

Supporting Information

Silica Sulfuric Acid Coated on SnFe₂O₄ MNPs: Synthesis, Characterization and its Catalytic Applications in the Synthesis of Polyhydroquinolines

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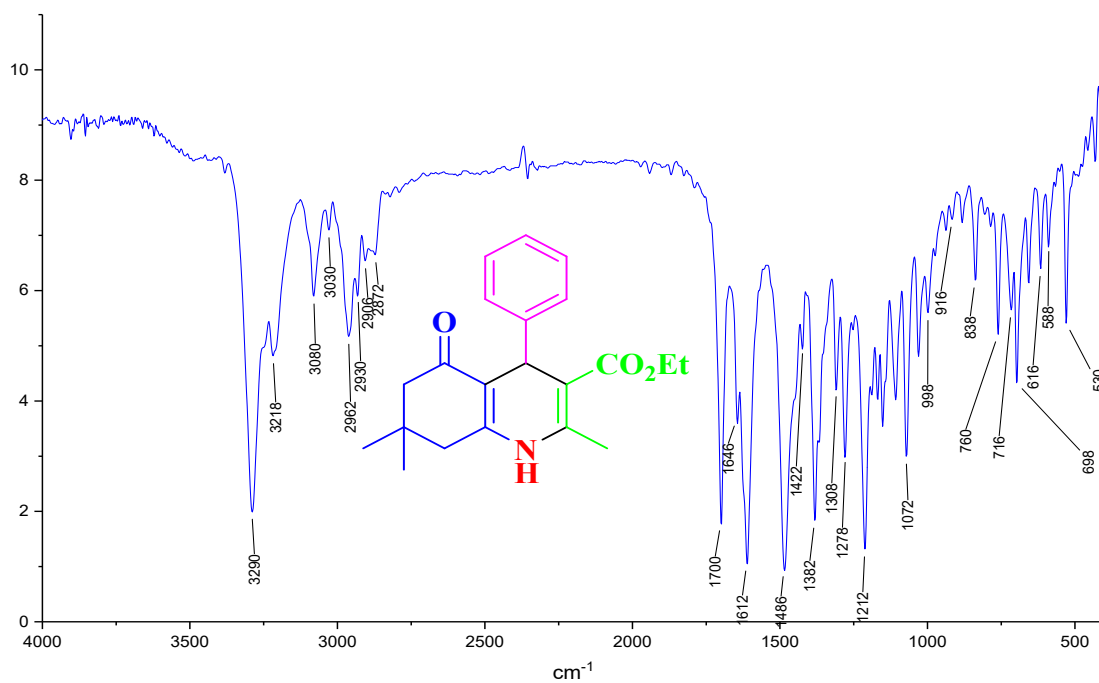
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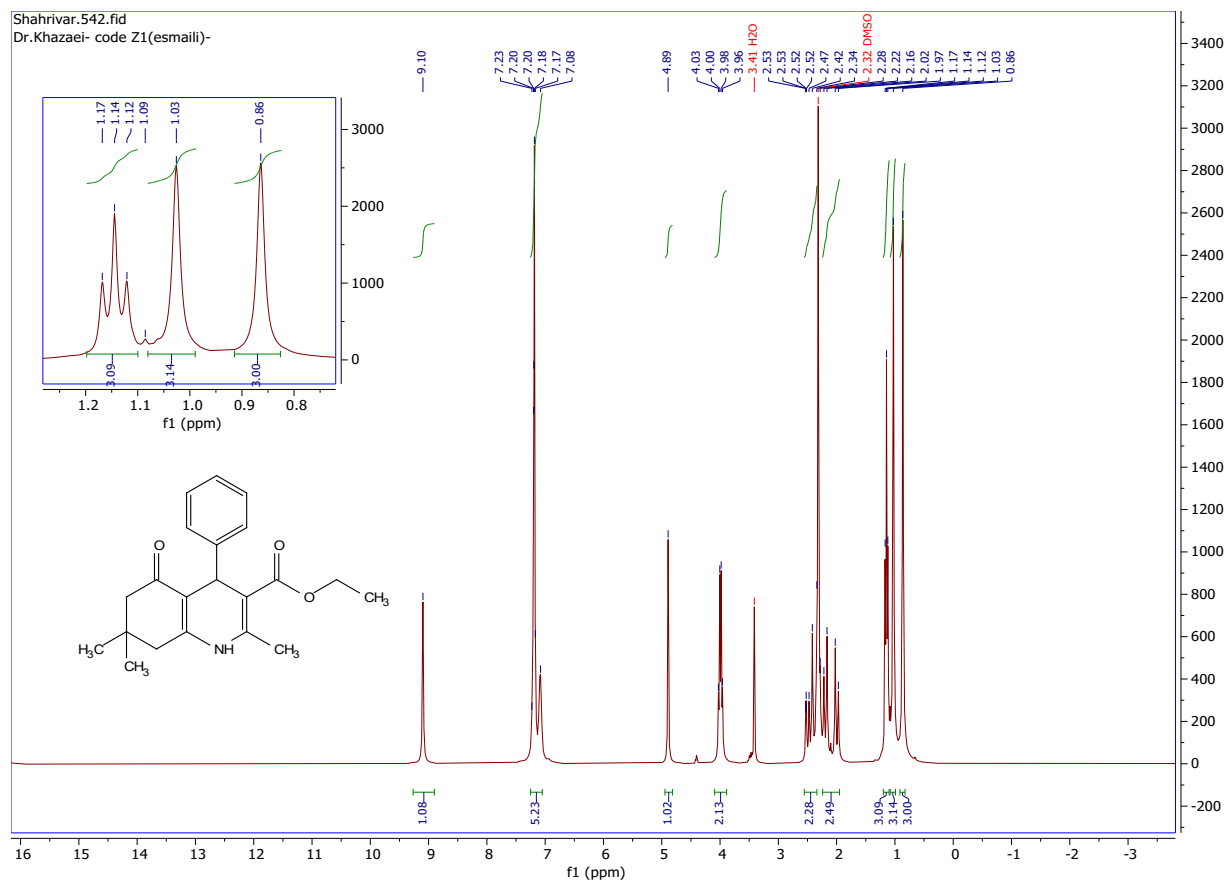
Spectral data:

Ethyl 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate:

FT-IR (KBr, cm⁻¹): 3288, 3218, 3083, 3027, 2961, 2930, 2908, 1698, 1644, 1610, 1484, 1381, 1309, 1071, 1030, 760 **S1**; ¹H NMR (300 MHz, DMSO-d₆): δ 0.86 (s, 3H), 1.03 (s, 3H), 1.14 (t, J= 3Hz, 3H), 1.97-2.22 (m, 2H), 2.34-2.53 (m, 2H), 3.99 (q, J= 3Hz, 2H), 4.89 (s, 1H), 7.08-7.20 (m, 5H), 9.1 (s, 1H) **S2**.



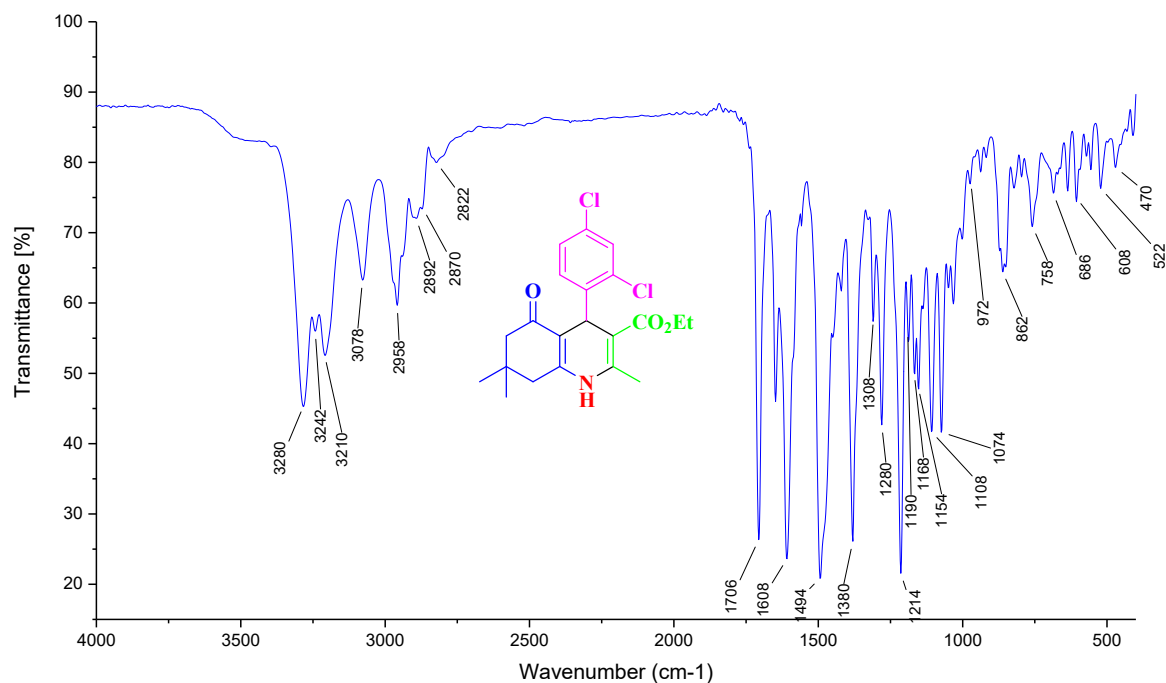
S1. FT-IR of Ethyl 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate carboxylate in KBr.



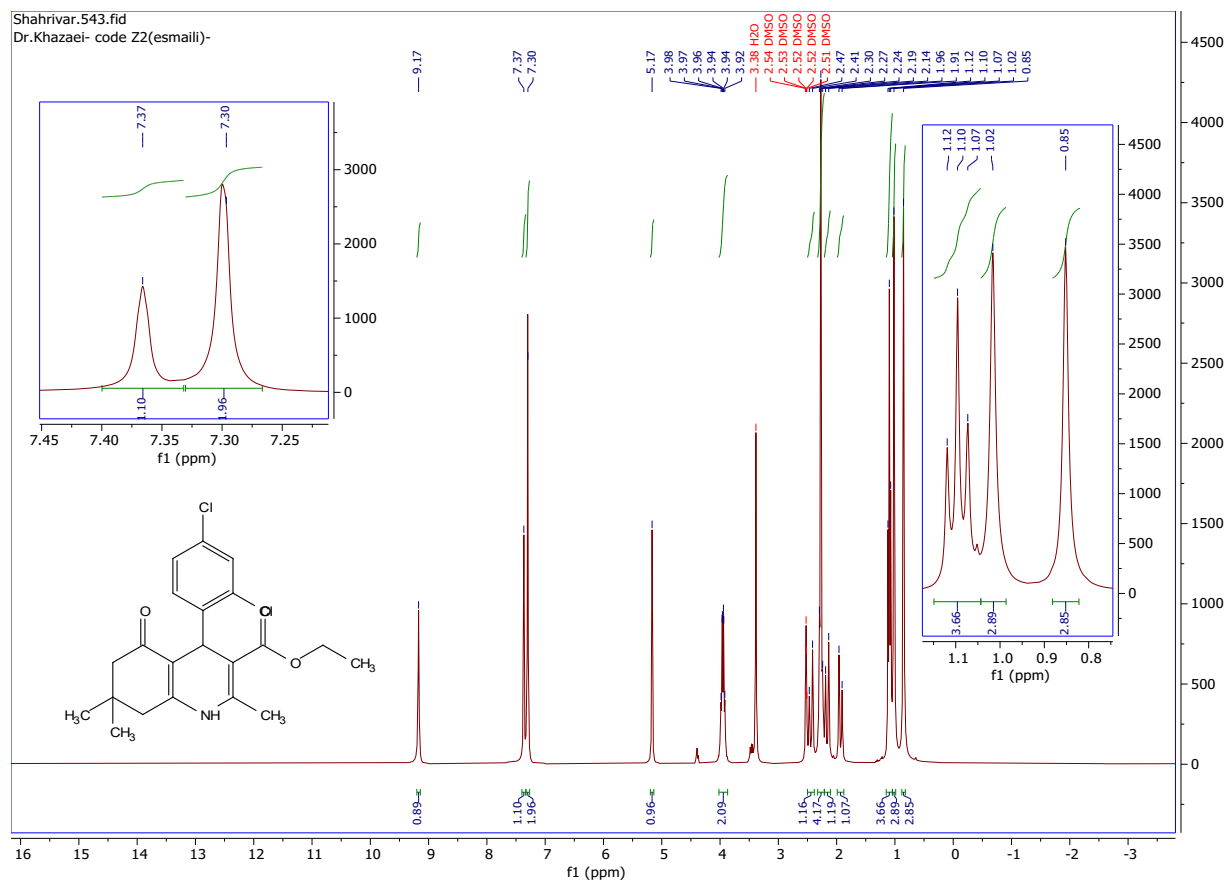
S2. ^1H NMR of Ethyl 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate carboxylate in DMSO.

Ethyl 4-(2,4-dichlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate

FT-IR (KBr, cm^{-1}): 3283, 3242, 3207, 3077, 2958, 2892, 1705, 1648, 1608, 1493, 1380, 1280, 1213, 1152, 1107, 1073, 861 **S3** ; ^1H NMR (300 MHz, DMSO-d_6): δ 0.85 (s, 3H), 1.02 (s, 3H), 1.1 (t, $J = 3\text{ Hz}$, 3H), 1.91-2.45 (m, 4H), 3.95 (m, 2H), 5.17 (s, 1H), 7.3 (s, 2H), 7.37 (s, 1H), 9.17 (s, 1H) **S4**.



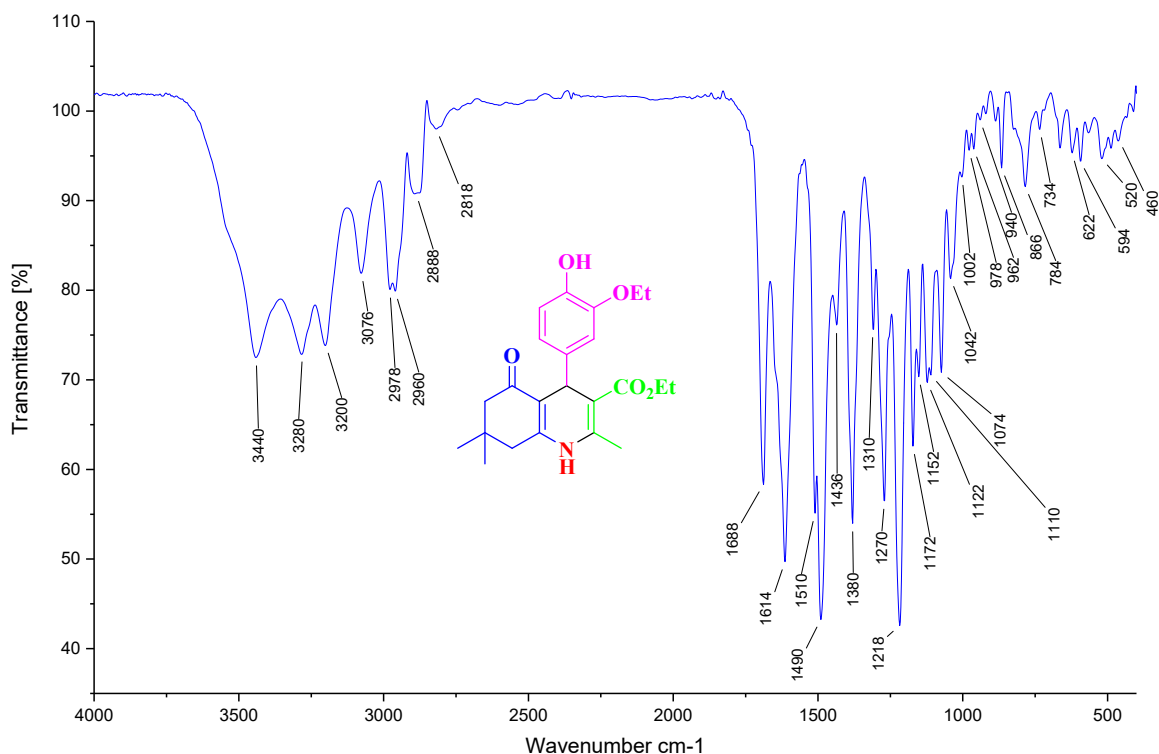
S3. FT-IR of Ethyl 4-(2,4-dichlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in KBr.



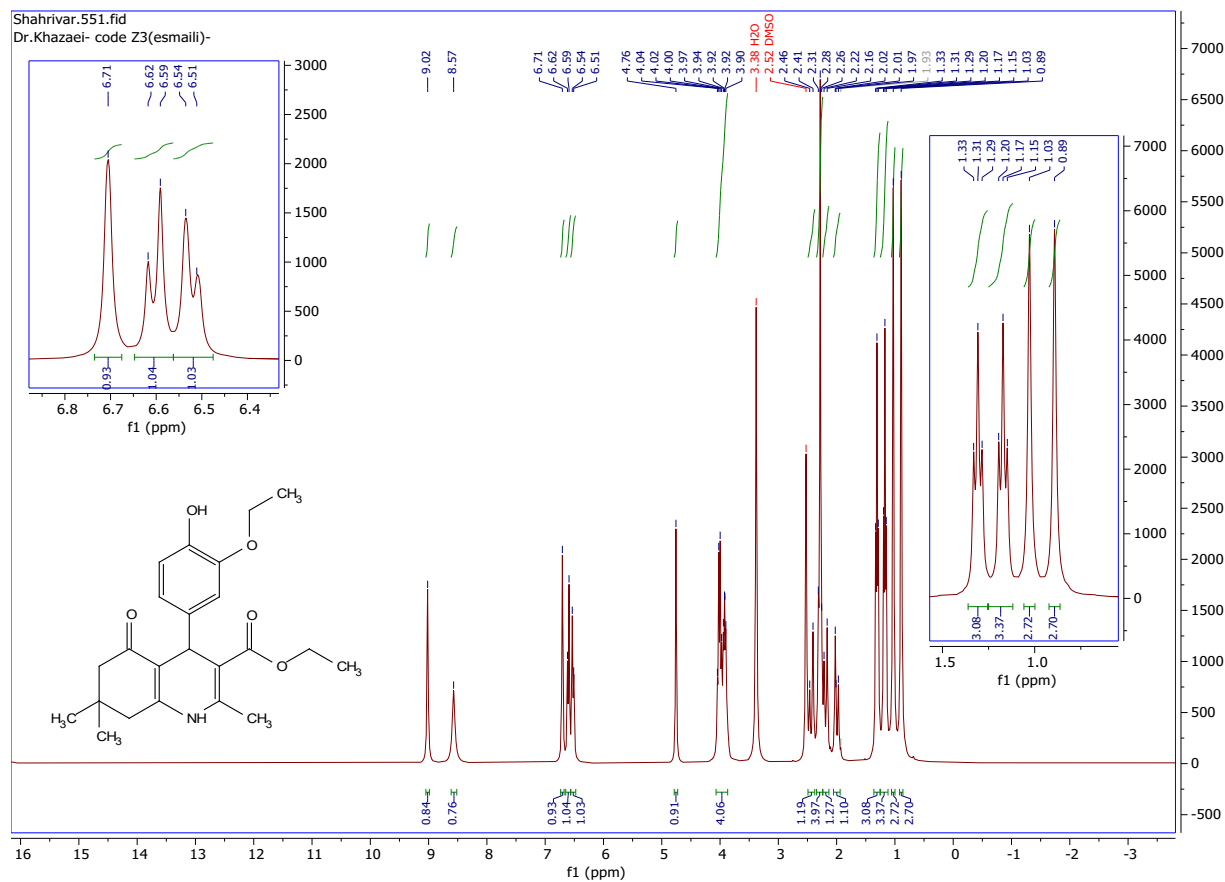
S4. ^1H NMR of Ethyl 4-(2,4-dichlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in DMSO.

Ethyl 4-(3-ethoxy-4-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate

FT-IR (KBr, cm^{-1}): 3441, 3283, 3201, 3077, 2959, 2893, 1688, 1614, 1489, 1380, 1270, 1217, 1171, 1151, 1074, 1042, 784 **S5**; ^1H NMR (300 MHz, DMSO-d_6): δ 0.89 (s, 3H), 1.03 (s, 3H), 1.17 (t, $J=3\text{Hz}$, 3H), 1.31 (t, $J=3\text{Hz}$, 3H), 1.97-2.46 (m, 7H), 3.90-4.04 (m, 4H), 4.76 (s, 1H), 6.52 (d, $J=9$, 1H), 6.6 (d, $J=9$, 1H), 6.71 (s, 1H), 8.57 (s, 1H), 9.1 (s, 1H) **S6**.



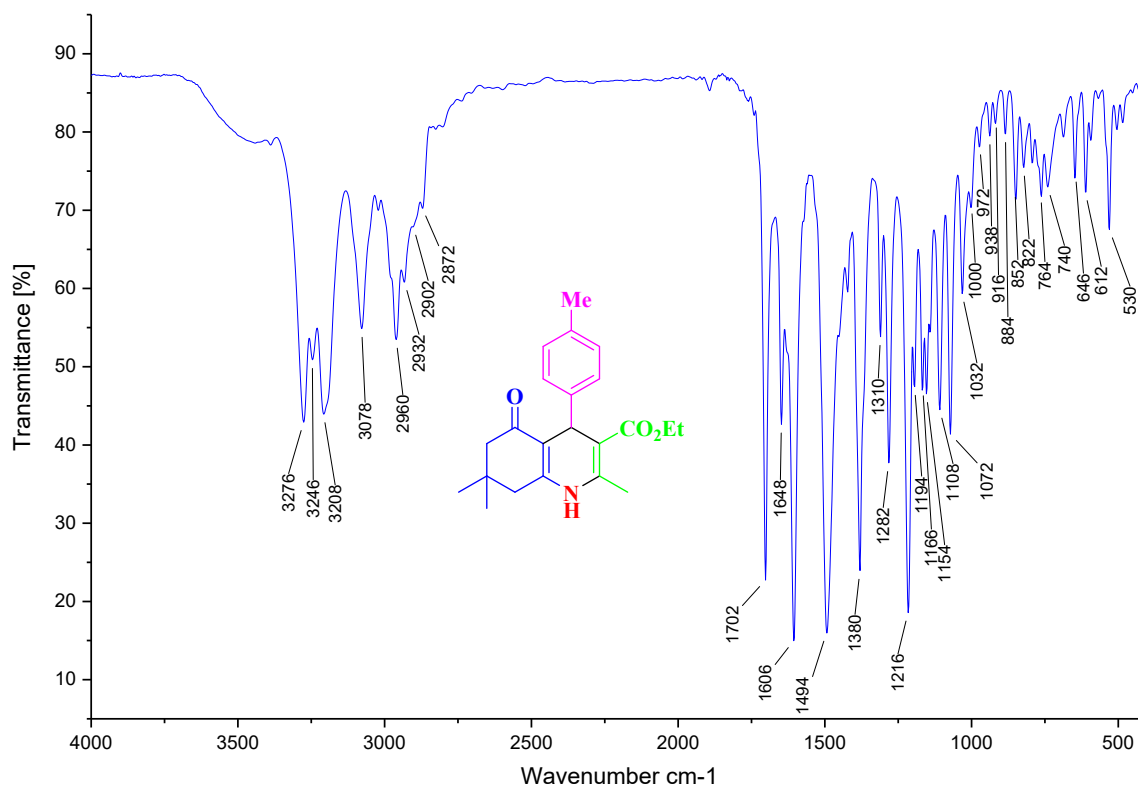
S5. FT-IR of Ethyl 4-(3-ethoxy-4-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in KBr.



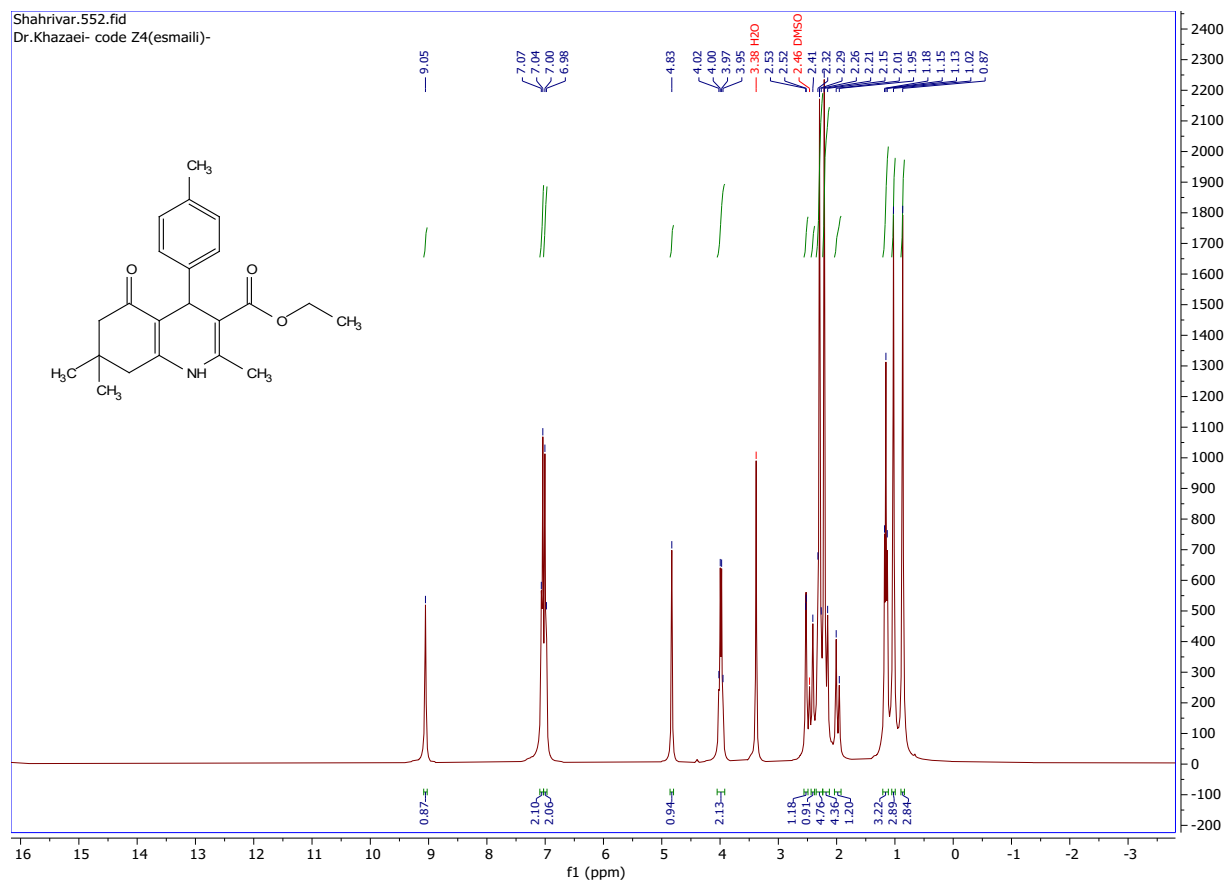
S6. ^1H NMR of Ethyl 4-(3-ethoxy-4-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in DMSO.

Ethyl 2,7,7-trimethyl-5-oxo-4-(p-tolyl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate

FT-IR (KBr, cm^{-1}): 3275, 3245, 3207, 3078, 2960, 2932, 2870, 1701, 1647, 1605, 1493, 1380, 1281, 1215, 1167, 1072, 1031, 530 **S7**; ^1H NMR (300 MHz, DMSO-d_6): δ 0.87 (s, 3H), 1.02 (s, 3H), 1.15 (t, 3H), 1.95-2.01 (d, $J = 18$ Hz, 2H), 2.15-2.32 (m, 8H), 2.41 -2.53 (m, 2H), 3.95-4.02 (q, 2H), 4.83 (s, 1H), 6.98 - 7.07 (m, 4H), 9.05 (s, 1H) **S8**.



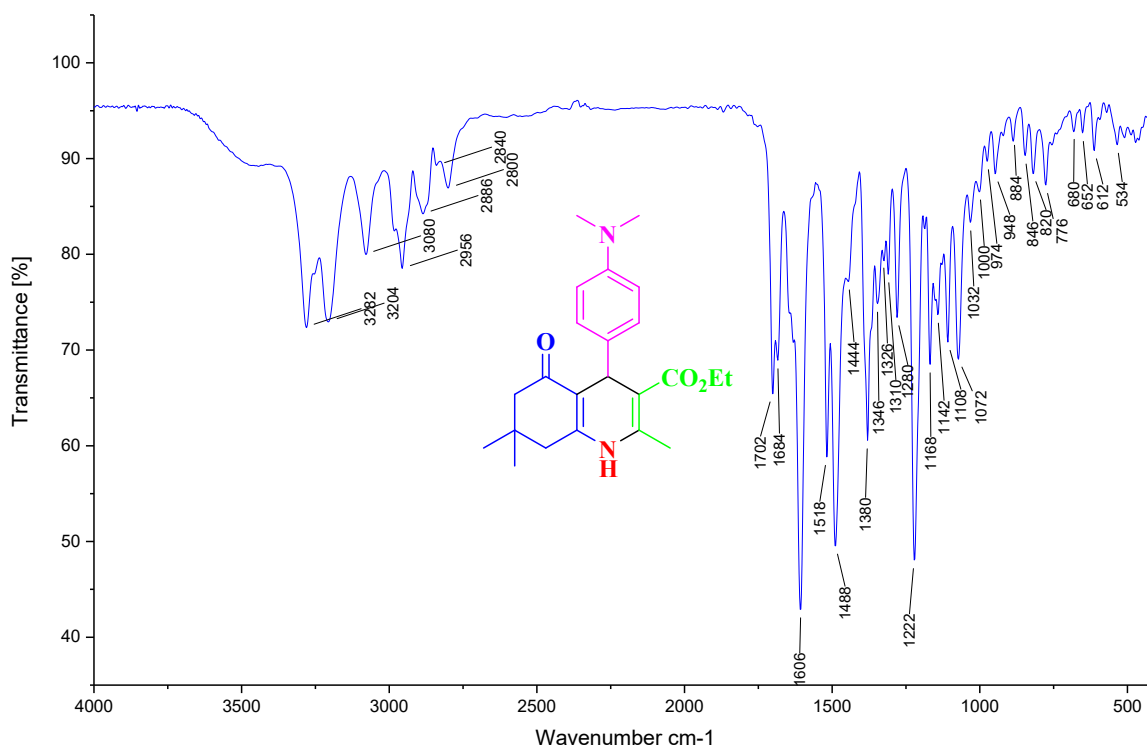
S7. FT-IR of Ethyl 2,7,7-trimethyl-5-oxo-4-(p-tolyl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in KBr.



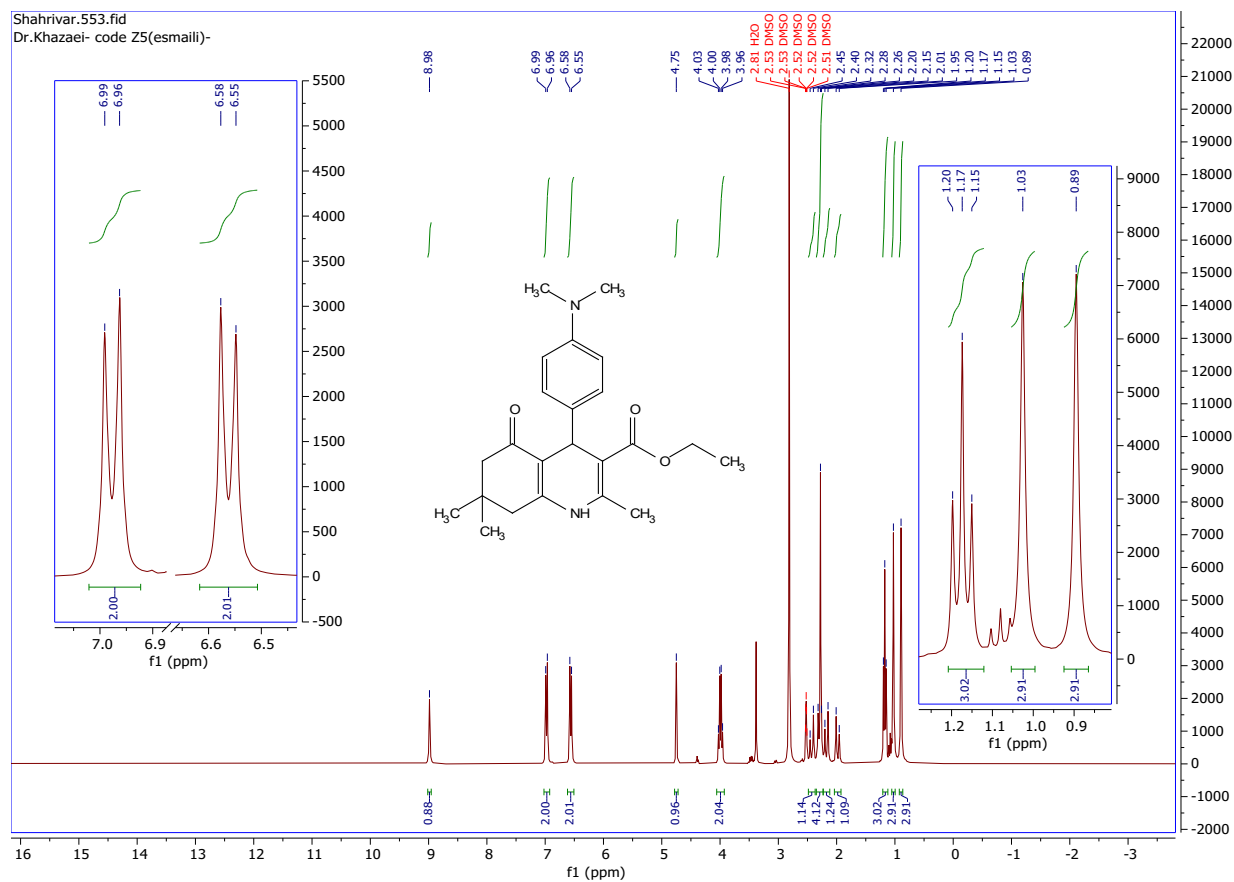
S8. ¹H NMR of Ethyl 2,7,7-trimethyl-5-oxo-4-(p-tolyl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in DMSO.

Ethyl 4-(4-(dimethylamino)phenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate:

FT-IR (KBr, cm^{-1}): 3280, 3206, 3078, 2956, 2885, 2800, 1701, 1689, 1606, 1517, 1489, 1379, 1279, 1221, 1168, 1072 **S9** ; ^1H NMR (300 MHz, DMSO-d_6): δ 0.89 (s, 3H), 1.03 (s, 3H), 1.17 (t, $J=3\text{Hz}$, 3H), 1.95-2.45 (m, 8H), 3.99 (q, $J=3\text{Hz}$, 2H), 4.75 (s, 1H), 6.55-6.58 (d, $J=9$, 1H), 6.96-6.99 (d, $J=9$, 1H), 8.98 (s, 1H) **S10**.



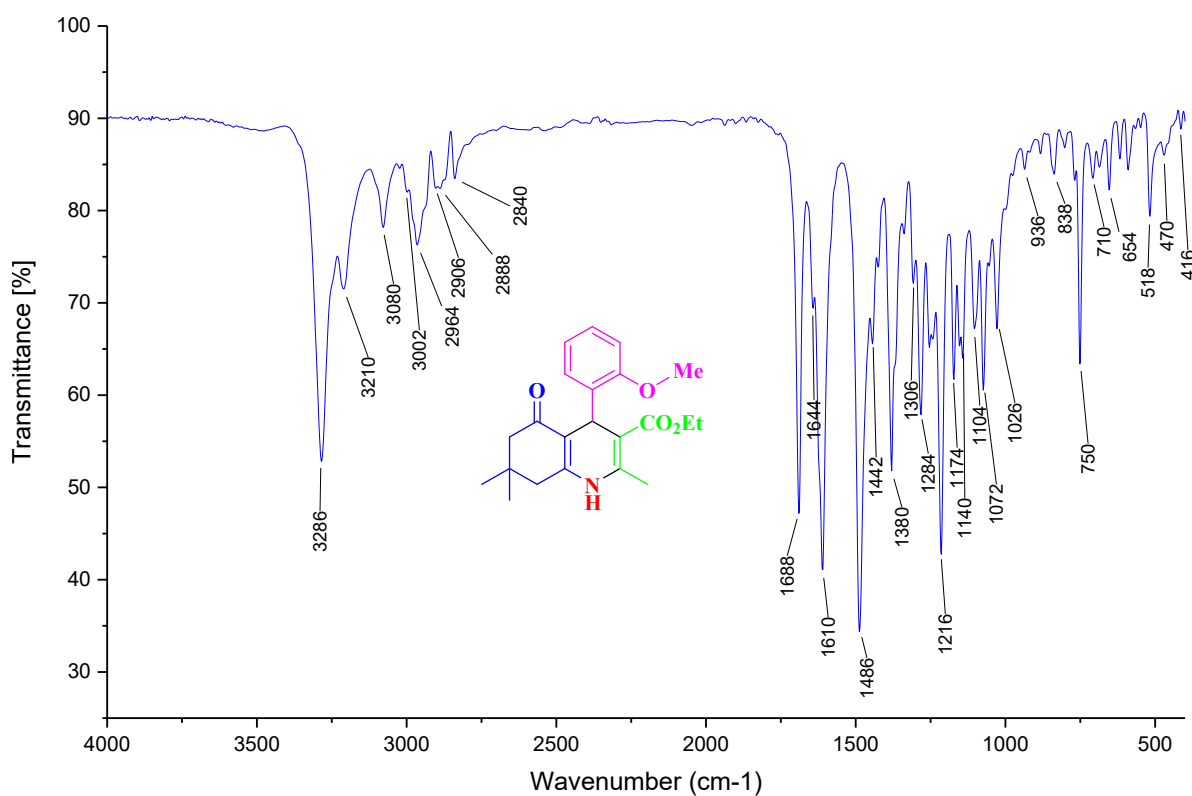
S9. FT-IR of Ethyl 4-(4-(dimethylamino)phenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in KBr.



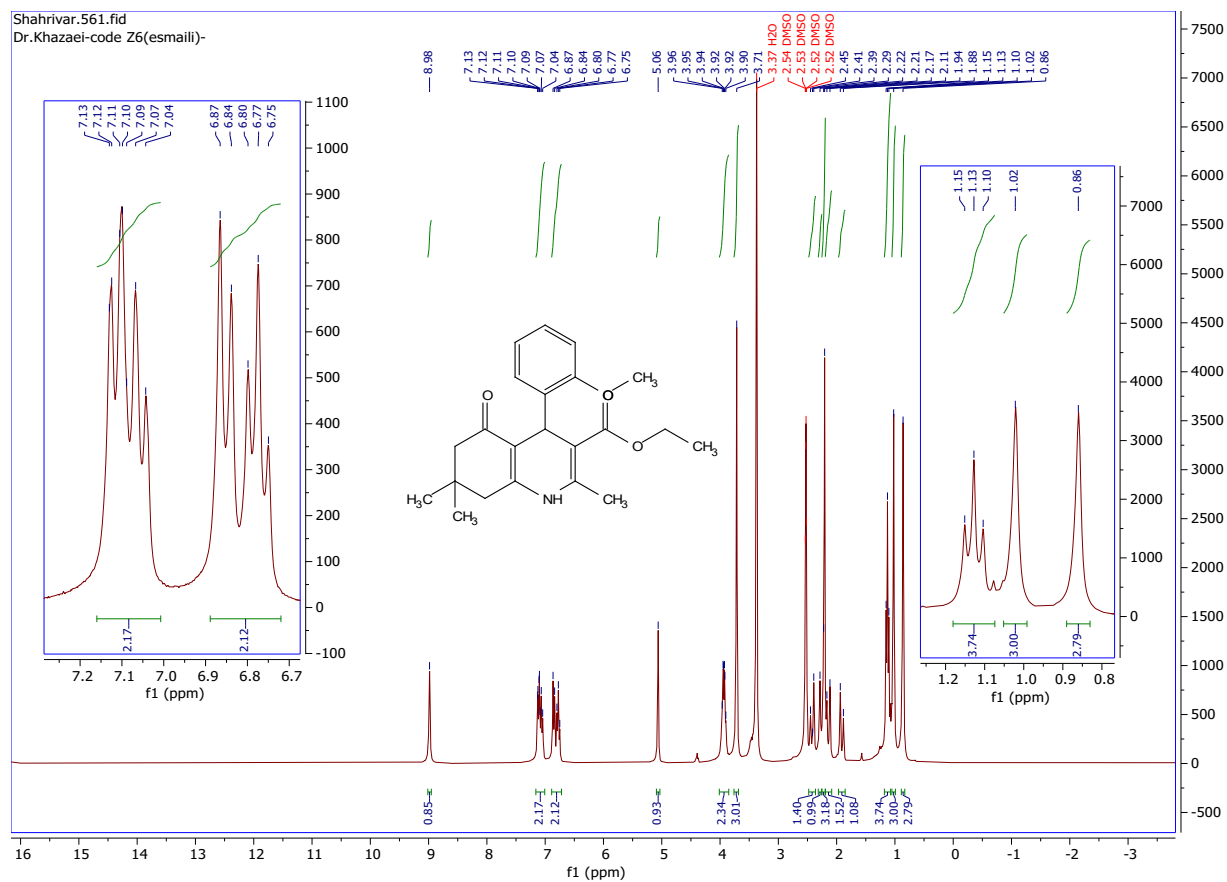
S10. ^1H NMR of Ethyl 4-(4-(dimethylamino)phenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in DMSO.

Ethyl 4-(2-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate:

FT-IR (KBr, cm^{-1}): 3284, 3210, 3078, 2964, 2895, 1689, 1610, 1487, 1380, 1214, 1153, 1073, 1028, 751 **S11**; ^1H NMR (301 MHz, DMSO-d_6): δ 0.86 (s, 3H), 1.02 (s, 3H), 1.13 (t, $J = 3\text{Hz}$, 3H), 3.21 (s, 3H), 1.88-2.45 (m, 8H), 3.71 (s, 3H), 3.9-3.96 (m, 2H), 5.06 (s, 1H), 6.75-6.87 (m, 2H), 7.04-7.13 (m, 2H), 8.98 (s, 1H) **S12**.



S11. FT-IR of Ethyl 4-(2-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in KBr.



S12. ^1H NMR Ethyl 4-(2-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate in DMSO.