Chemistry and Materials Research
ISSN 2224- 3224 (Print) ISSN 2225- 0956 (Online)
Vol.10 No.3, 2018

Preparation of the Thiourea Ester Dreivatives

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Abstract
The Carbamidoylthio phenyl methyl benzoate **(1)** have been synthesized by the reaction of 1-chloro ester (2) with Thiourea (3), the compound (2) was synthesised by the reaction of Benzaldehyde (4) with Benzoyl chloride (5). The reaction were followed thin layer chromatography (T.L.C), and idendification structurel was achived by spectroscopic analysis: ^{1}H-^{13}C-NMR, FT-IR.
Keywords: preparation 1-halo esters, alkylation of 1-halo esters, reactions of thiourea.

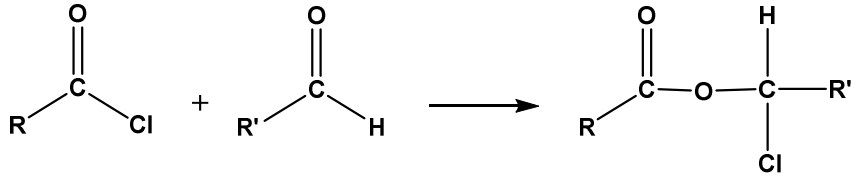
1. Introduction

1-chloro esters are compounds that contain an atom of chlorine in the alpha position of ester , their general formula is RCOOC(Cl)R'R" which R',R" (H, alkyl or aryl) and R (alkyl or aryl).

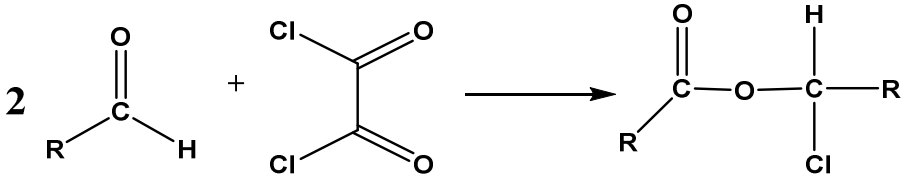
1-chloro esters are a type of compounds used as medium compounds in industrial applications [1], and they have a biological activity [2,3], and used to modify the acidic function of some drugs [4] and anti insecticides [5].

1-chloro esters can be prepared by several methods:

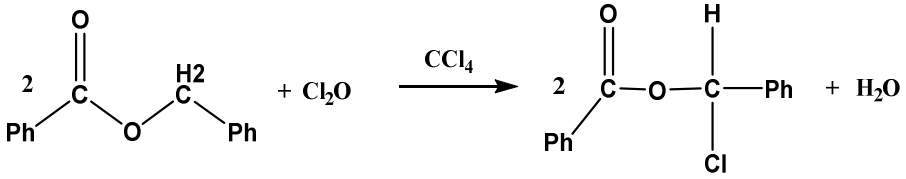
From the condensation of an aldehydes with an acyl chloride in presence of a Lawis acid according to the following reaction[2]:



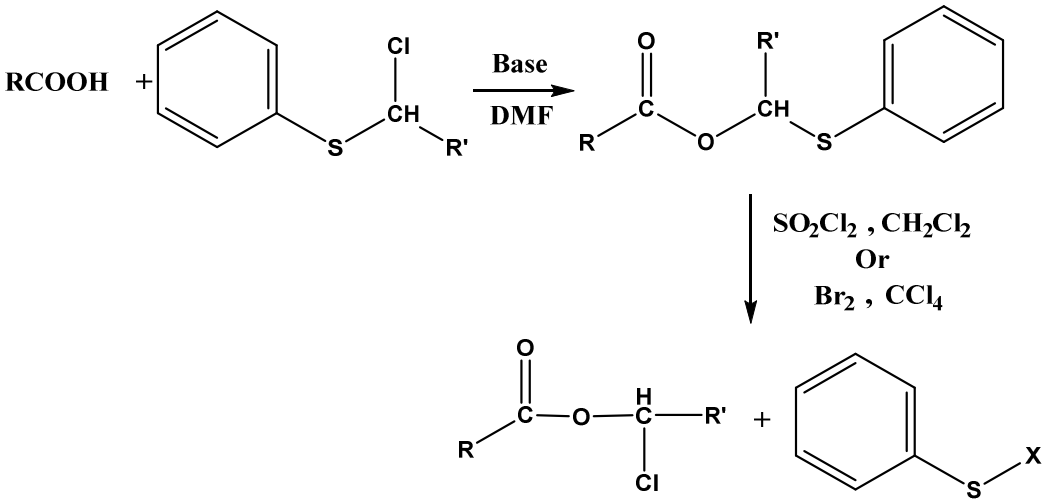
The reaction of oxalyl chloride with aldehyde according to the following reaction[6]:



Chlorination of benzyl esters with chlorine monoxide in carbon tetrachloride, chlorine monoxide is characterized by excellent selectivity which effects on methyl group without effect on the aromatic ring according to the following reaction[7]:



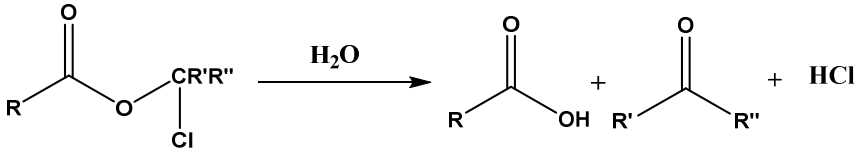
1-chloro esters have been prepared under mild conditions in high yields by selective cleavage of the carbon-sulfur bond in 1-phenyl thioalkyl esters using sulfuryl chloride or bromine. The intermediate 1-phenyl thioalkyl esters have been prepared by alkylation of carboxylic acids. The differents steps of these reaction showed in the following [4]:



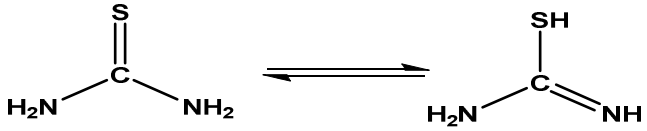
It is important to say the first method is general the prefered method, because of its great yield and easy conditions[4].It is apparent that increased nucleophilic character of the aldehyde oxygen (for attack on the carbonyl carbon of the acid chloride) enhances the rate of reaction[8].

In general, The presence of strongly electron-withdrawing substituents in acid halides or aldehyde (Cl, Br ,I ,NO_2) the reaction became slower, but the products will be more stable forward hydrolysis, while in the acid halides and aldehyde which are unsubstituted or containing (Me, -OMe) the reaction will be faster but the products will be less stable[8-11].

1-chloro esters are dissolved in water solvents or air moisture to produce carboxylic acids, carbonyl compounds and hydrochloric acid according to the following reaction[8,10,11]:



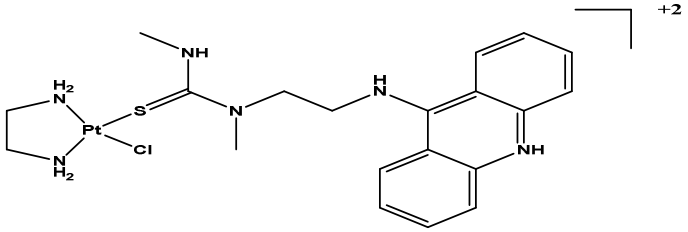
Thiourea is an organosulfur compound , is a white crystalline solid . It is soluble in polar solvents, and insoluble in none-polar solvents, and has two tautomeric forms:



Thione form **Thiol form**

And thus has three functional group : amino, imino, and thiol [12,13].

Thiourea and their derivatives are used in several industrial applications in addition of biological, medical applications, such as (vulcanization accelerators, production of flame retardant resins, as an auxiliary agent in diazo paper, light-sensitive photocopy paper and almost all other type of copy paper. Produce pharmaceuticals, insecticides, and antioxidation[12], use as a electroless tin plating soluation for copper and gold, (as an improved material in the galvanic coating process)[14], used as antimicrobial [15], and the compounds containing trialkylated thiourea groups showed activity against diseases lung, colon and cancer cells, while the compound containing tetraalkylated thiourea showed less active toward the studied diseases, and the derivatives of thiourea with platinum showed activity toward cancer cells [16].



Reaction of thiourea depending on high nucleophelic of sulfur.

2. Experimental

2.1. Apparatus

Spectrum NMR proton and carbon device 400 MHz model Bruker by Switzerland company, optical absorption spectrum infrared device model FT-IR-4100 from the Japanese company Jasco, thin layer chromatographic of Aluminum coated by Silica Gel $60F_{254}$ measuring 20 X 20 from the German company Merk.

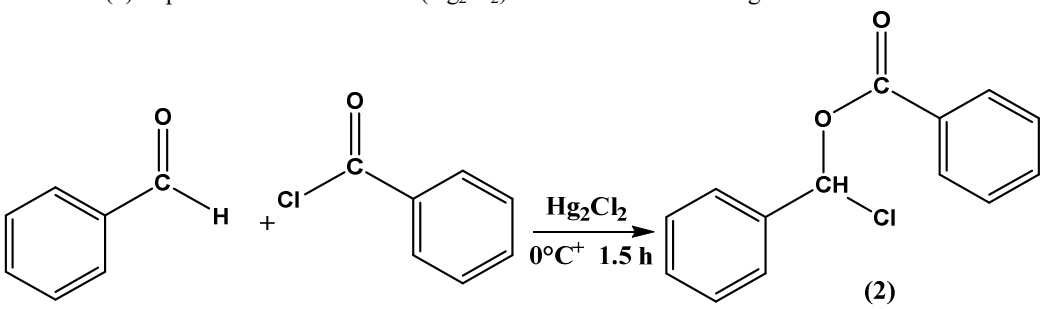
2.2. Reagents and materials

All chemical materials used in this work were produced by sigma - aldrich Company.

2.3. Experimental Procedure and results

2.3.1: synthesises of chloro phenyl methyl benzoate (2):

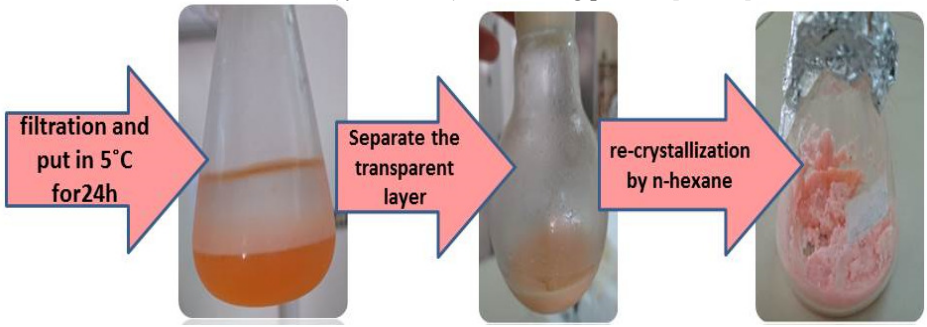
The preparation of chloro phenyl methyl benzoate (2), by reaction of Benzaldehyde (4) with Benzoyl chloride (5) in presence of a Lawis acid (Hg_2Cl_2). As showed in following this reaction:



benzaldehyde **benzoyl chloride** **chloro phenyl methyl benzoate**

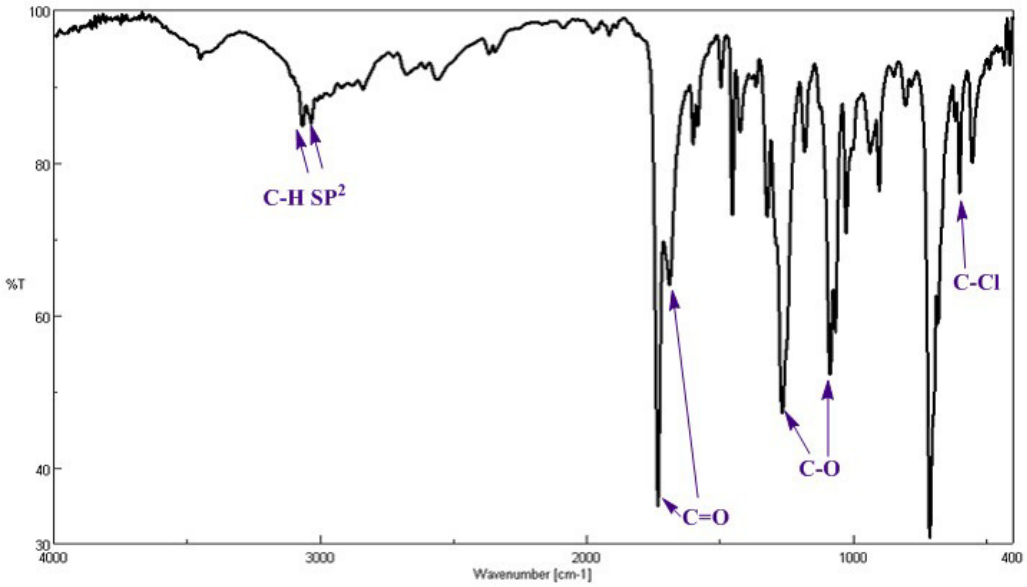
Scheme 1. Synthesis chloro phenyl methyl benzoate (2)

The reaction of (0.01mol, 1.1613ml) of benzoyl chloride in an ice bath, in presence of Hg_2Cl_2 as lawis acid was stirred for 15 min, then (0.01mol, 1.014ml) of benzaldehyde was quickly added, and the reaction stirred for 1.5 hours. The reaction followed by T.L.C in the stationary phase (Ethyl acetate : n-hexane) (4:1). After this time the reaction contined in 5˚C in refrigerator for 24 h, the transparent layer was separated, and recrystallized in n-hexane, and washed by diethyl ether to remove the benzoyl chloride residual. The light pink precipitate then drieded and collected with (yield 95%), it's melting point is [45-46]˚C.



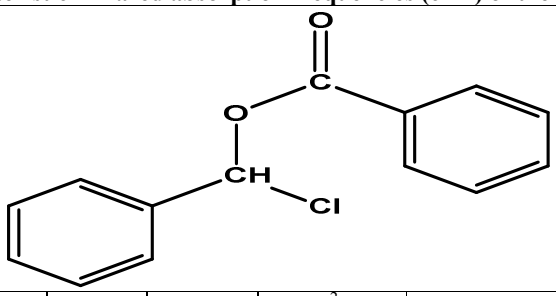
2.3.2: Characterisation of compound (2):

a) **FT-IR Results:** The IR spectroscopy figure(1) shows an sharp and font two absorption peaks at 1732 and 1690 cm^{-1} belong to carbonyl group [9]. In addition there were two absorption peaks at 1266 and 1087 cm^{-1} characteristic of the C-O-C stretching. In addition to absorption peak at 600 cm^{-1} characteristic of C-Cl stretching bond.



Figure(1): IR spectrum of chloro phenyl methyl benzoate(2).

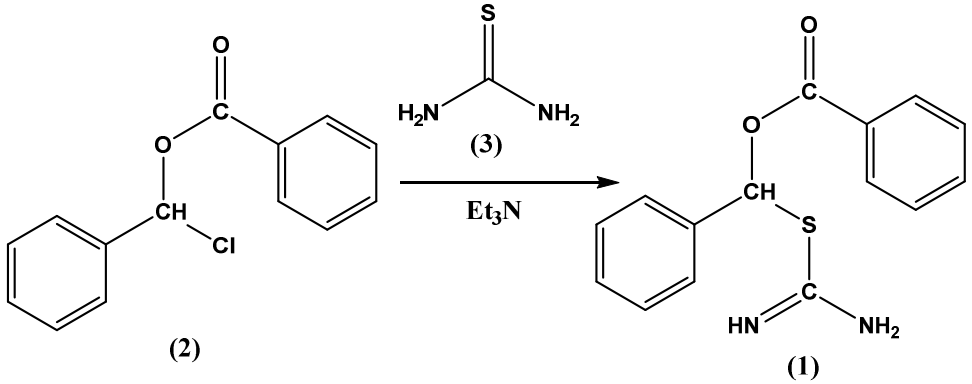
Table(1):characteristic infrared absorption frequencies (cm^{-1}) of the compound (2).



C-Cl	C-O	C=O	C_{SP}^{2}–H	**Functional group**
600	1266 & 1087	1732 & 1690	3067	**Wavenumber (cm^{-1})**

2.3.2: synthesises of compound (1):

The compound (2) has synthesised by the reaction of chloro phenyl methyl benzoate (2) with thiourea (3) in presence of Et_3N as catalyst.



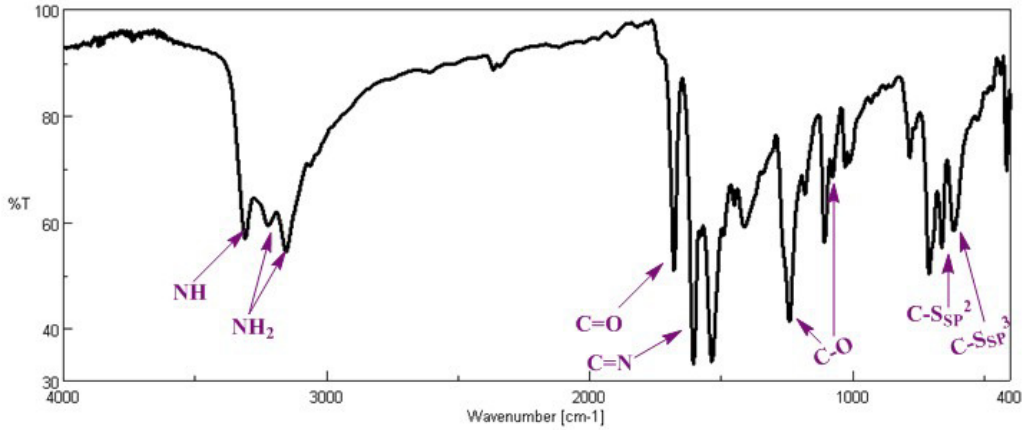
Scheme 2. Synthesis Carbamidoylthio(phenyl)methyl benzoate (1).

The mixture of (0.005mol, 0.38gr) of thiourea dissolved in 10ml of acetone was stirred and the Et_3N was added and the mixture was stirred for 15 min, and (0.005mol, 1.233gr) of compound (2) was added drop by dripping funnel, the reaction stirred in ice bath for 2 h. The reaction followed by T.L.C in the stationary phase (

Ethyl acetate : n-hexane) (2.5:1). After this time the reaction contined in 5˚C in refrigerator for 2 h, and washed by diethyl ether and acetone . The white precipitate collected with (yield 75%), it's melting point is [154-155]˚C.

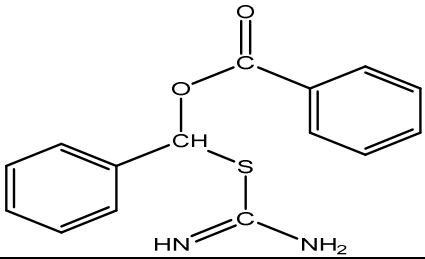
2.3.3: Spectro scopic analysis of compound (1):

a) FT-IR Results: The IR spectroscopy figure(2) shows an obvious absorption peak at 3309 cm^{-1} belong to NH group. In addition there were two absorption peaks at 3220 and 3154 cm^{-1} belong to NH_2. In addition a peak at 1678 cm^{-1} characteristic of carbonyl group. The another absorption peak show in the table(2).



Figure(2): IR spectrum of Carbamidoylthio(phenyl)methyl benzoate(1).

Table(2):characteristic infrared absorption frequencies (cm^{-1}) of the compound (1).



C_{SP}^3-S	C_{SP}^2-S	C-O	C=N	C=O	NH_2	NH	**Functional group**
615	660	1240 & 1075	1604	1678	3220 & 3154	3309	**Wavenumber (cm^{-1})**

b) ^{13}C-NMR Result: Carbamidoylthio(phenyl)methyl benzoate was further confirmed by ^{13}C-NMR spectroscopy in the solvent of DMSO. We observe in figure (3) seven signals refer to fifteen carbon atoms in compound (1).

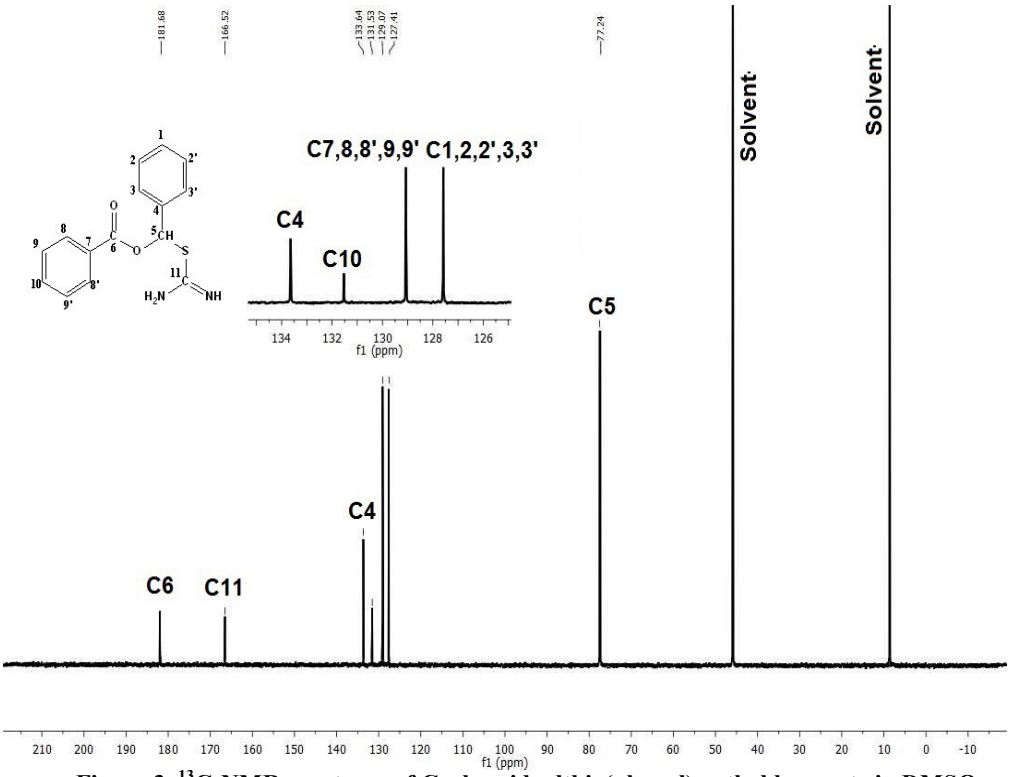
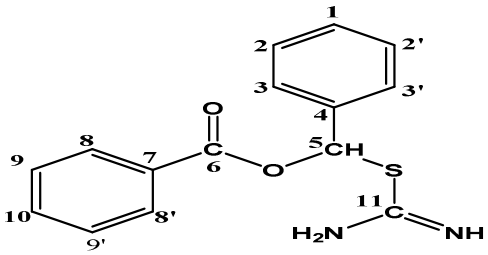


Figure 3. ^{13}C-NMR spectrum of Carbamidoylthio(phenyl)methyl benzoate in DMSO.

Table(3): Explanation of ^{13}C-NMR (ppm) of the Carbamidoylthio(phenyl)methyl benzoate (1).



Chemical shift (ppm)	Position of carbon atom	Chemical shift (ppm)	Position of carbon atom
181.6	6	127.4	1,2,2'
129.07	7,8,8',9,9'	127.4	3,3'
131.5	10	133.6	4
166.5	11	77.24	5

c) ^{1}H-NMR Result: The structure of compound (1) was further confirmed by ^{1}H-NMR spectroscopy in DMSO figure (4). The characteristic peaks at 9.6 and 9.86 ppm belonged to amine 1°, 2° groups. The peaks at 7.49 ppm represented - CH – and aromatic groups. The another chemical shift peaks showed in table(4).

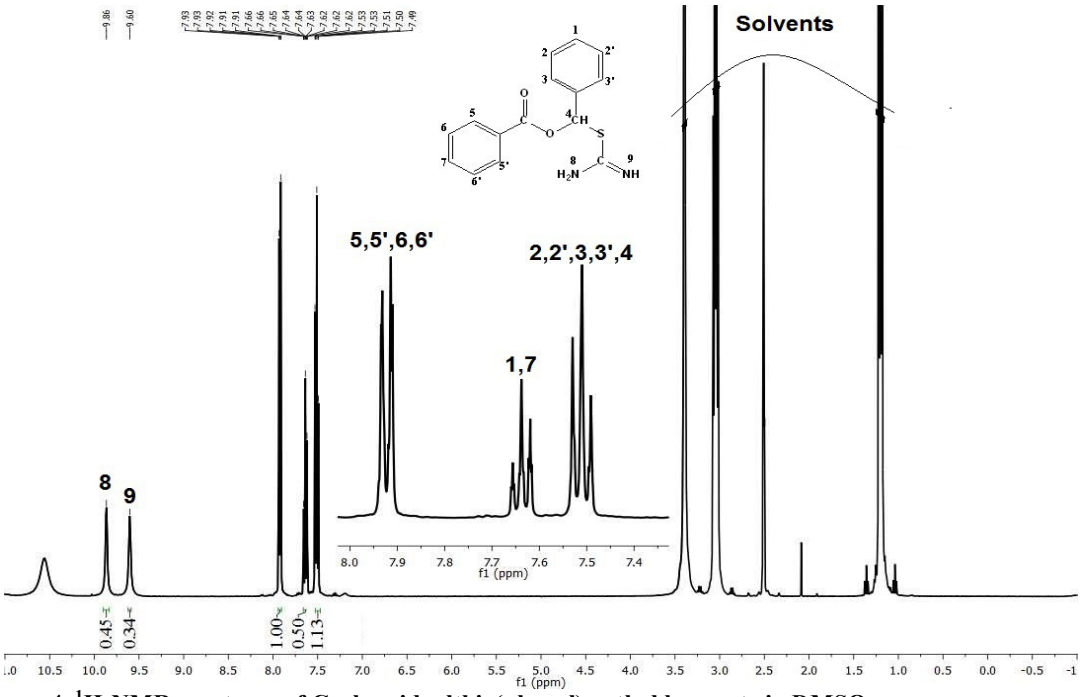
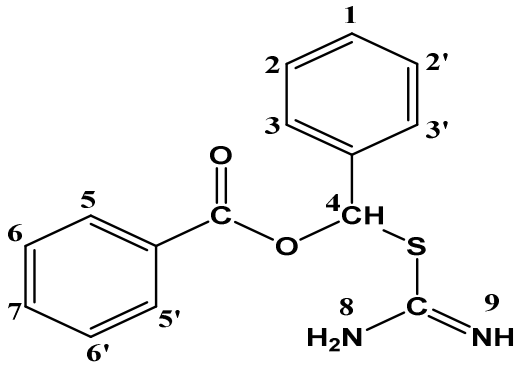


Figure 4. ^{1}H-NMR spectrum of Carbamidoylthio(phenyl)methyl benzoate in DMSO.

Table(4):Explanation of ^{1}H-NMR (ppm) of the Carbamidoylthio(phenyl)methyl benzoate (1).



Kind of Hydrogen Atom	^{1}H-NMR [δ,PPm]	.No
Aromatic	7.62-7.66 (m , 2H)	1,7
Aliphatic & Aromatic	7.49-7.53 (m , 5H)	2,2',3,3',4
Aromatic	7.91-7.93 (dd , 4H) J=8Hz	5,5',6,6'
NH_2	9.86 (S , 2H)	8
NH	9.6 (S , 1H)	9

3. Conclusion

In summary two compound (1) and (2) were synthesised 1-chloro ester (2) with (yield 95%), this compound was used to synthesised the compound (1) with (yield 75%).

4. Acknowledgments

The authors express their thanks to central laboratory of organic chemistry in department of chemistry, Al Baath University, Faculty of sciences for their assistance during the work.

5. References

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