

Synthesis and application of novel urea-benzoic acid functionalized magnetic nanoparticles for the synthesis of 2,3-disubstituted thiazolidin-4-ones and hexahydroquinolines

Fazlollah Fazl, Morteza Torabi, Meysam Yarie,* Mohammad Ali Zolfigol

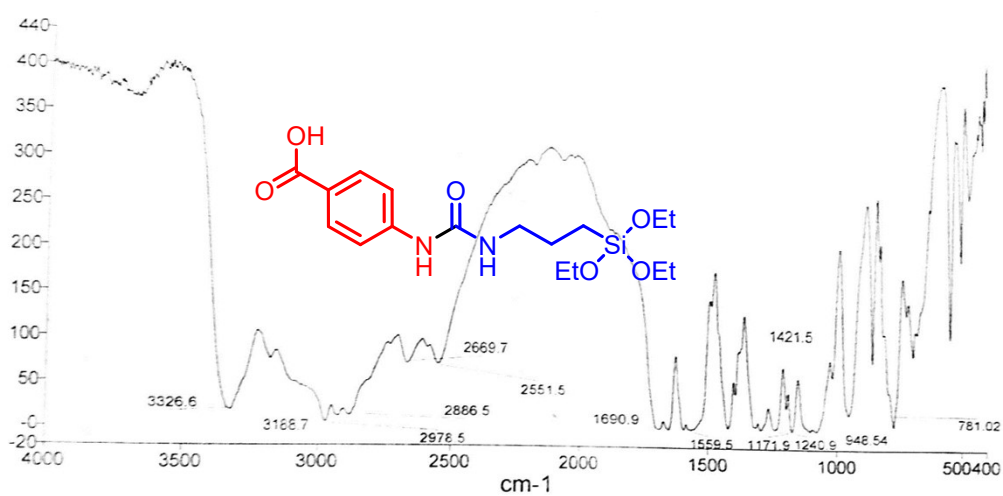
Department of Organic Chemistry, Faculty of Chemistry, Bu-Ali Sina University, Hamedan, Iran.

Correspondence: Meysam Yarie, Email: myarie.5266@gmail.com

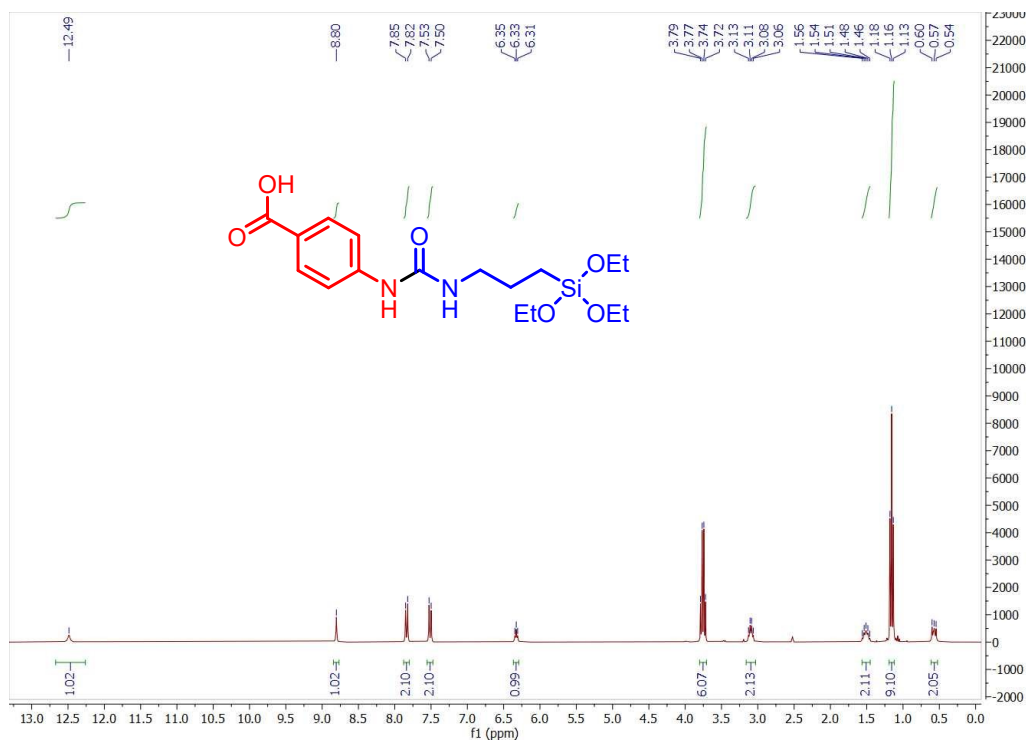
- 1: FT-IR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.
- 2: ¹H NMR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.
- 3: ¹³C NMR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.
- 4: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-phenylthiazolidin-4-one.
- 5: ¹H NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-phenylthiazolidin-4-one.
- 6: ¹³C NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-phenylthiazolidin-4-one.
- 7: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.
- 8: ¹H NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.
- 9: ¹³C NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.
- 10: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.
- 11: ¹H NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.
- 12: ¹³C NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.
- 13: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(4-bromophenyl)thiazolidin-4-one.
- 14: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(4-nitrophenyl)thiazolidin-4-one.
- 15: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(*p*-tolyl)thiazolidin-4-one.
- 16: FT-IR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-(2-hydroxyphenyl)thiazolidin-4-one.
- 17: FT-IR spectrum of 3,3'-(1,4-phenylene)bis(2-phenylthiazolidin-4-one).
- 18: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).
- 19: ¹H NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).
- 20: ¹³C NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).
- 21: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-chlorophenyl)thiazolidin-4-one).
- 22: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-methylphenyl)thiazolidin-4-one).

- 23: ¹H NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-methylphenyl)thiazolidin-4-one).
- 24: ¹³C NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(*p*-tolyl phenyl)thiazolidin-4-one).
- 25: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 26: ¹H NMR spectrum of 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 27: ¹³C NMR spectrum of 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 28: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-(*p*-tolyl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 29: FT-IR spectrum of ethyl 4-(4-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 30: FT-IR spectrum of ethyl 4-(3-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 31: FT-IR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 32: ¹H NMR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 33: ¹³C NMR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 34: ¹H NMR spectrum of ethyl 4-(4-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 35: ¹³C NMR spectrum of 4-(4-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 36: FT-IR spectrum of 4-(2-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 37: FT-IR spectrum of ethyl 4-(2,4-dichlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 38: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-(thiophen-2-yl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.
- 39: FT-IR spectrum of 4-(4-nitrophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.

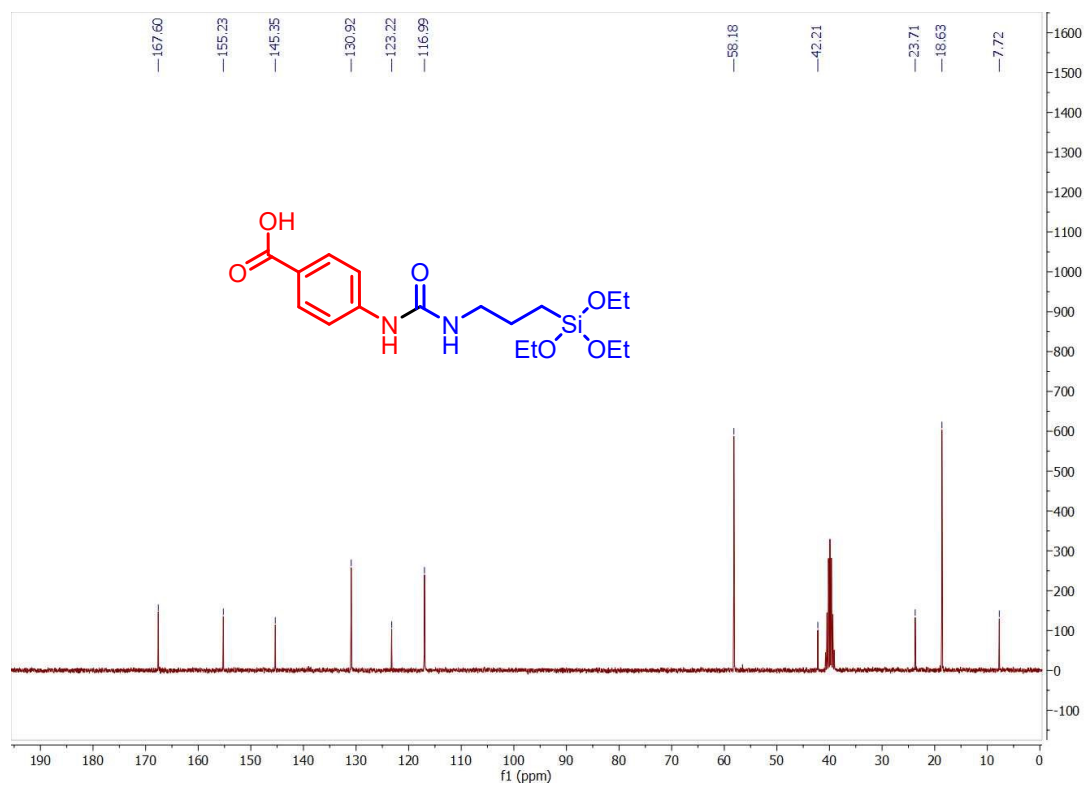
1: FT-IR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.



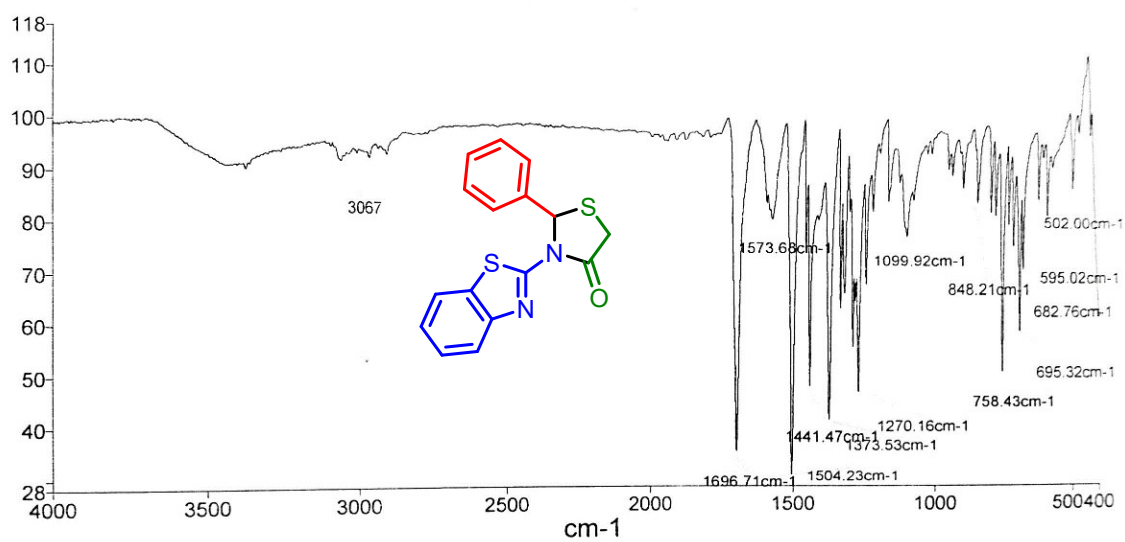
2: ¹H NMR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.



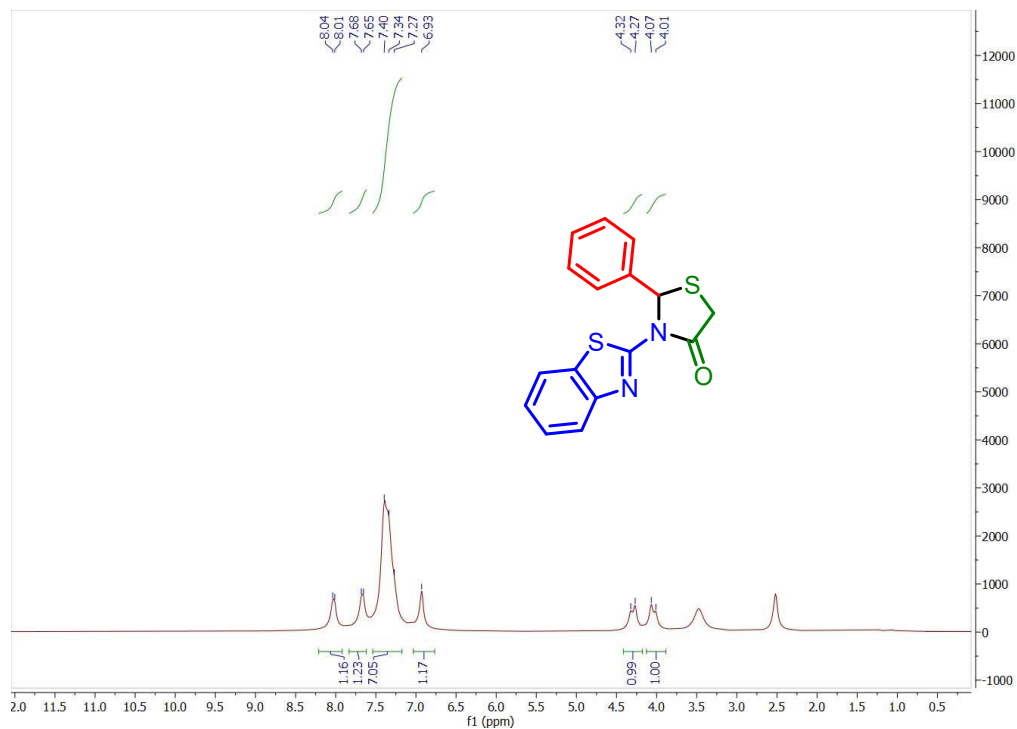
3: ^{13}C NMR spectrum of 4-(3-(3-(triethoxysilyl)propyl)ureido)benzoic acid.



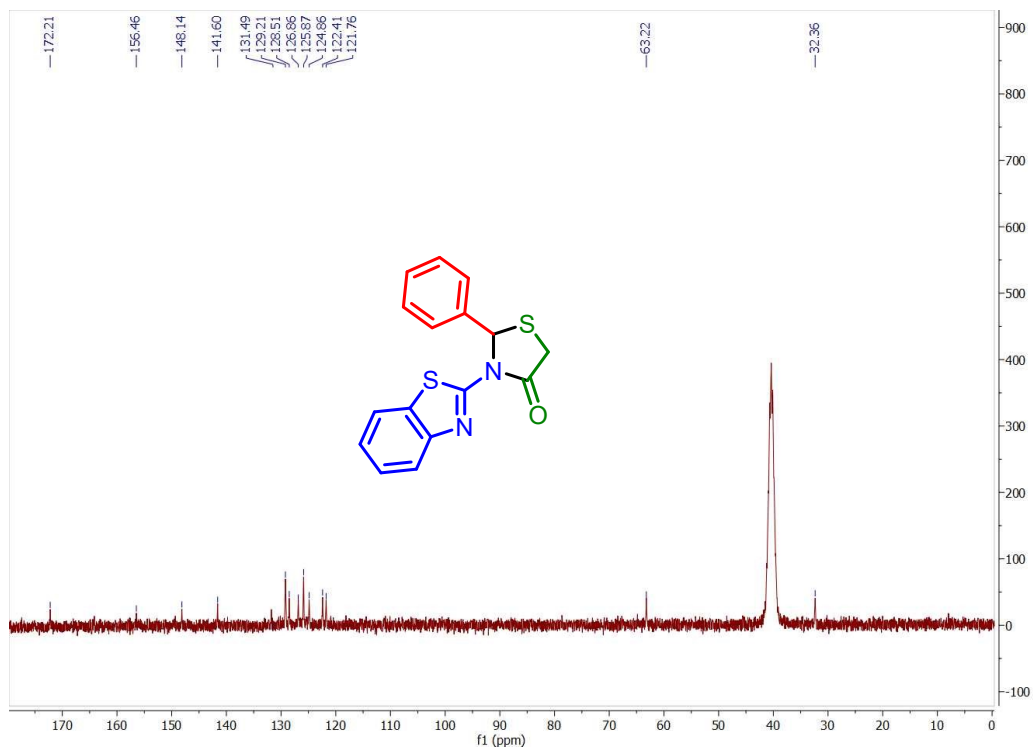
4: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-phenylthiazolidin-4-one.



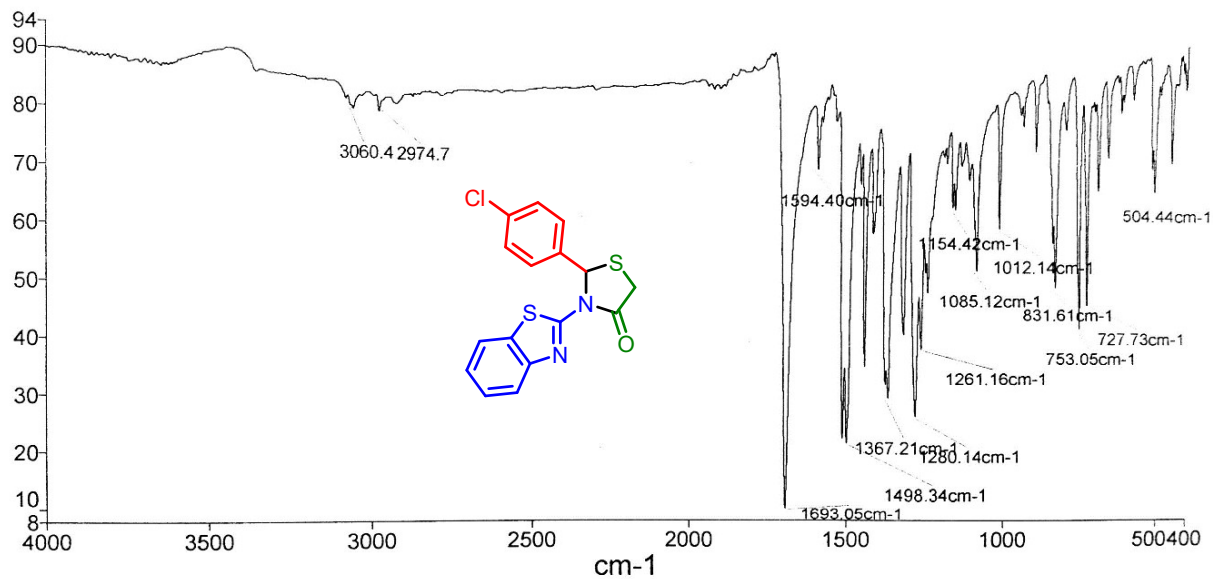
5: ^1H NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-phenylthiazolidin-4-one.



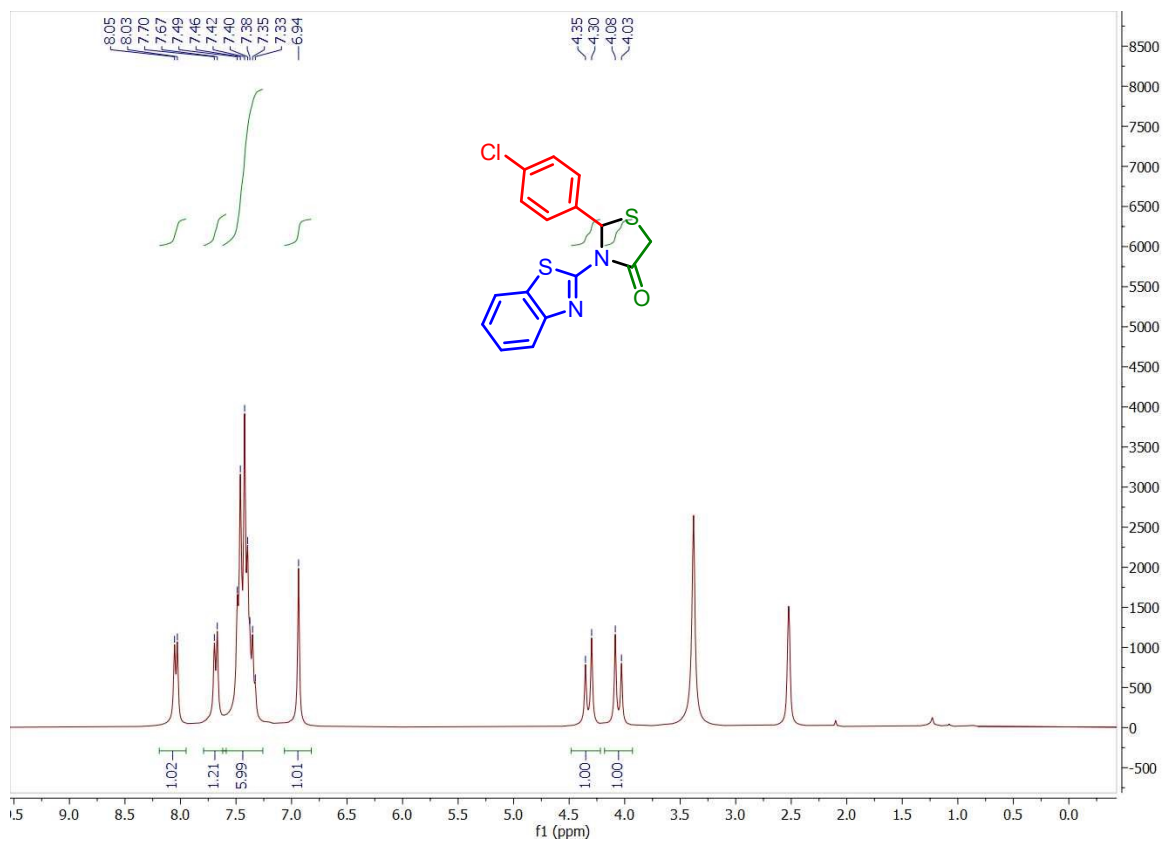
6: ^{13}C NMR spectrum of 3-(benzo[*d*]thiazol-2-yl)-2-phenylthiazolidin-4-one.



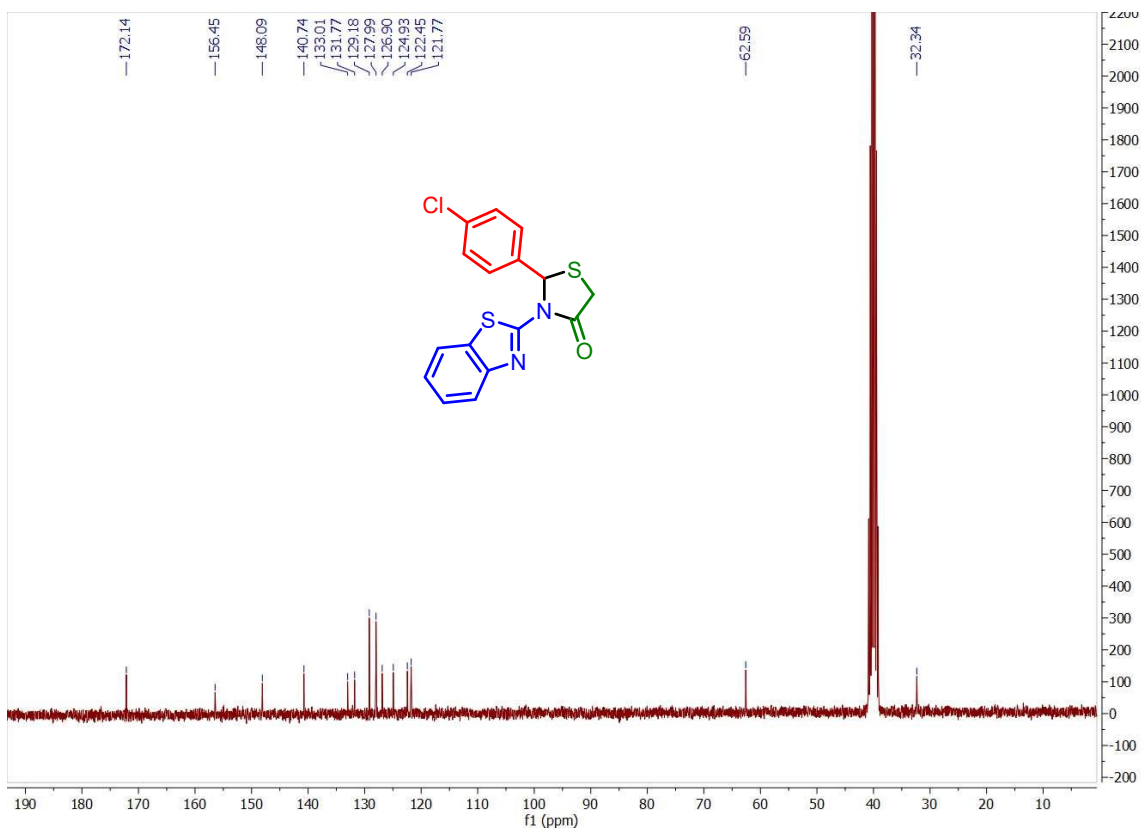
7: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.



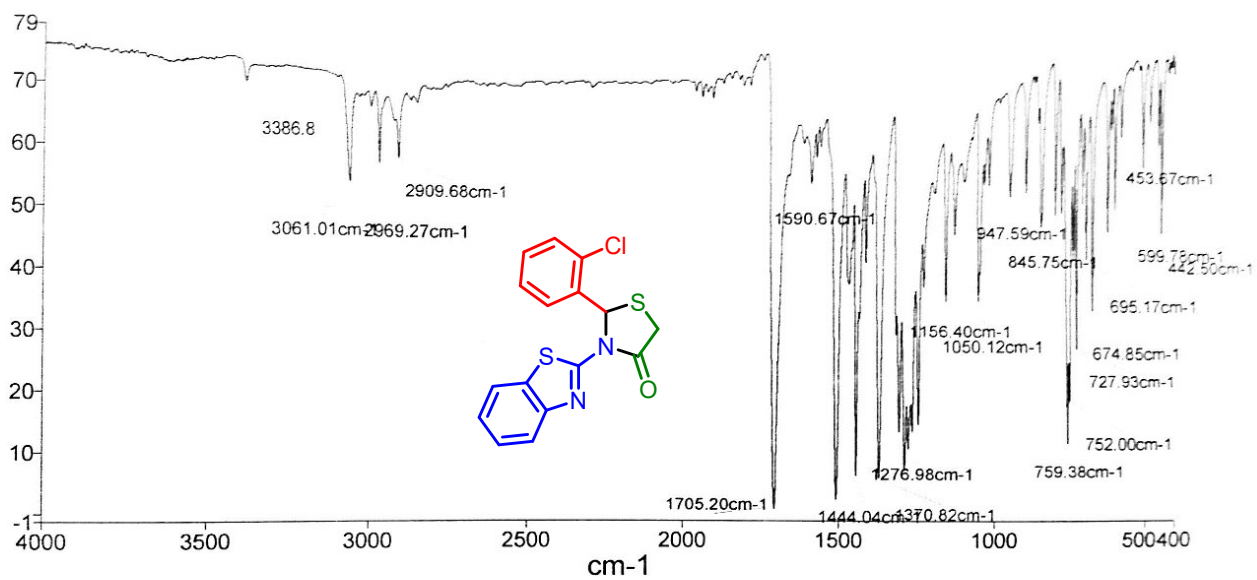
8: ¹H NMR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.



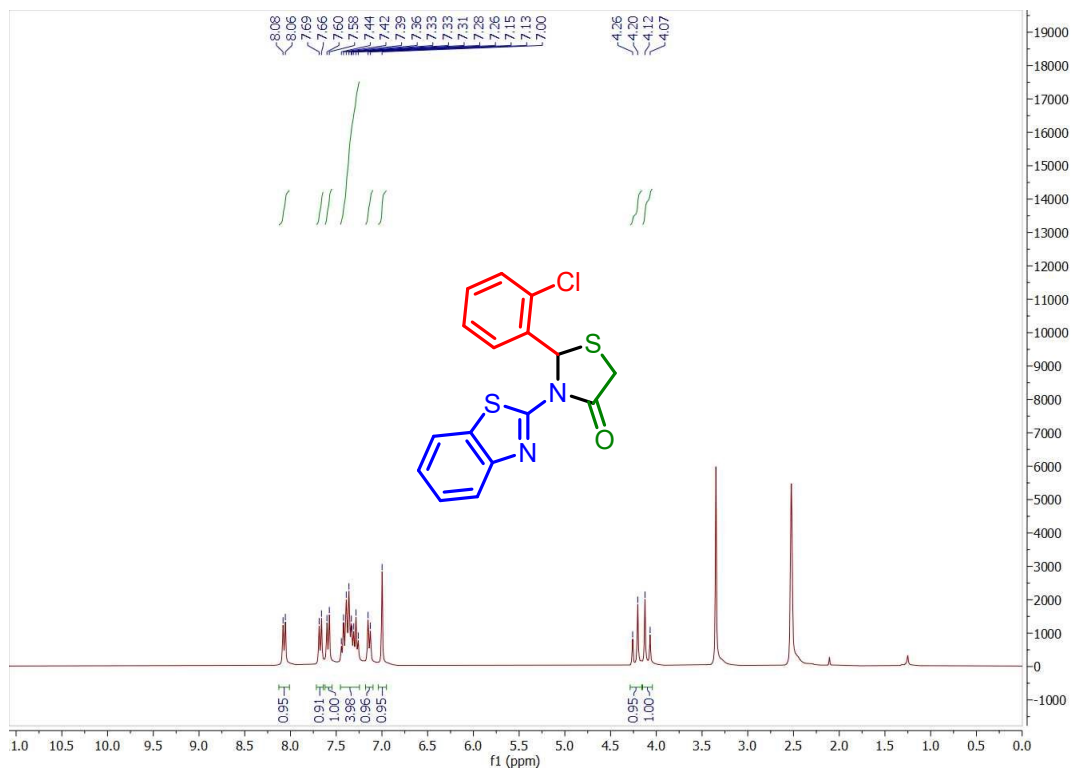
9: ^{13}C NMR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(4-chlorophenyl)thiazolidin-4-one.



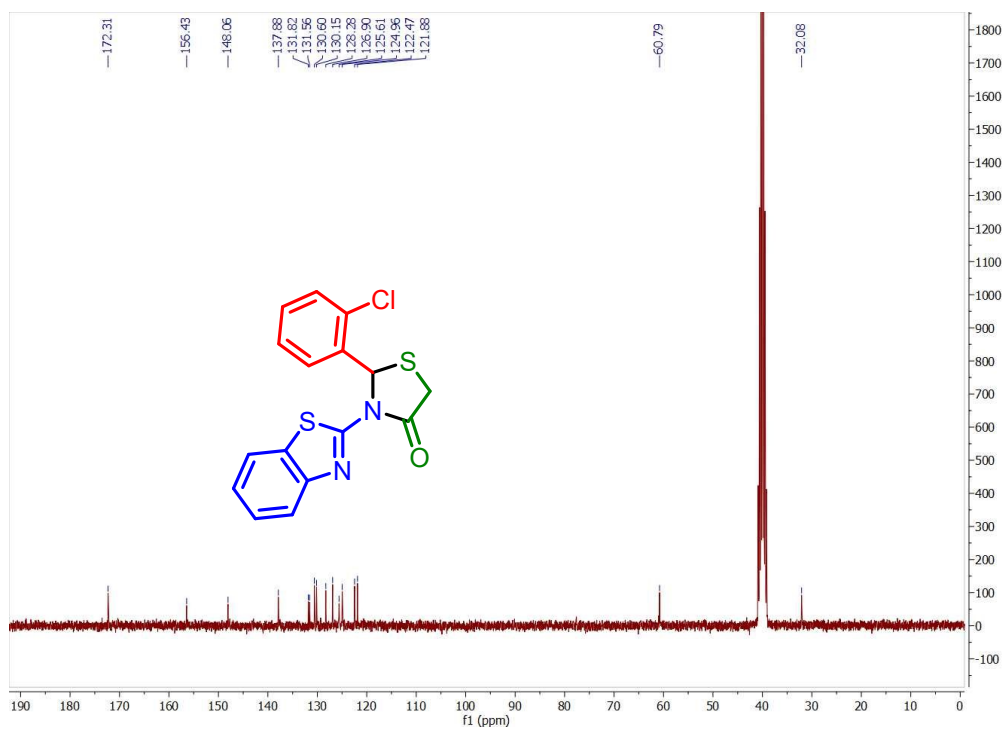
10: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.



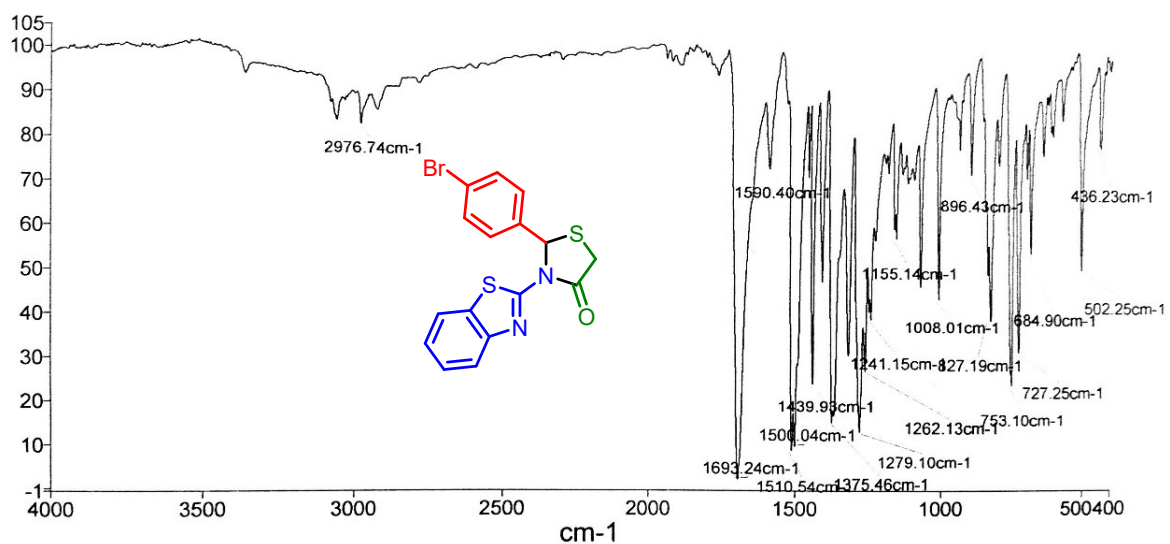
11: ^1H NMR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.



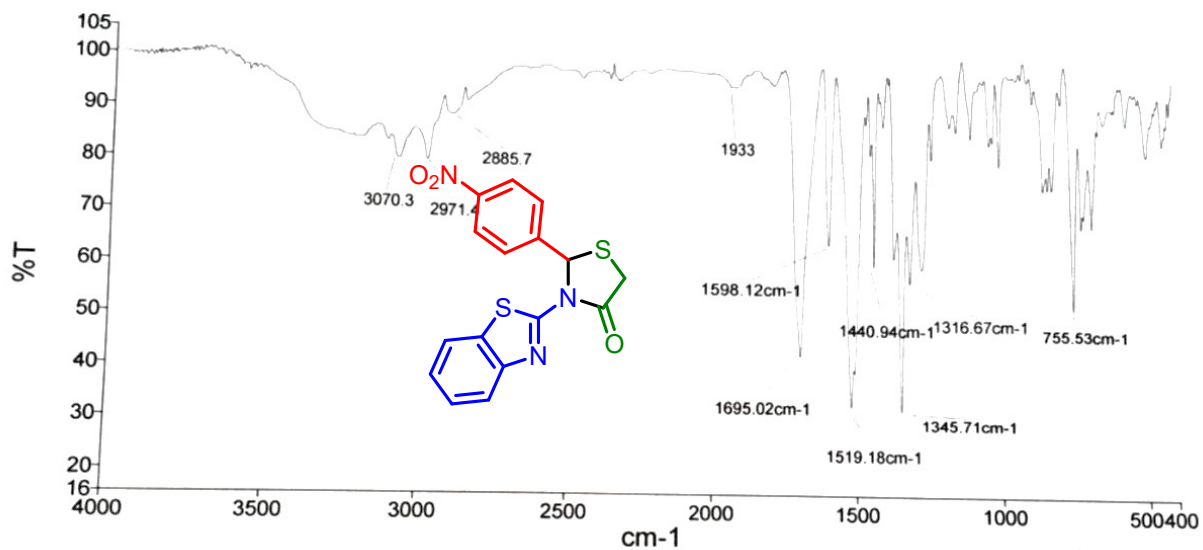
12: ^{13}C NMR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(2-chlorophenyl)thiazolidin-4-one.



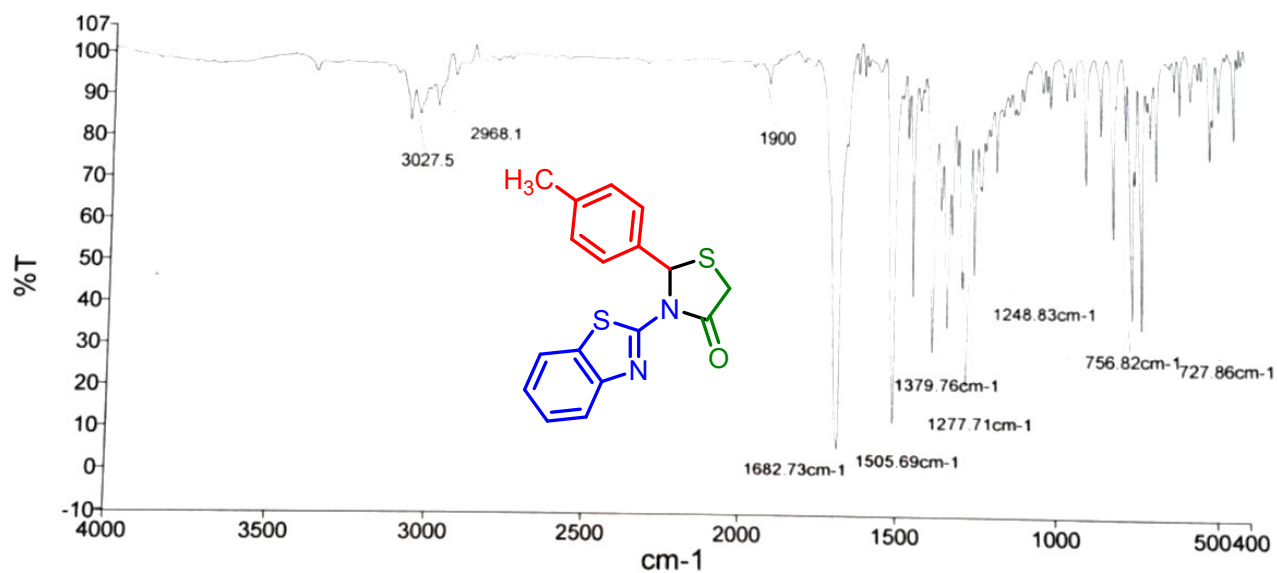
13: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(4-bromophenyl)thiazolidin-4-one.



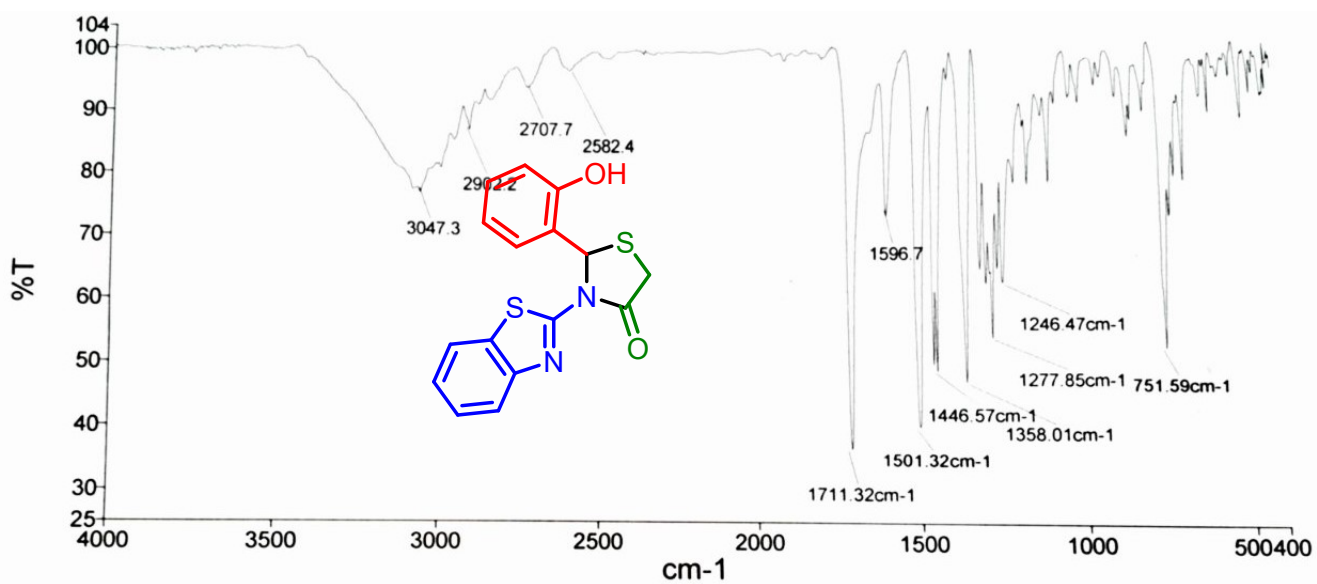
14: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(4-nitrophenyl)thiazolidin-4-one.



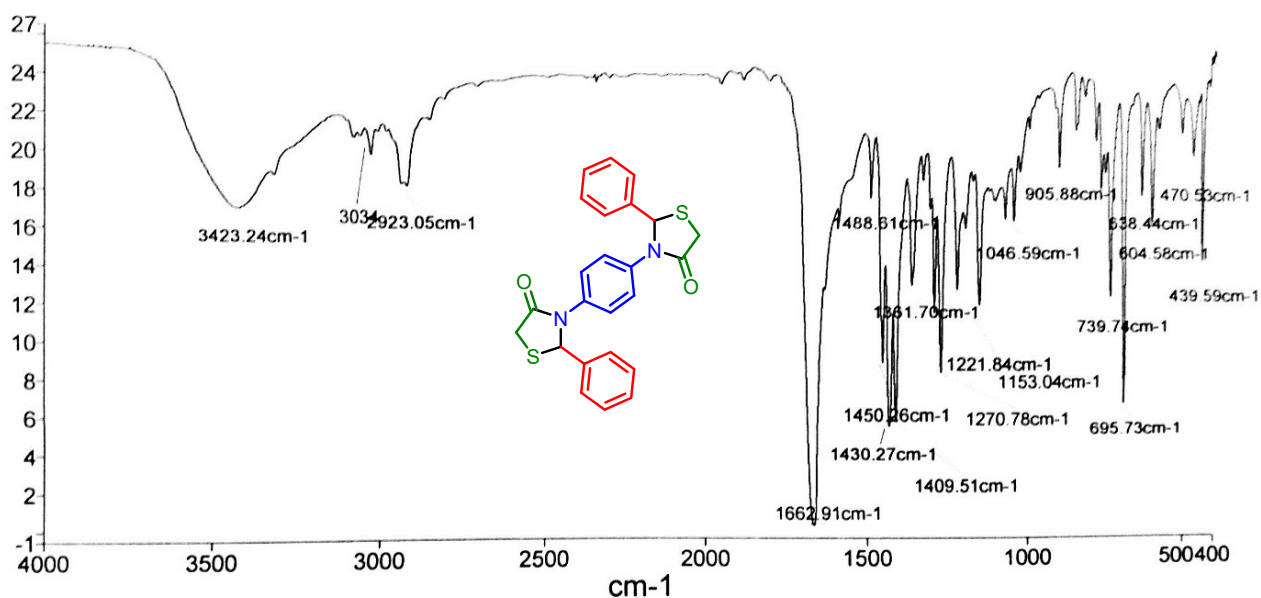
15: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(p-tolyl)thiazolidin-4-one.



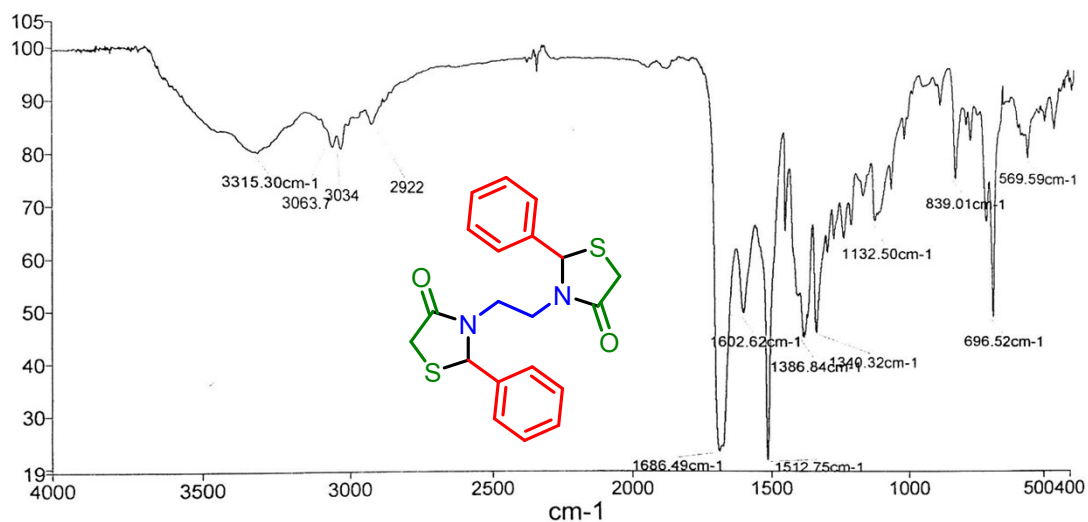
16: FT-IR spectrum of 3-(benzo[d]thiazol-2-yl)-2-(2-hydroxyphenyl)thiazolidin-4-one.



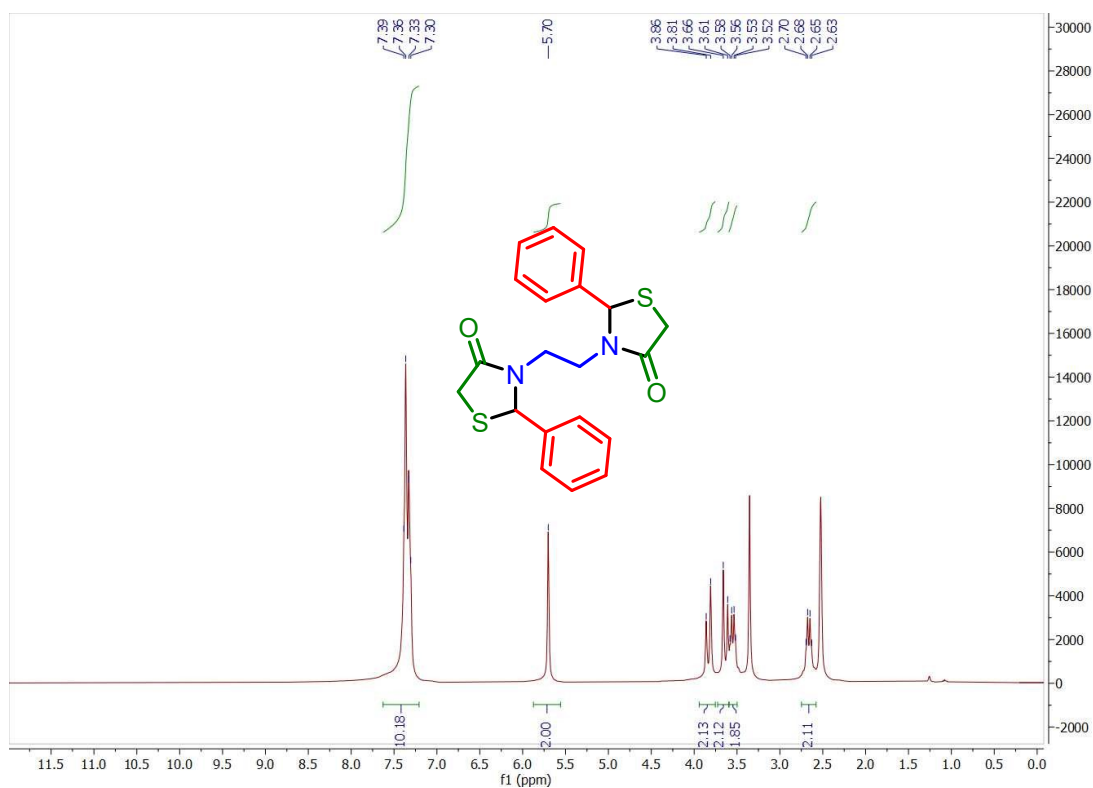
17: FT-IR spectrum of 3,3'-(1,4-phenylene)bis(2-phenylthiazolidin-4-one).



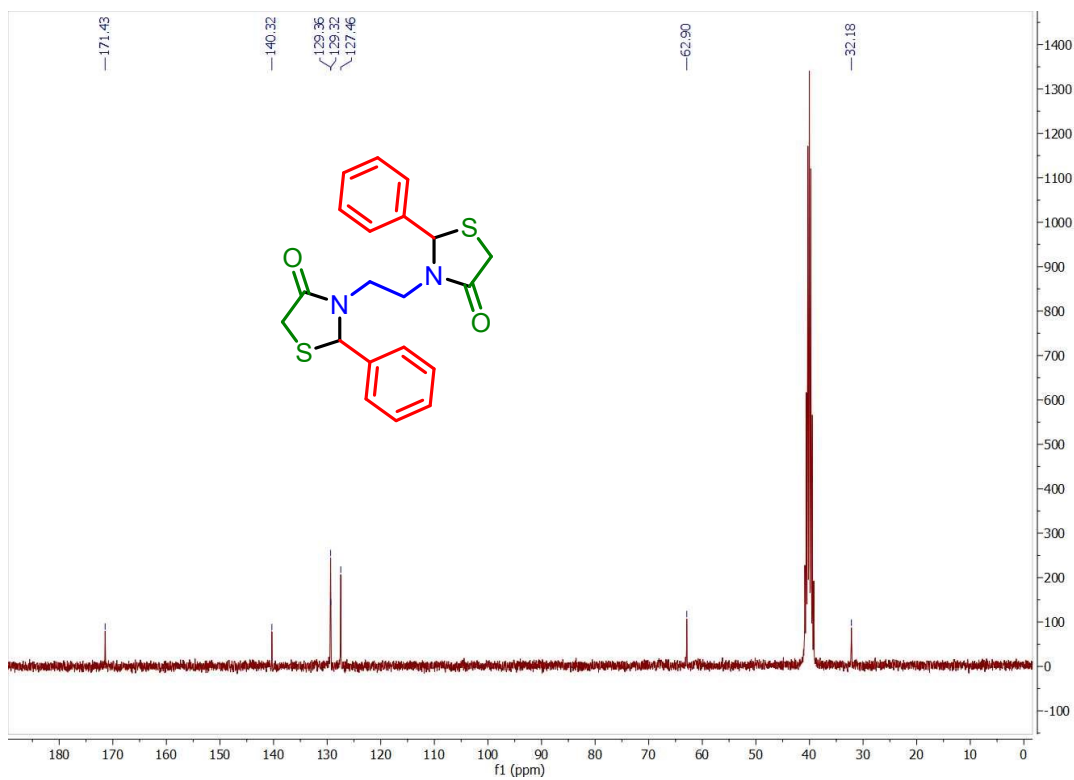
18: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).



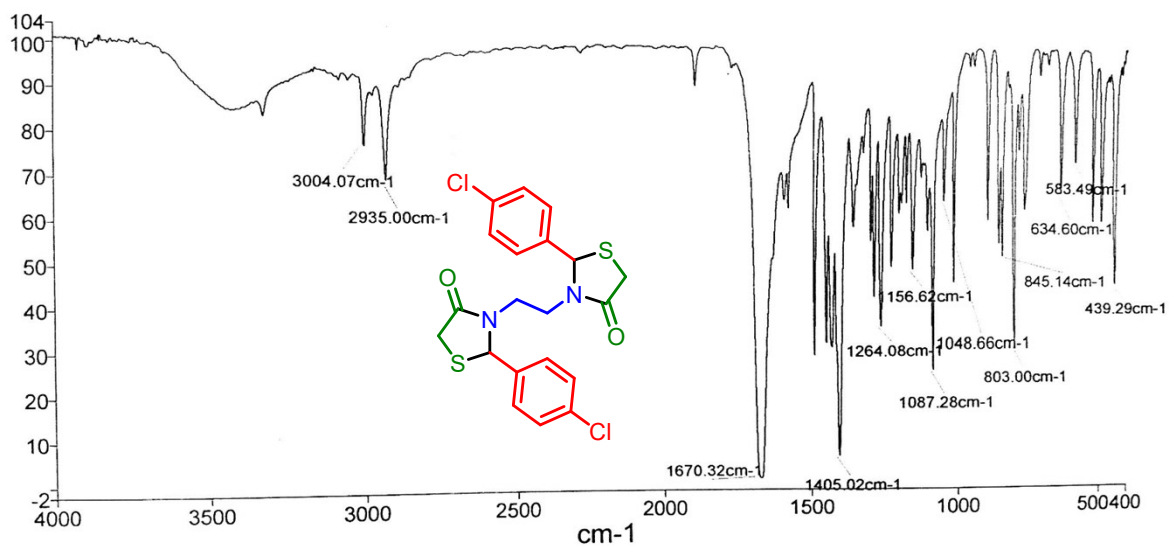
19: ^1H NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).



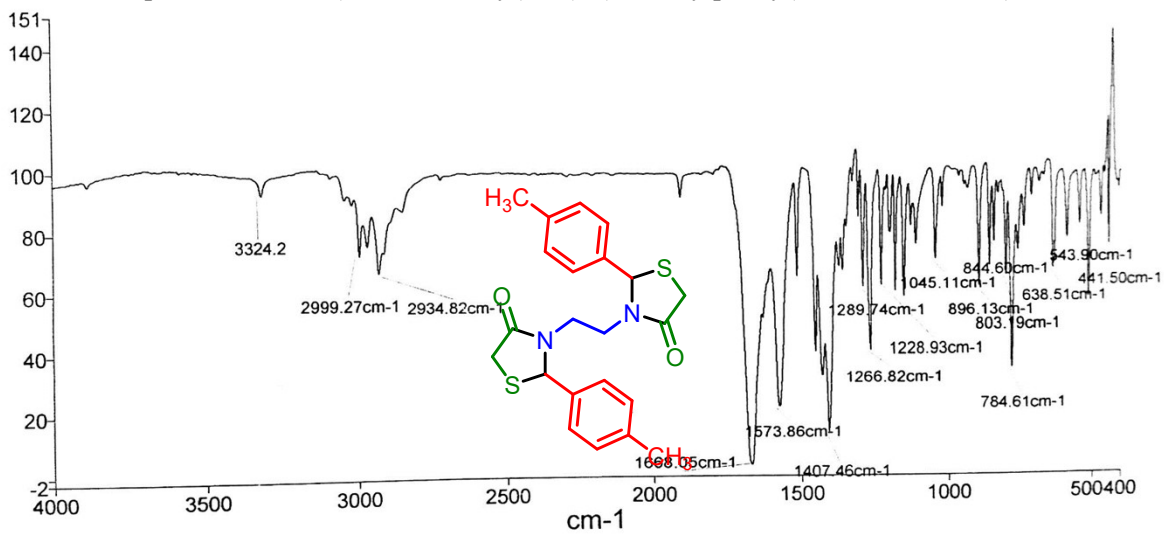
20: ^{13}C NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-phenylthiazolidin-4-one).



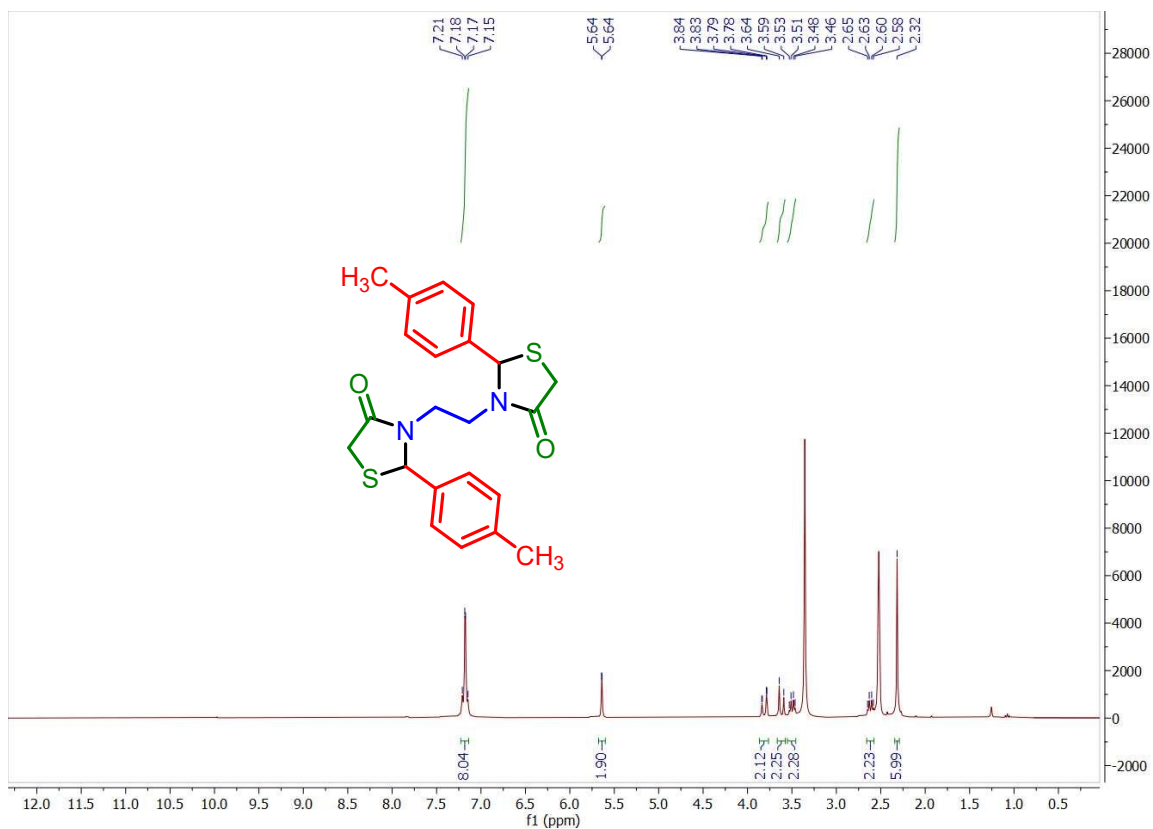
21: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-chlorophenyl)thiazolidin-4-one).



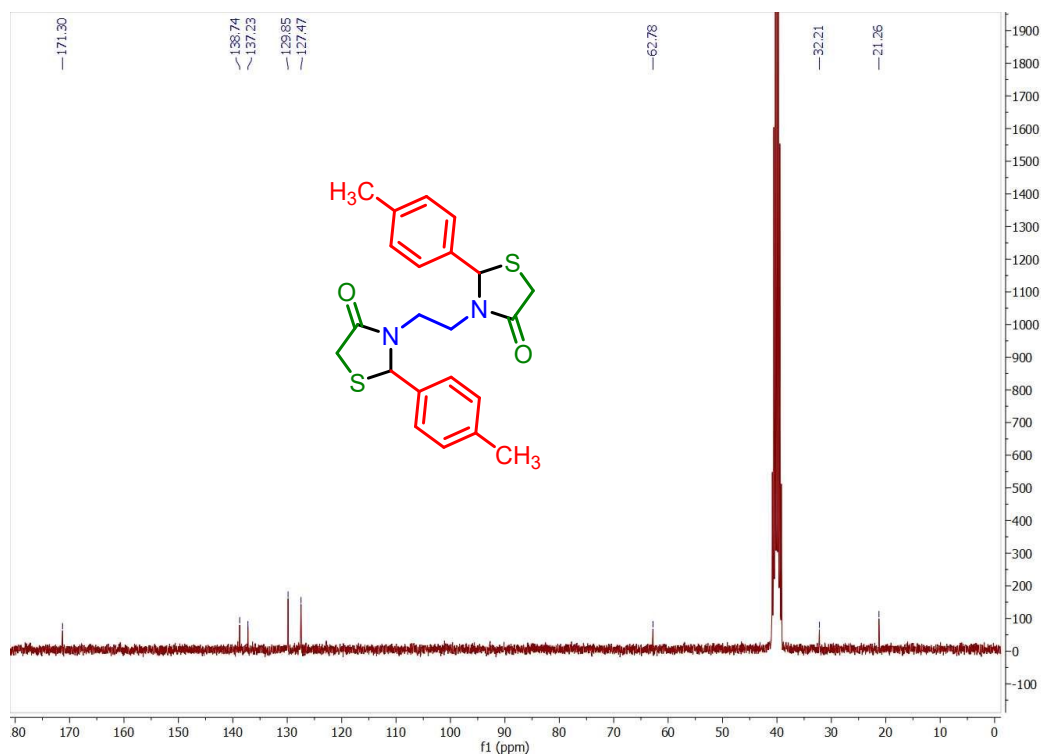
22: FT-IR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-methylphenyl)thiazolidin-4-one).



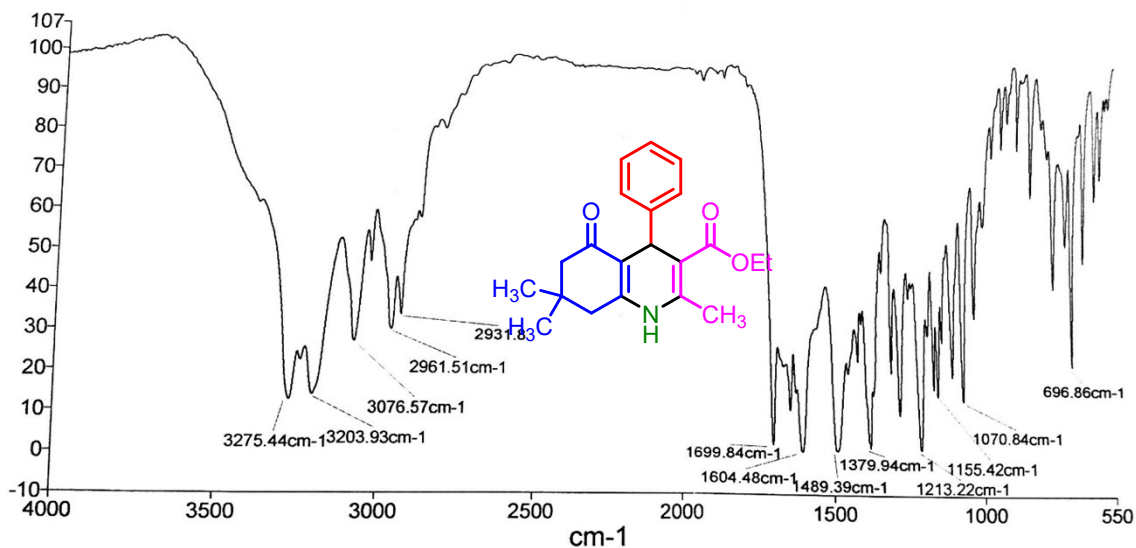
23: ^1H NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(4-methylphenyl)thiazolidin-4-one).



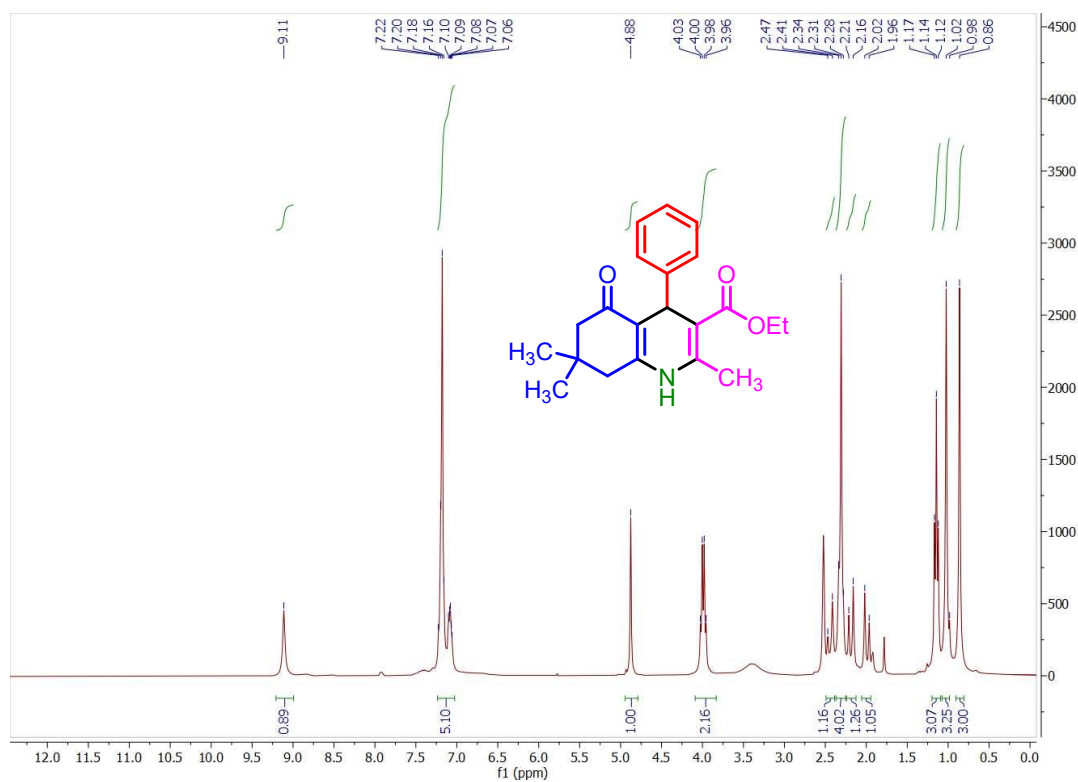
24: ^{13}C NMR spectrum of 3,3'-(ethane-1,2-diyl)bis(2-(*p*-tolyl)phenyl)thiazolidin-4-one).



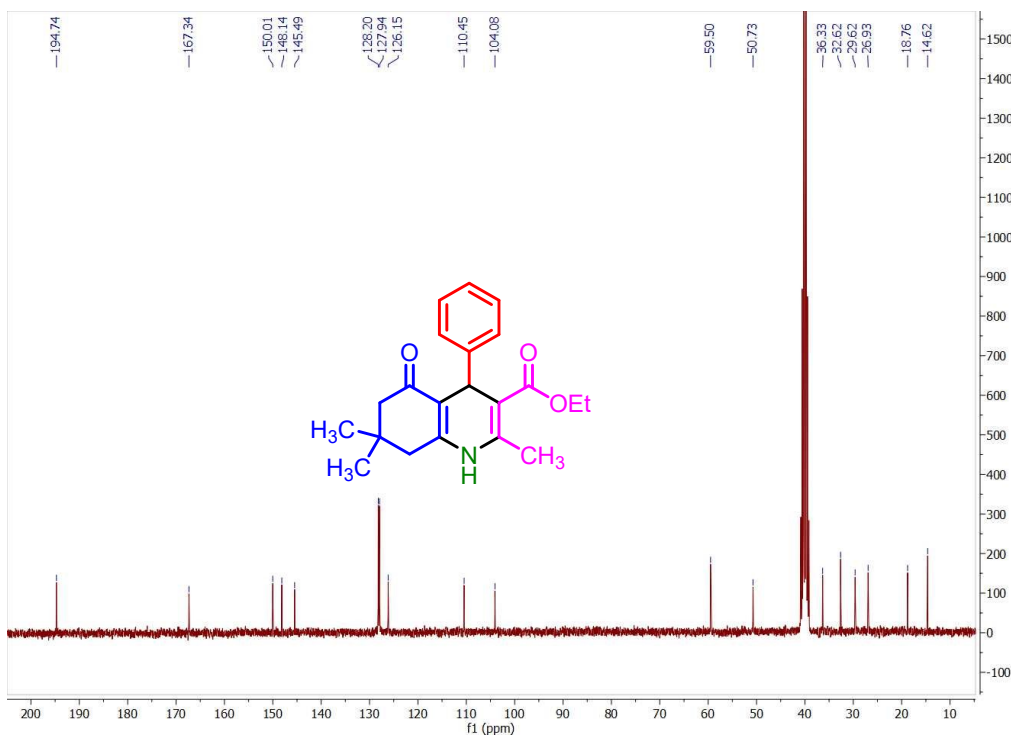
25: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



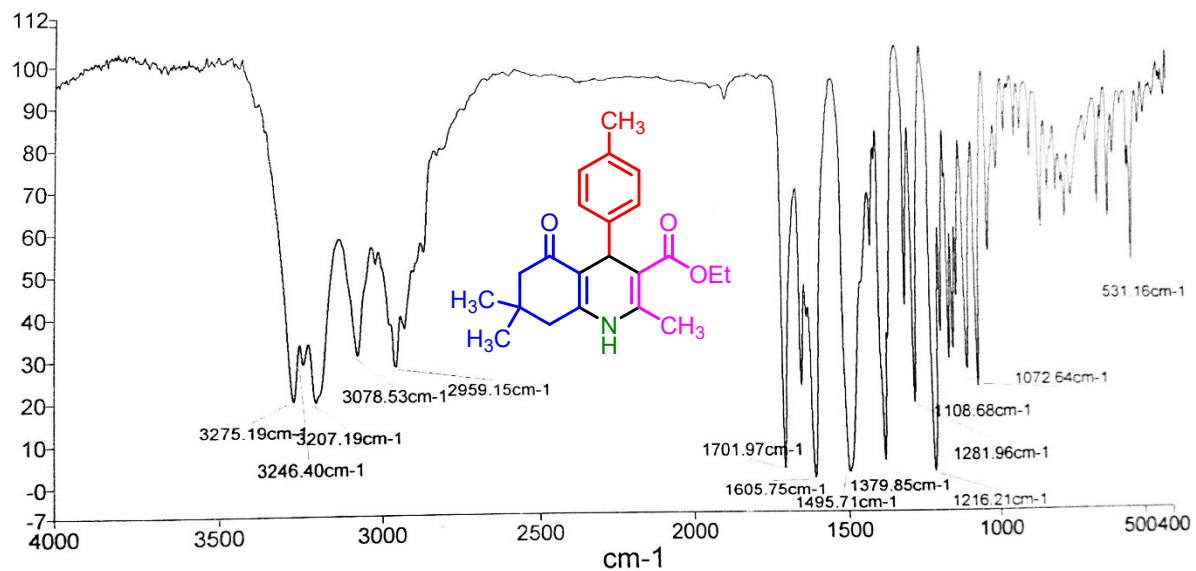
26: ¹H NMR spectrum of 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



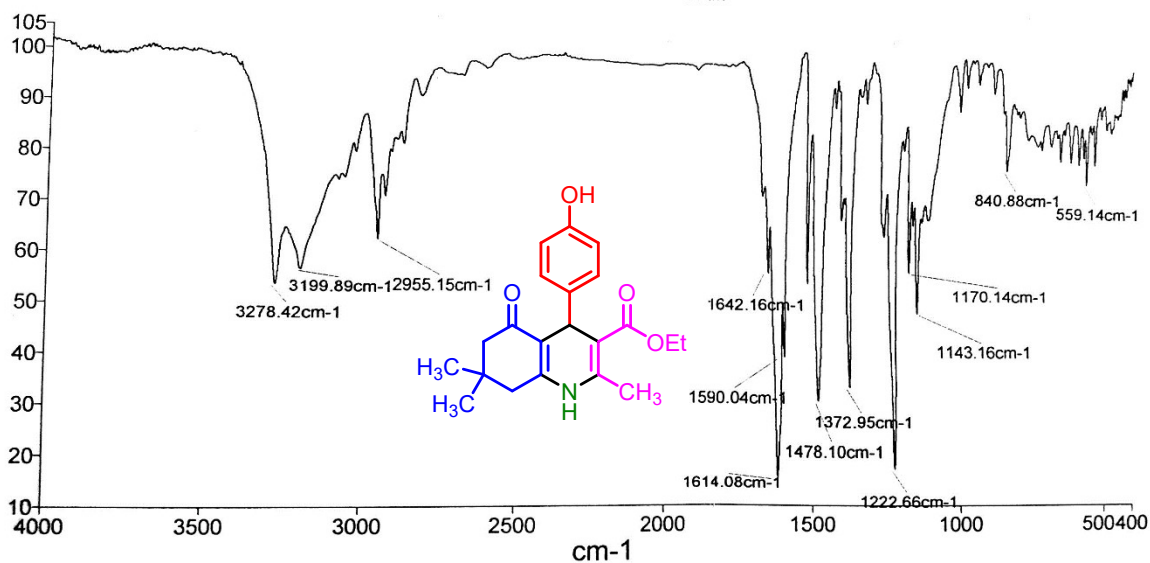
27: ^{13}C NMR spectrum of 2,7,7-trimethyl-5-oxo-4-phenyl-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



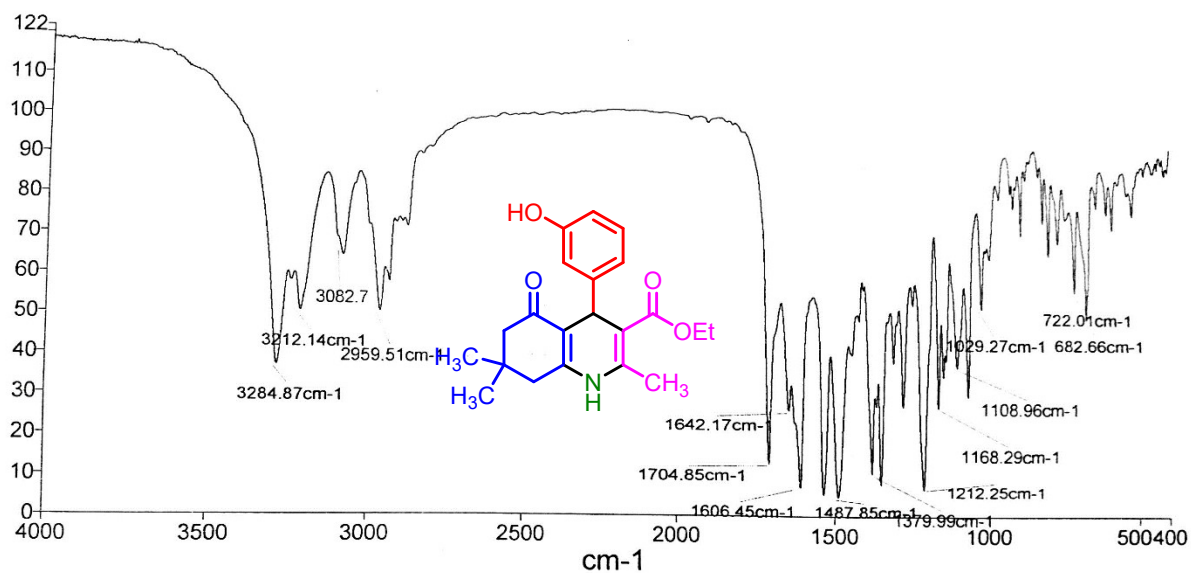
28: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-(*p*-tolyl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



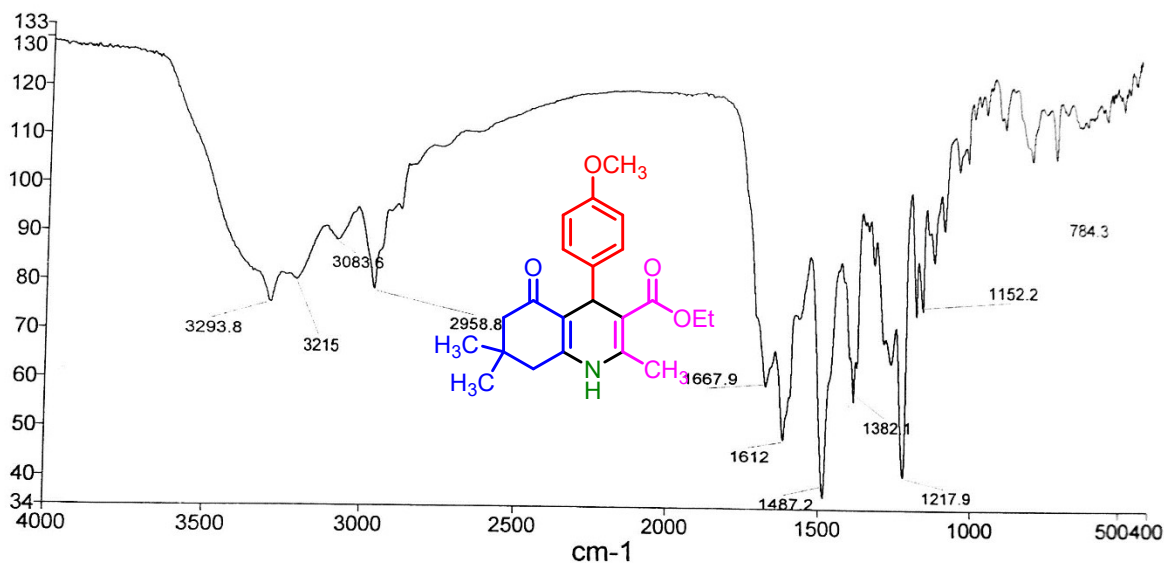
29: FT-IR spectrum of ethyl 4-(4-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



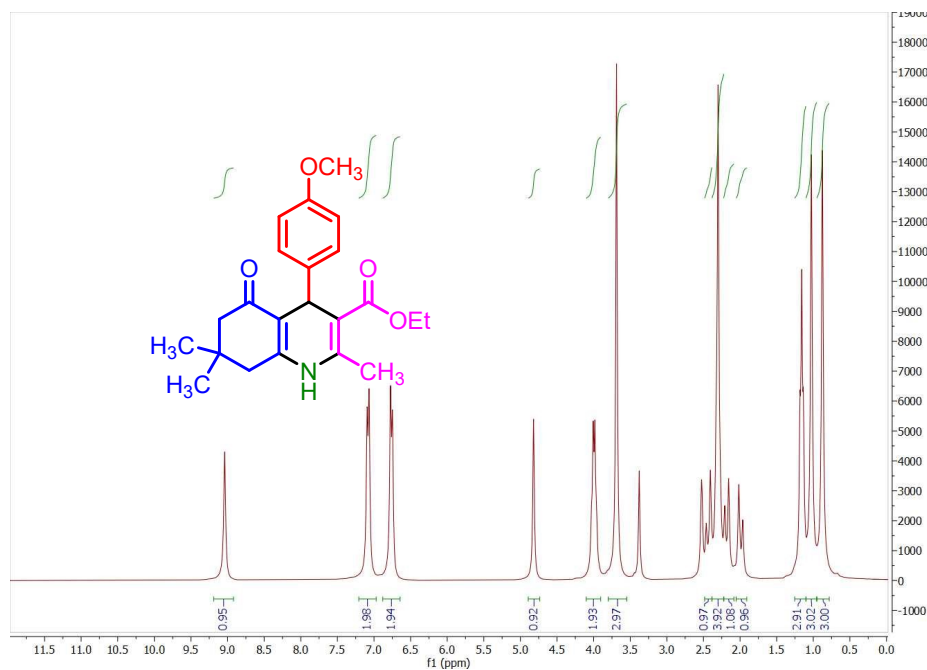
30: FT-IR spectrum of ethyl 4-(3-hydroxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



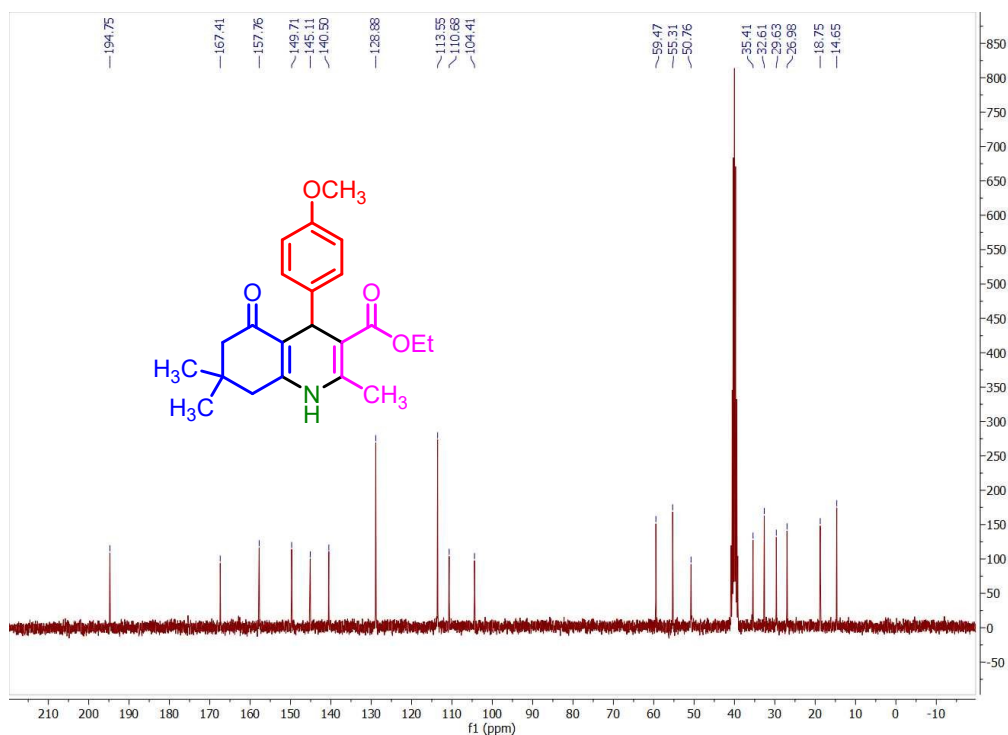
31: FT-IR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



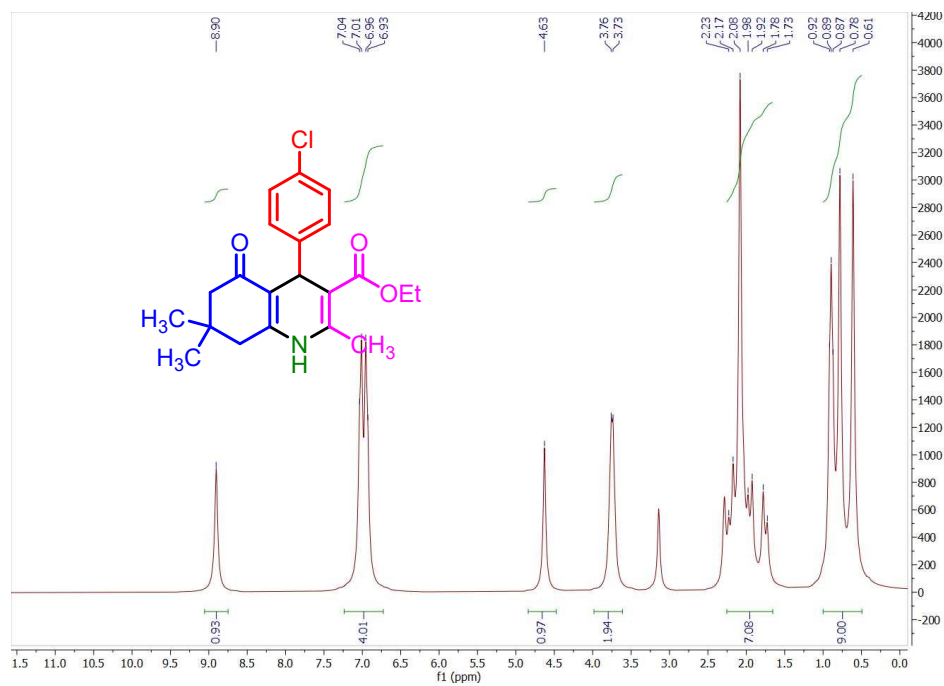
32: ¹H NMR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



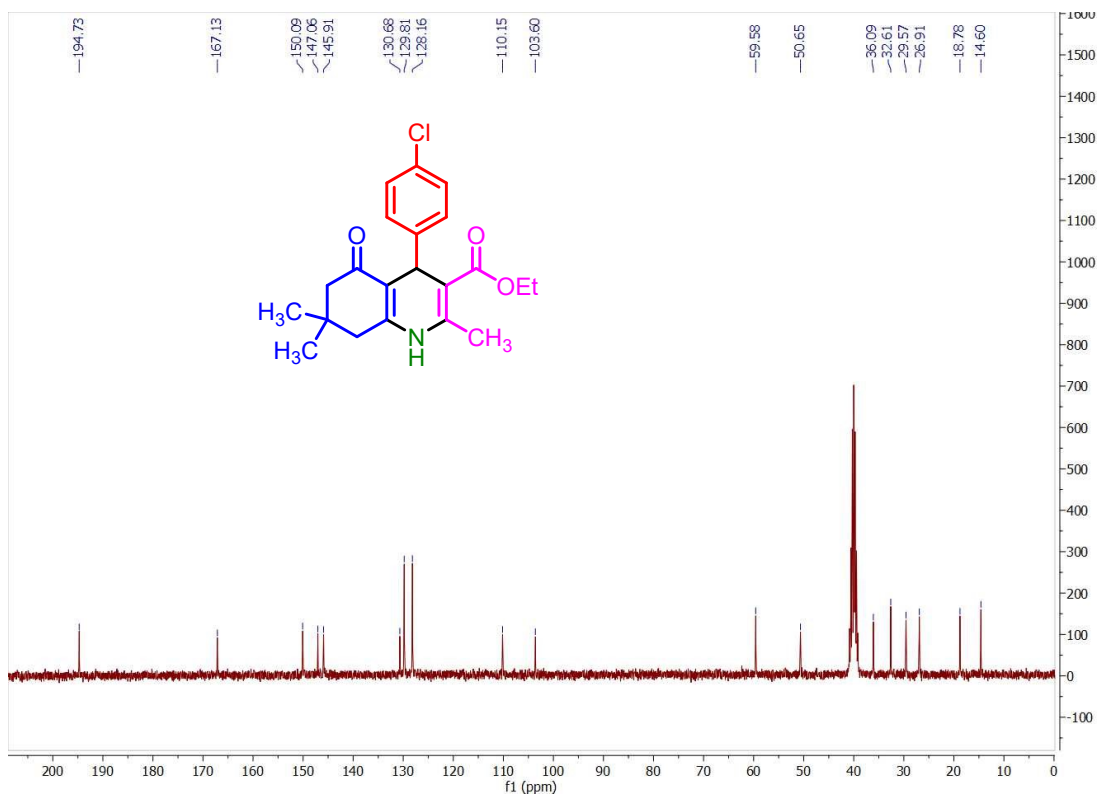
33: ^{13}C NMR spectrum of ethyl 4-(4-methoxyphenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



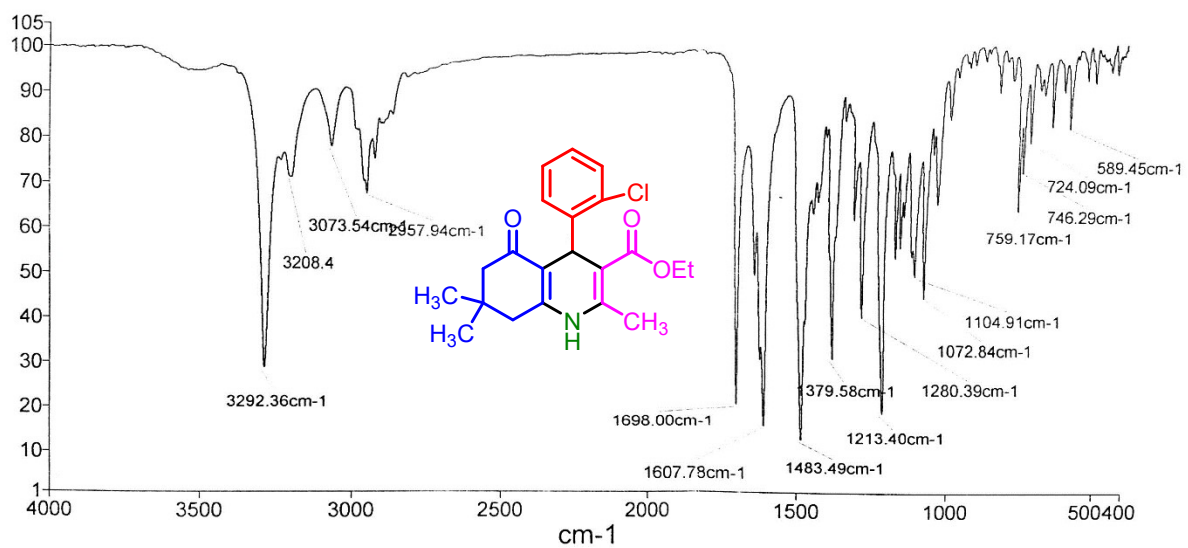
34: ^1H NMR spectrum of ethyl 4-(4-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



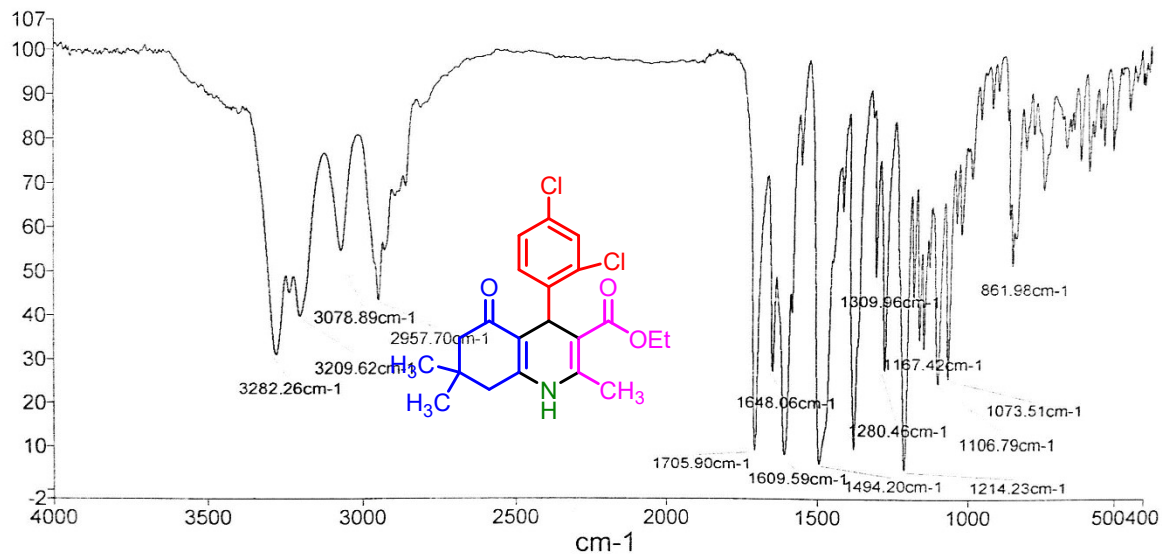
35: ^{13}C NMR spectrum of 4-(4-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



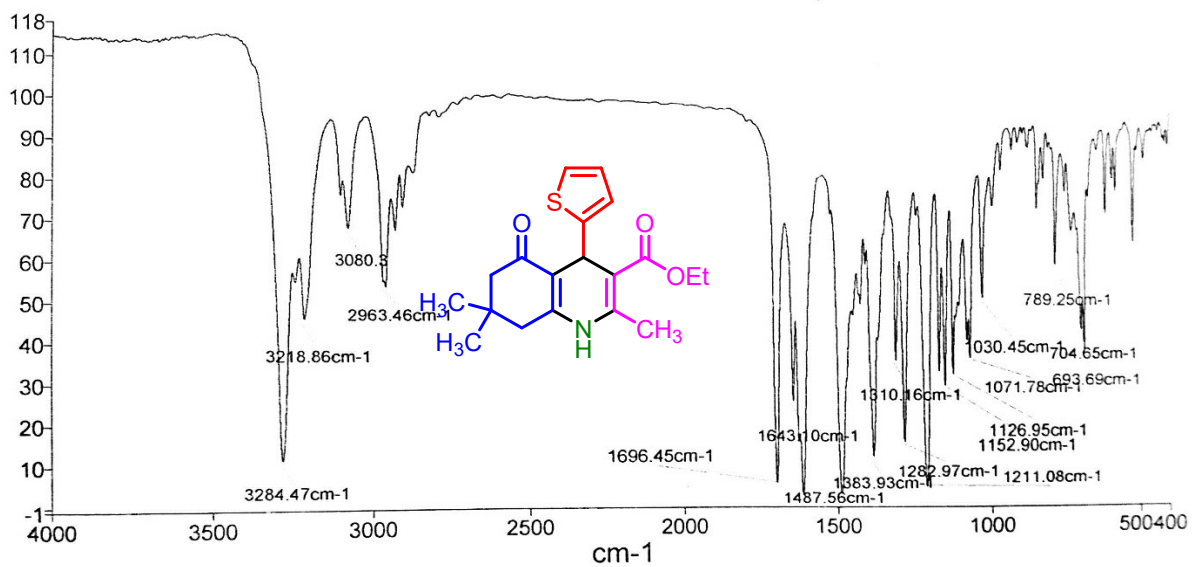
36: FT-IR spectrum of 4-(2-chlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



37: FT-IR spectrum of ethyl 4-(2,4-dichlorophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



38: FT-IR spectrum of ethyl 2,7,7-trimethyl-5-oxo-4-(thiophen-2-yl)-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.



39: FT-IR spectrum of 4-(4-nitrophenyl)-2,7,7-trimethyl-5-oxo-1,4,5,6,7,8-hexahydroquinoline-3-carboxylate.

