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Biochemical Study of New Cyclic Organic Compounds from Aldol Reaction

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ABSTRACT
The aldol reaction is one of the basic reactions in building the basic organic compounds for many medicines, medical drugs and treatments, which was and still is the cornerstone of cyclic chemistry through organic addition and formation reactions of three-component reactions and others. The aldol reaction was one of the long-established reactions in organic synthesis chemistry, especially in the preparation of ligands, coordination chemistry, organic reagents, analytical reagents, biochemistry, as well as ammonium chemistry because of its paramount importance and several applications. All new manufactured organic compounds recognized through forms of instrumental approaches like (FT.IR, H.NMR, Mass)-spectrophotometric and other chemical studies, as well as estimation of equipped compounds as bio-compounds.

INTRODUCTION

In 1869, Russian scientist Alexander Borodin[1] and French Charles Adole-Wurtz[2-4] independently discovered the reaction that combined two carbonyl compounds (main experiments used aldehydes to synthesize a new-hydroxy carbonyl compound). These are aldols, which are derived from aldehyde and alcohol, a structural ingredient found in many products. Units of measurement aldol skeletal in many substantial molecules were found, both natural and synthetic, the large-scale production of the chemical pentaerythritol and the heart disease medication synthesis Lipitor and atorvastatin (calcium salt)[5-7] are two examples of drugs that utilized the aldol reaction. Furthermore, as described above, a typical modern aldol adding reaction, the nucleophilic addition of ketone enolates to the aldehyde, may be involved[8,9]. It is found that when this formed, the aldol product can occasionally lose a molecule of water, in order to form an unsaturated, carbonyl complex, which is known as aldol condensation. Furthermore, a variety of nucleophilic compounds, including enolates, enolate esters, ketones, aldehydes and a variety of other carbonyl compounds[10-13], can be operated in the aldol reaction.

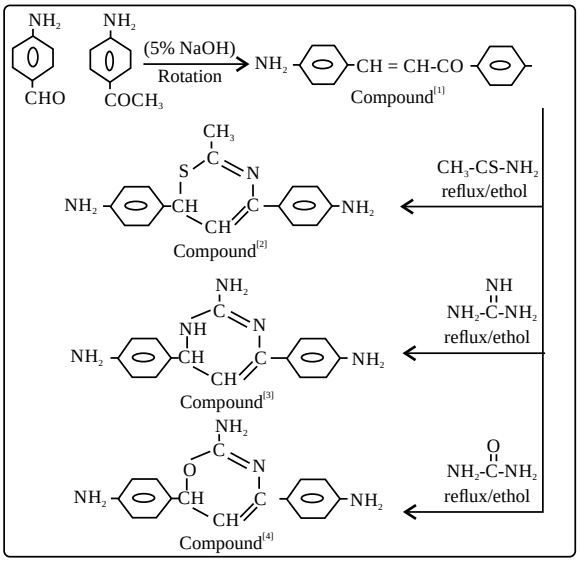
Through the reaction, two main different mechanisms of aldol may proceed. Also, carbonyl compounds can be changed into enol ethers or enols[14-15], like aldehydes and ketones, these types, being nucleophilic in the alpha carbon, can hit the carbonyls of particularly reactive protons like protonated aldehydes. It's called the "enol mechanism". Carbonic acids, from carbonyl compounds, can be removed to form enolates[16,17], that are greatly more nucleophilic compared to enol ethers or enols as well as can hit electrophiles right. Due to ketones are less reactive, the usual electrophile is an aldehyde.

It is found that the condensation may occur, If the reaction conditions are (NaOMe/MeOH/reflux) but this may be avoided by using light reagents and low temperatures (LDA, THF-78°C)[18-21]. Though aldol addition is frequently near completion under irreversible conditions[22]. When an acid catalyst is used, The reaction begins with the acid-catalyzed tautomerization of the carbonyl molecule to enol. The acid also uses a proton to excite the carbonyl group of another molecule, making it super electrolytic[23-26]. Furthermore, Enol is nucleophilic at the alpha carbon, allowing it to attack a protonated carbonyl molecule[27-39], resulting in an aldol next deprotonation. This is dehydrated on a regular basis to yield a unsaturated carbonyl complex[30-32].

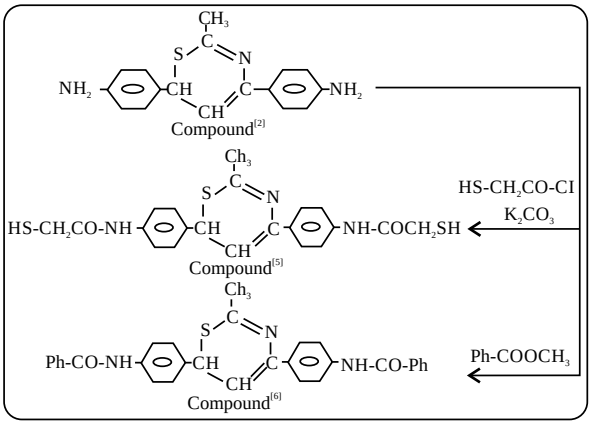
Experimental part: The work dealt with the preparation of several compounds depending on the reactions of aldol and cyclic formation and several measurements were made on them to prove their chemical structures. Several investigative techniques have been smeared to categorize the planned compounds resembling by FTIR analysis"using Shimadzu 8300 with range 400-4000 cm^{-1}". ^{1}H-NMR-Spectrain (DMSO)-solvent, Mass-spectrumin addition to Bio-Assay for compounds.

Preparation processes[4-8]:

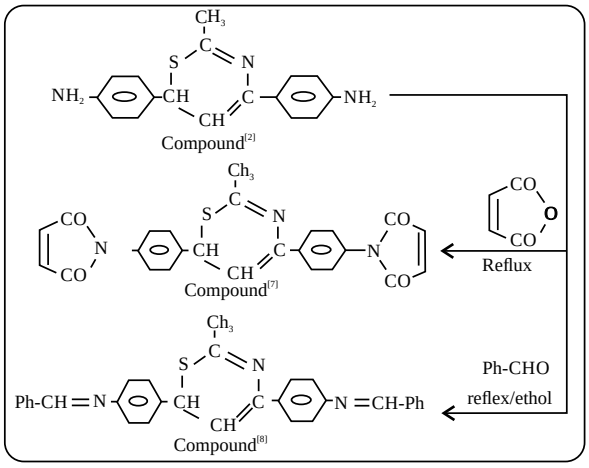
- **Preparation process of compound-1 (C1):** (0.01 mole) of 4-aminobenzaldehyde rotated with (0.01 mole) 4-aminoacetophenonein presence of (5 % of sodiumhydroxide) with continues rotation for (8 h) in absolute ethanol via Aldole reaction according to methods[4-8] to yield precipitation, the product filtered, dried, then recrystallized to produce (C1)
- **Preparation process of compound-2 (C2):** (C1) (0.01 mole) chalcone compound was condensed with (0.01 mole) thioacetamide in the presence of hydrochloric acid for 8 h, the product was filtered, dried and recrystallized to generate six-membered ring acts (C2) according to procedures[4-8]
- **Preparation process of compound-3 (C3):** (C1) (0.01 mole) that acts chalcone compound was condensed with (0.01 mole) from guanidine in presence of hydrochloric for (7 h), the product filtered, dried, then recrystallized to produce six-membered ring acts (C3) according to procedures[4-8]
- **Preparation process of compound-4 (C4):** (C1) (0.01 mole) that acts chalcone compound was condensed with (0.01 mole) from urea in presence of hydrochloric for (7 h), the product filtered, dried, then recrystallized to produce six-membered ring acts (C4) according to procedures[4-8]
- **Preparation process of compound-5 (C5):** (C2) (0.01 mole) was condensed with (0.02 mole) from mercapto-acetyl chloride in presence of potassium carbonate (0.001 moles) for (4 h), the product was filtered, dried, then recrystallized to produce (C5) according to procedures[8].
- **Preparation process of compound-6 (C6):** (C2) (0.01 mole) was condensed with (0.02 mole) from methylbenzoate for (3 h), the product was filtered, dried, then recrystallized to produce (C6) according to procedures[4-8].
- **Preparation process of compound-7 (C7):** (C2) (0.01 mole) was condensed with (0.02 mole) from maleic anhydride for (5 h) by insertion reaction in presence of acetone as a solvent, the product was filtered, dried, then recrystallized to produce (C7) according to procedures[4-8]
- **Preparation process of compound-8 (C8):** According to methods[4-8], (C2) (0.01 mole) was condensed with (0.02 mole) from benzaldehyde for (3 h) by Schiff reaction with drops of glacial acetic acid in the presence of ethanol as a solvent and the product was filtered, dried and recrystallized to yield (C8)



Scheme 1: C1-C4: Synthesis procedure



Scheme 2: C5 and C6: Procedure of synthesis



Scheme 3: C7 and C8: Procedure of synthesis

RESULTS AND DISCUSSION

Spectral sympathy

FT.IR-sympathy of manufactured compounds: The new functional groups in spectra appeared to be strong evidence for formatted new compounds via group disappearance, despite the appearance of additional new groups via new bands that designate to the production of the new compounds that represented via:

According to literature of Aljamali[29], it appeared bands at (3200, 3213 cm^{-1}) due to (NH_2) amine group, band at (1678 cm^{-1}) due to carbonyl group of chalcone and band at (3128 cm^{-1}) due to (CH = C) of chalcone.

(C2): it appeared bands at (3270, 3300 cm^{-1}) due to (NH_2) in amine group, band at (1647 cm^{-1}) due to (C = N) endocycle, band at (1103 cm^{-1}) due to(CH-S), band at (772 cm^{-1}) due to (C-S) in compound cycle, band at (1289 cm^{-1}) due to (C-S) in compound cycle, band at (1289 cm^{-1}) due to (C-N).

(C3): it appeared bands at (3292, 3309 cm^{-1}) due to (NH_2) in amine group, band at (3200 cm^{-1}) due to (NH) in amine of cycle, band at (1653 cm^{-1}) due to (C = N) endocycle, band at (1274 cm^{-1}) due to (C = N)endocycle, band at (1274)cm-1 due to (C-N).

According to literature of Aljamali[29], it appeared bands at (3200, 3213 cm^{-1}) due to (NH_2) amine group, band at (1678 cm^{-1}) due to carbonyl group of chalcone and band at (3128 cm^{-1}) due to (CH = C) of chalcone.

(C4): Bands appeared at (3286, 3221 cm^{-1}) due to (NH_2) in amine group, (1178 cm^{-1}) due to (C-O-C) in cycle, (3164 cm^{-1}) due to (CH = C) alkene and (1655 cm^{-1}) due to (C=N) endocycle.

(C5): It appeared as a band at (3211 cm^{-1}) due to (NH-CO) in the amide group, a band at (1683 cm^{-1}) due to the carbonyl group of the amide (CO-N-), a band at (2428 cm^{-1}) due to (SH) of thiol, a band at (1123 cm^{-1}) due to (CH-S) and a band at (767 cm^{-1}) due to (C-S) According to literature of Aljamali[29], it appeared bands at (3200, 3213 cm^{-1}) due to (NH_2) amine group, band at (1678 cm^{-1}) due to carbonyl group of chalcone and band at (3128 cm^{-1}) due to (CH = C) of chalcone.

(C6): It appeared band at (3300 cm^{-1}) due to (NH) in amide group, band at (1696 cm^{-1}) due to carbonyl group of amide, band at (3120 cm^{-1}) due to alkene in (CH = C) in cycle, band at (3120 cm^{-1}) due to alkene in (CH = C) in cycle, band at (3120 cm^{-1}) due to alkene in (CH = C) in cycle (1651 cm^{-1}) due to (C = N)endocycle, band at (1112 cm^{-1}) because of (CH-S), band at (790 cm^{-1}) due to (C-S) in cycle of compound.

(C7): It appeared band at (1673 cm^{-1}) due to carbonyl group of amide, band at (3104 cm^{-1}) due to alkene in (CH=CH) in cycle, band at (1657cm^{-1}) due to (C = N) endocycle, band at (1124 cm^{-1}) due to (CH-S), band at (777 cm^{-1}) due to (C-S) in cycle of compound.

According to literature of Aljamali[29], it appeared bands at (3200, 3213 cm^{-1}) due to (NH_2) amine group, band at (1678 cm^{-1}) due to carbonyl group of chalcone and band at (3128 cm^{-1}) due to (CH = C) of chalcone.

According to literature Aljamali[29], it appeared band at (1627 cm^{-1}) due to (CH=N) of imine group, band at (3098 cm^{-1}) due to alkene in (CH = C) in cycle, band at (1644 cm^{-1}) due to (C = N)endocycle, band at (1118 cm^{-1}) due to (CH-S), band at (759 cm^{-1}) due to (C-S) in compound cycle. Other frequencies were visible in some Fig. 1 and 2.

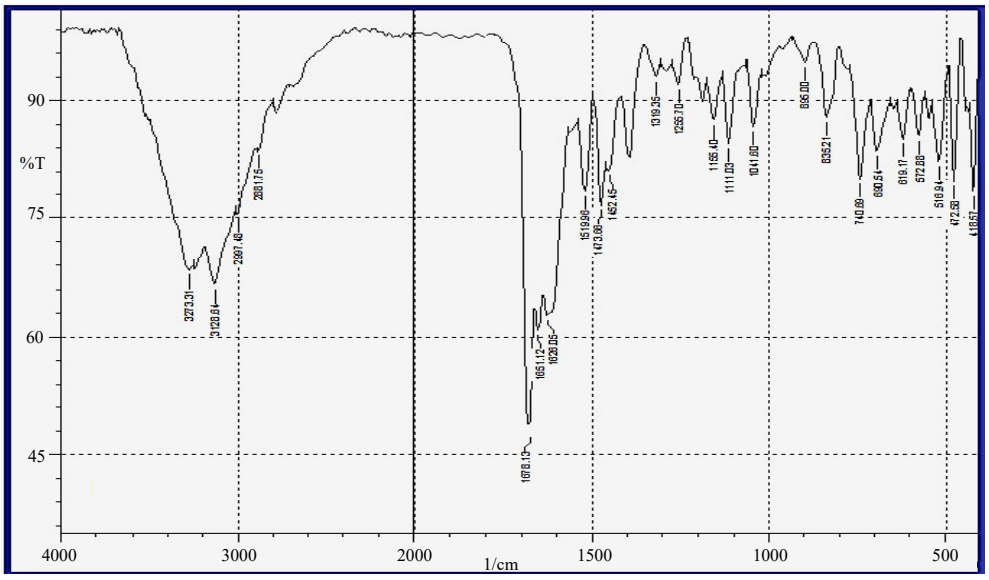


Fig. 1: The IR spectrum of C1

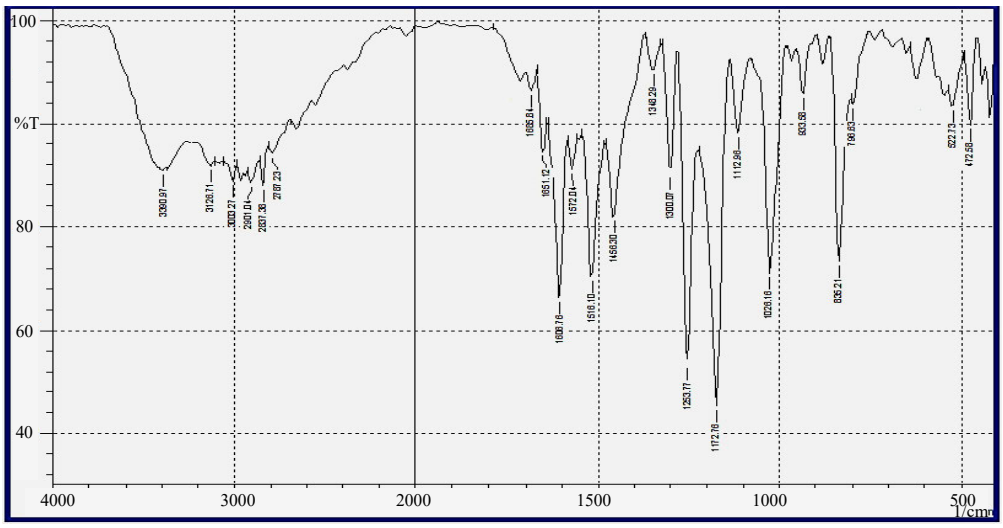


Fig. 2: The IR spectrum of C6

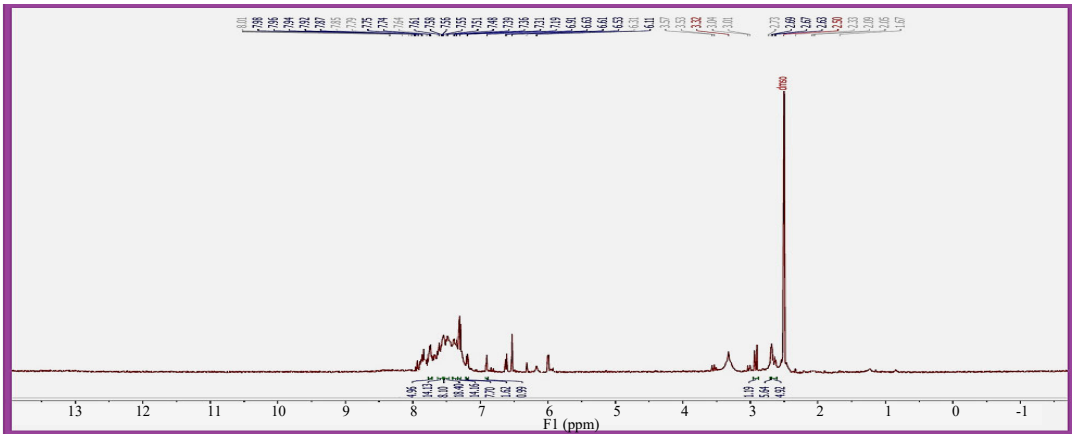


Fig. 3: 1H-NMR spectrum of C1

^{1}H.NMR-sympathy of compounds: The new functional groups in spectra appeared to be strong pieces of evidence for formatted new compounds due to the disappearance of groups while the appearance of additional new groups via new signals that designate to the production of the new compounds that represented via.

C1: Signals at δ (6. 11) to (CH = CH) protons of chalcone, (3.57) to (NH_2) protons of an amine group, protons of phenyl ring at δ (6.96-7.98). but the signals of chalcone disappeared in new (C2-C8) and other signals appeared like the signal at δ (2.36-2.77) due to the proton of (CH-S) in a cycle of compounds {2-8} respectively, other signals like δ (9.01 to 9.43) according to the literature of Aljamali[29], signal due to proton of amide (NH-CO), respectively in (C5 and C6), signal due to proton of Alkene (CH = C) at (2.82-2.98) in compounds 2-8, respectively and signal at (8.61) due to proton of imine group in (CH = N) in (C8) (Fig. 3-6).

Mass-spectra of new compounds: The spectrum of (C7) gave fragments represented by parts of the prepared compound that improved structure of a compound with strong evidence (Fig. 7).

Some physical and chemical properties and analysis: Other Physical and chemical investigation and other chemical measurements in Table 1.

Antibacterial estimation[26]: The estimation of manufactured compounds have been studied against brands of bacteria viamedium (agar) thru the following sevral processes (29). The estimation of mirobil inhibition executed at (three concs) (15, 30, 50 micrograms) concentration in blank solvent (DMS0) with bacteria (*Staphylococcus aureus*, *E. coli*, *Streptococcus pneumonia*). The studied brands of bacteria incubated for (24 h) at (37°C). The estimation of compounds on brands of seemed clear data,

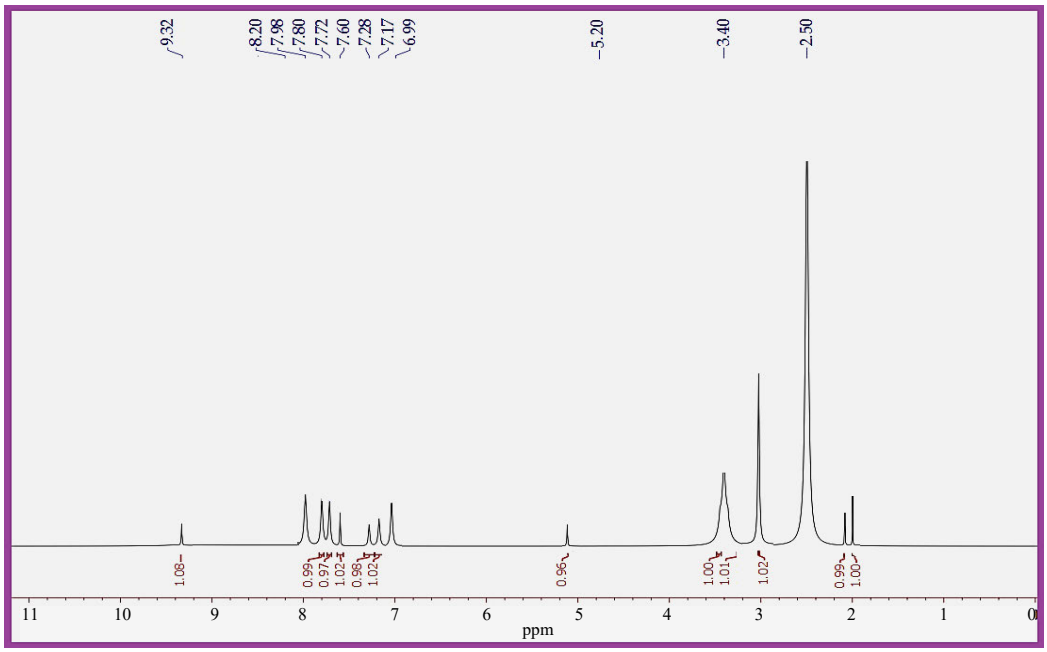


Fig. 4: 1H-NMR spectrum of C4

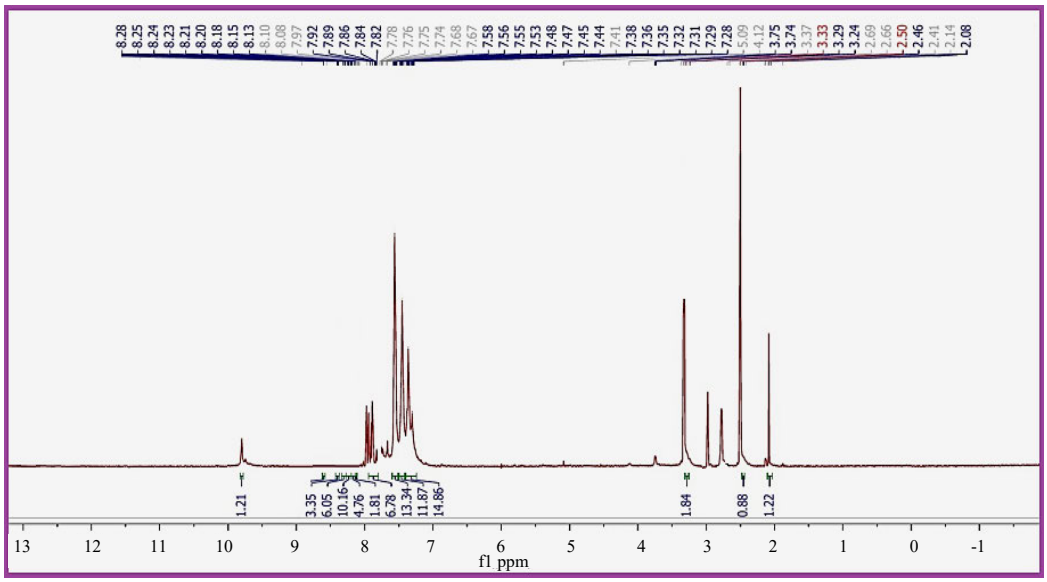


Fig. 5: 1H-NMR spectrum of C6

Table 1: Some physical description of new heterocyclic compounds

Compounds	Product (%)	Colour	M.P (C°)
C1	78	Orang	162
C2	80	Yellowish orang	178
C3	84	Deep yellow	188
C4	82	Reddish yellow	192
C5	80	Reddish orang	200
C6	80	Yellowish	198
C7	78	Yellowish orang	228
C8	82	Yellowish orang	202

with compounds (5 and 7) outperforming other compounds due to (sulphur and nitrogen)-atoms in the same compounds that contribute to bacterial inhibition of bacteria all results in Table 2 and Photos 1-2.

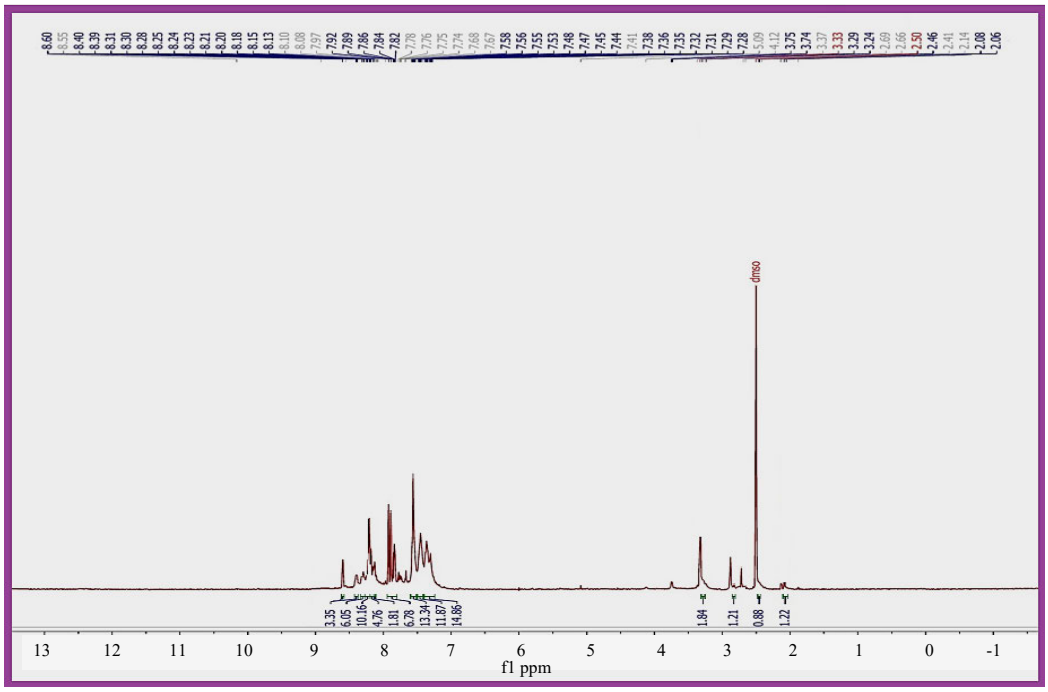


Fig. 6: 1H-NMR spectrum of C8

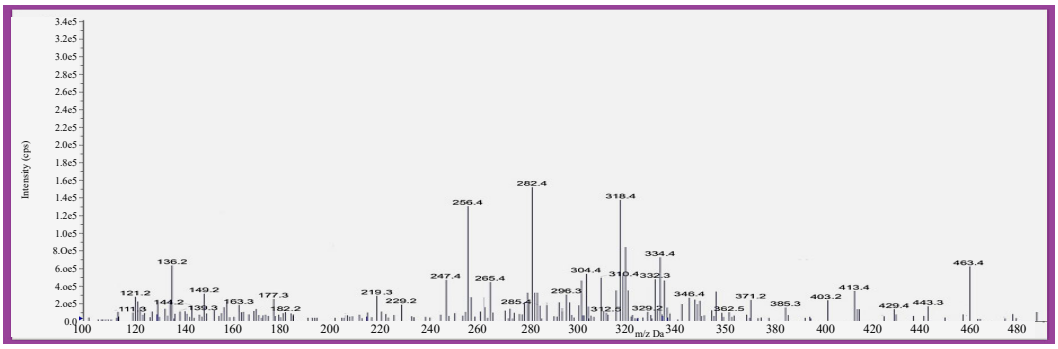


Fig. 7: The mass spectrum of C7

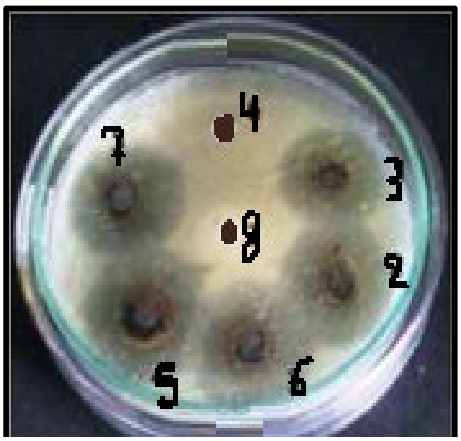


Photo 1: Inhibition of compounds on *Escherichia coli*

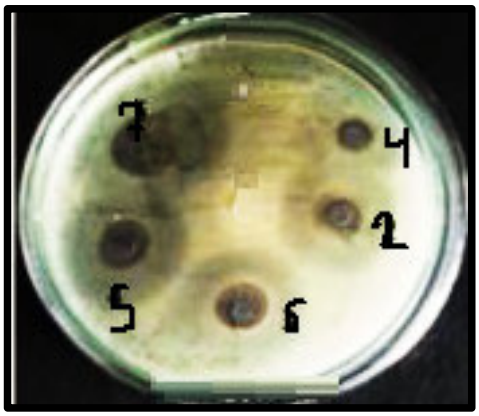


Photo 2: Inhibition of Compounds on *Streptococcus pneumonia*

Table 2: Inhibition test of compounds in concentration (30 mg)

Compounds	*Staphylococcus aureus*	*Streptococcus pneumonia*	*Escherichia coli*
C1	v	v	v
C2	vv	vv	vv
C3	vv	vv	v
C4	vv	vv	v
C5	vvv	vvv	vv
C6	vvv	vv	vv
C7	vv	vv	vv
C8	v	v	v

v: Inhibition (2-6) mm, vv: Inhibition (8-12) mm, vvv: Iinhibition (13-18) mm

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