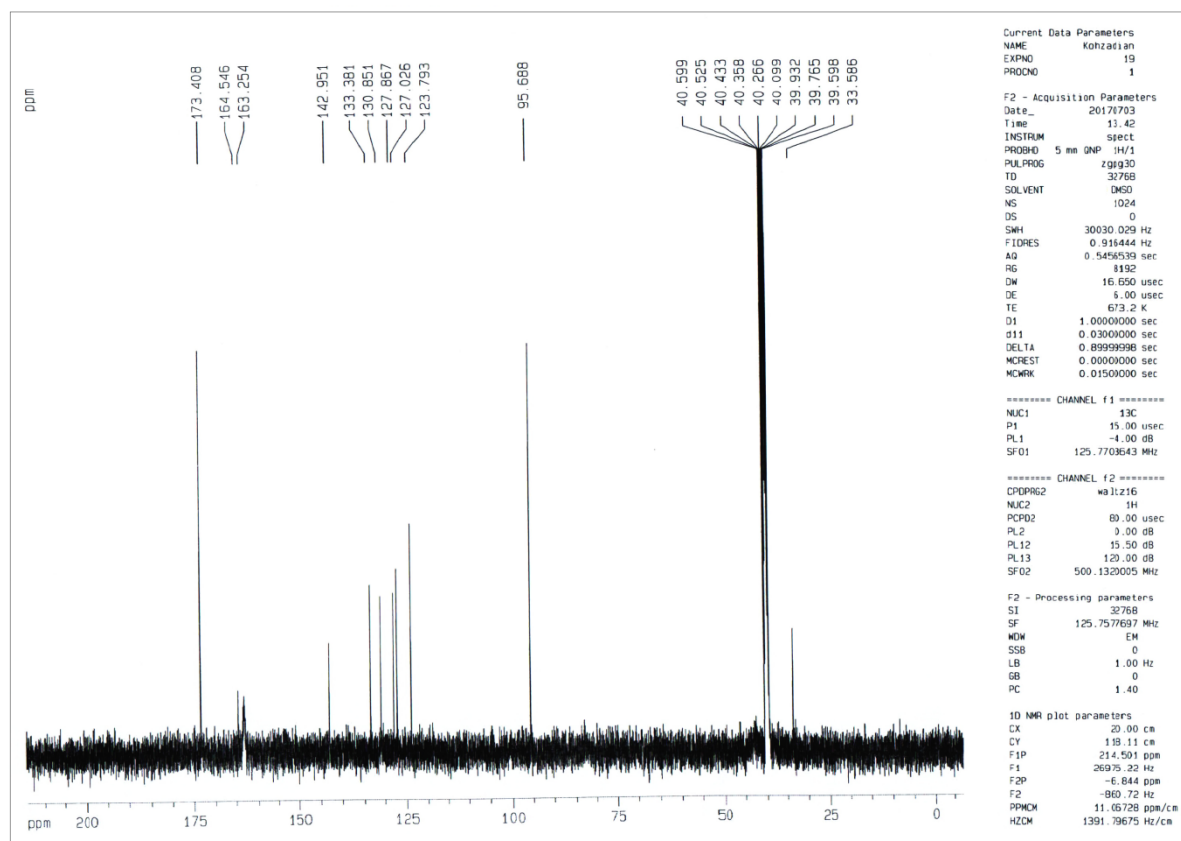


Fig. S9 The structure and ^{13}C NMR spectrum of product **6**.

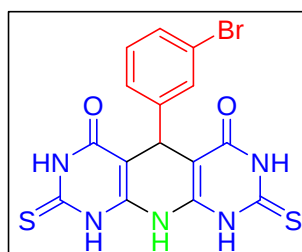
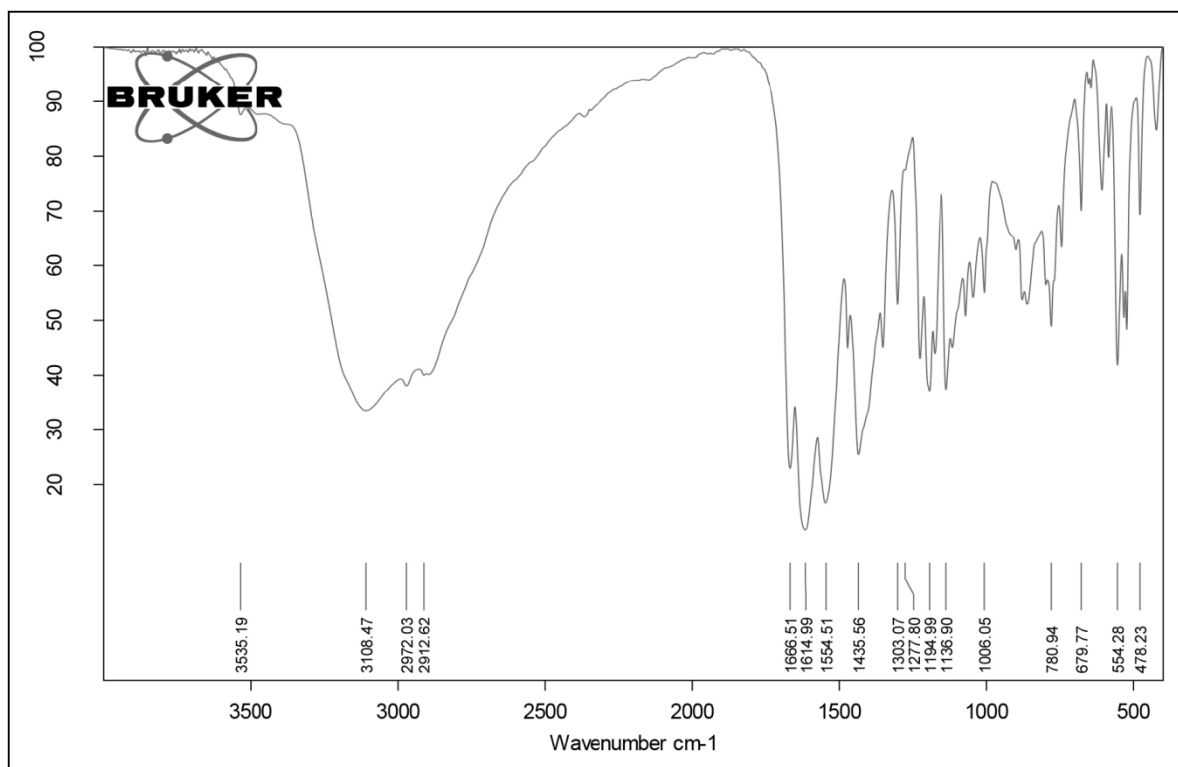
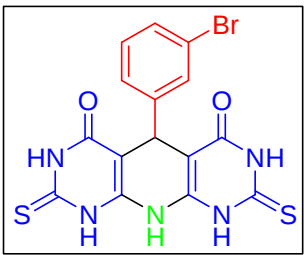


Fig. S10 The structure and FT-IR spectrum of product 7.



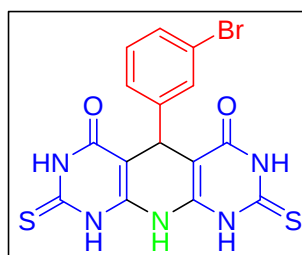
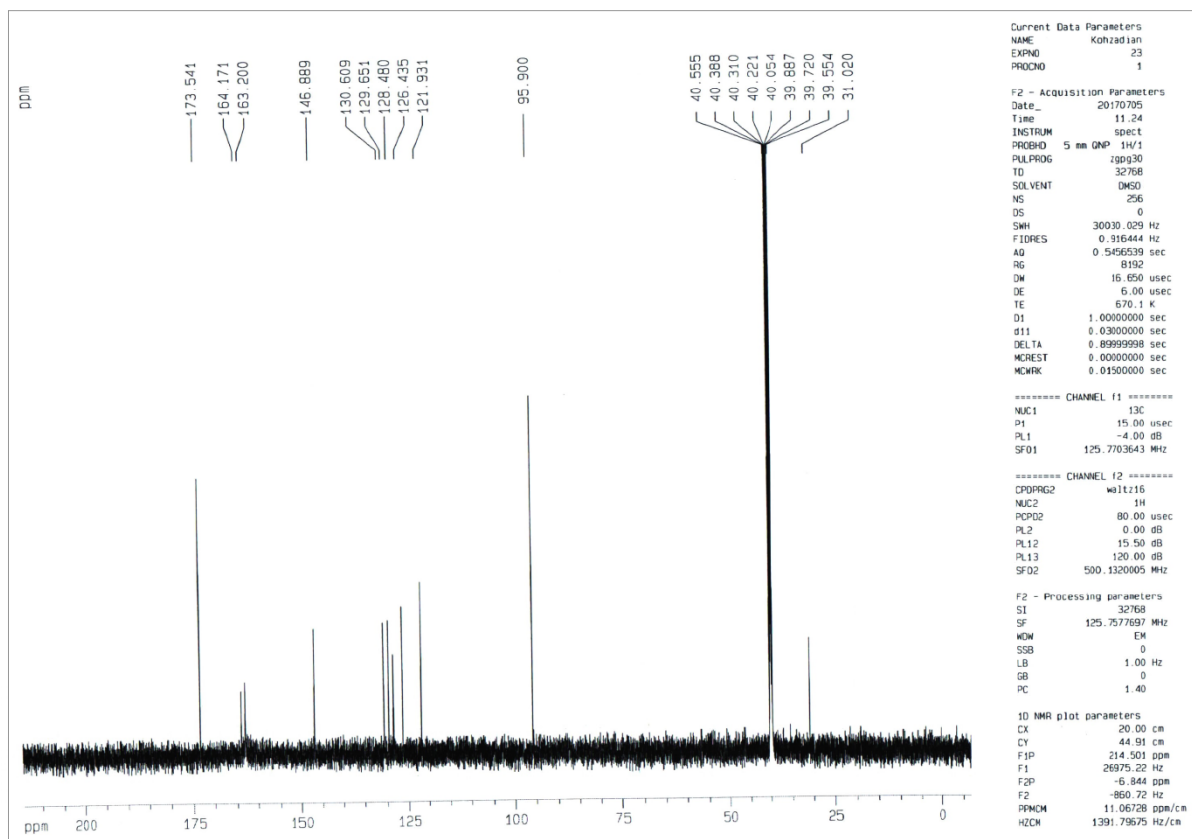


Fig. S12 The structure and ^{13}C NMR spectrum of product **7**.

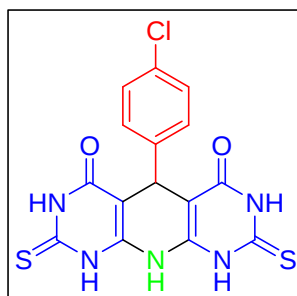
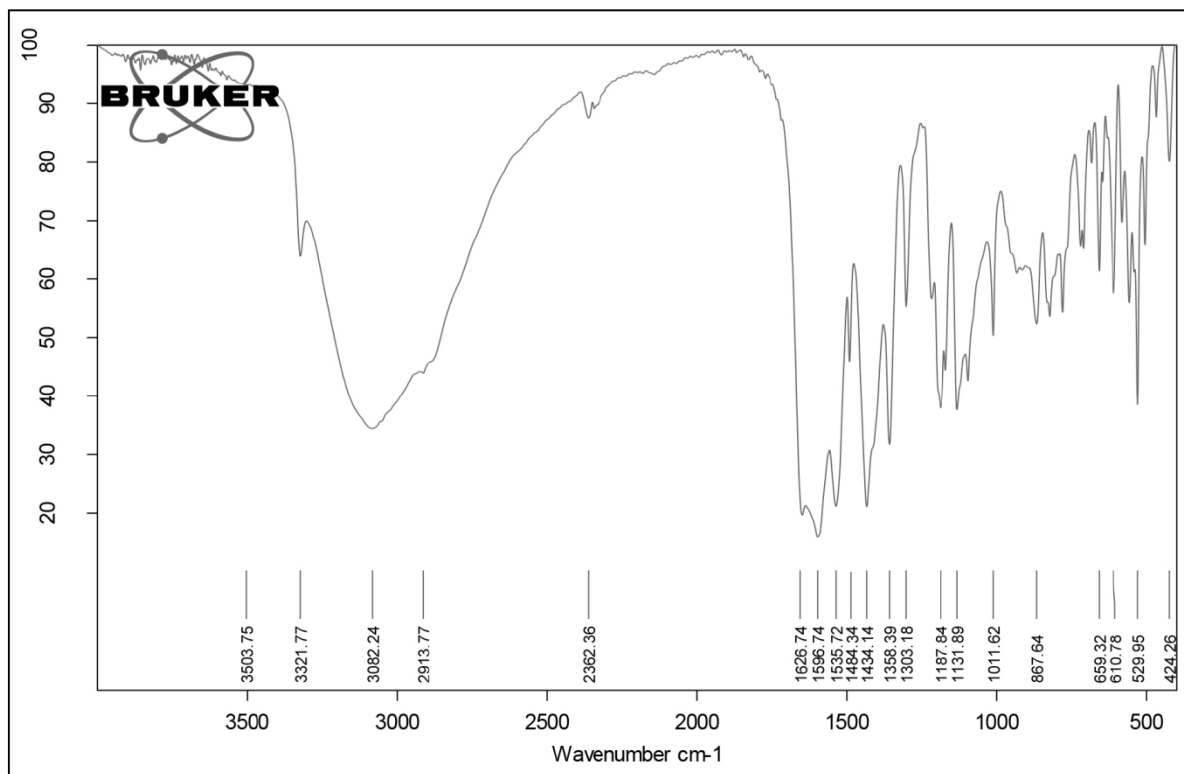


Fig. S13 The structure and FT-IR spectrum of product **9**.

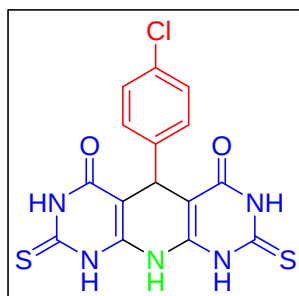
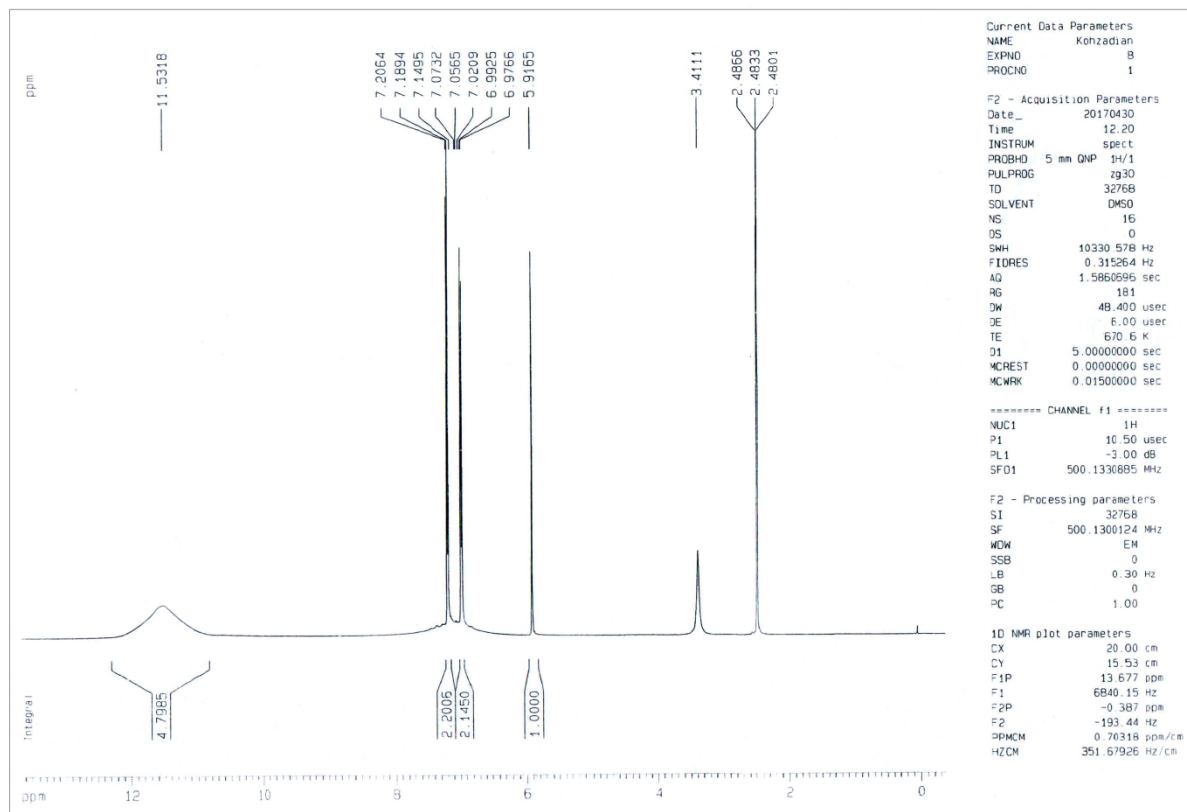


Fig. S14 The structure and ^1H NMR spectrum of product **9**.

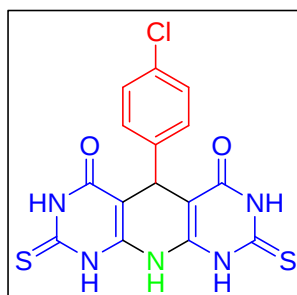
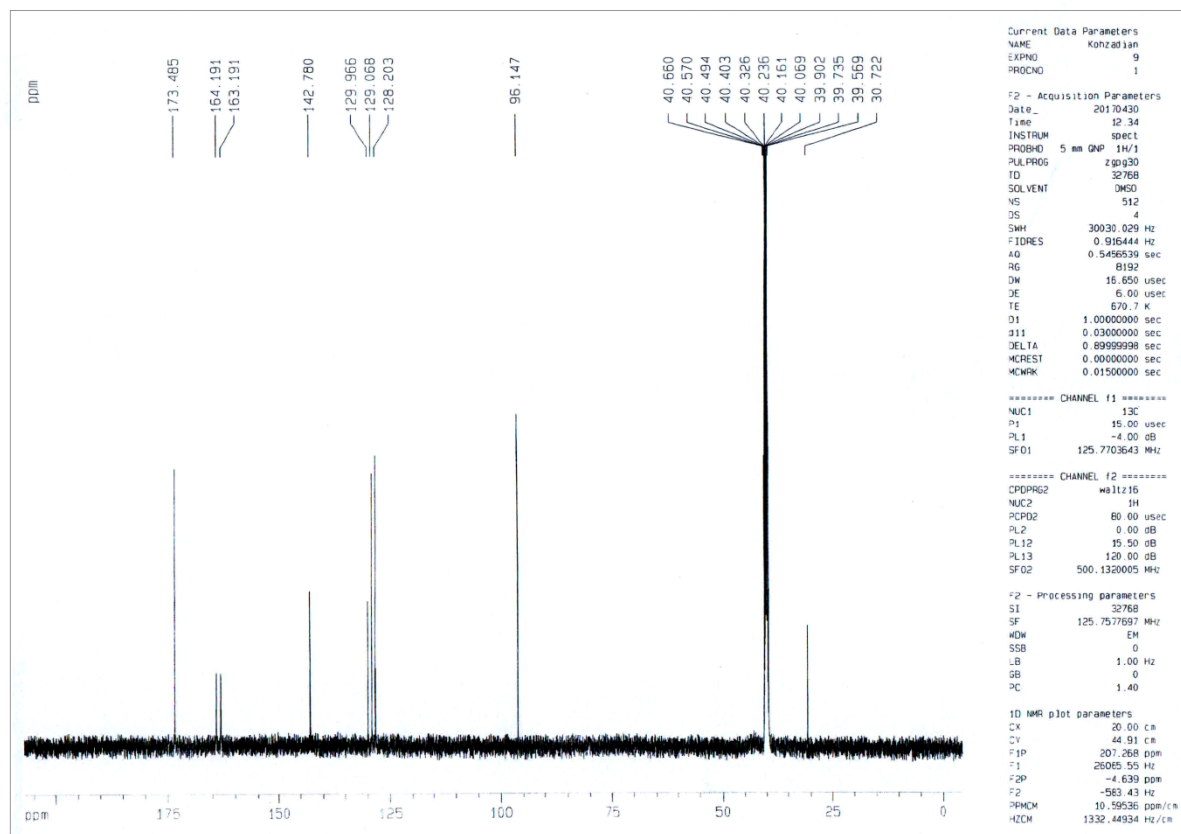


Fig. S15 The structure and ^{13}C NMR spectrum of product **9**.