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Article

Preparation and Diagnosis of Atenolol And Amlodipine and Their Interactions With Some Medical Drugs

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Abstract: Atenolol and salicylic acid are prepared by esterifying the reaction between salicylic acid and atenolol in the presence of an acidic catalyst, H_2SO_4Preparation of amlodipine with aspirin by esterification of aspirin chlorination and then its reaction with amlodipine. We identified the prepared and derived compounds using FT-IR, HNMR, and C13NMR techniques.

Keywords: Aylodopine, Atenolol, Aspirin, Sildenafil

Introduction

Atenolol (ATL) is a prescription medication used to treat high blood pressure and reduce stress on the heart. It belongs to a class of drugs known as cardioselective beta-blockers. Atenolol can be prescribed alone or in combination with other medications and is available in liquid suspension and tablet forms. It is sold under the brand name Tenormin and in a generic version [1]. This medication has been widely utilized to lower the risk of death in patients with high blood pressure and cardiovascular diseases. Atenolol primarily affects the heart; rather than dilating blood vessels like some other medications, it operates through the central nervous system (CNS). By blocking the effects of certain chemicals released by the CNS, it prevents an increase in heart rate, thereby reducing stress on the heart.It's important to note that atenolol is not an ACE inhibitor; it is classified as a beta-blocker. Although both ACE inhibitors and beta-blockers are used to treat or prevent conditions such as high blood pressure, heart failure, stroke, and migraines, they function through different mechanisms. Additionally, beta-blockers can help relieve angina or chest pain, which is not a primary action of ACE inhibitors. [2]

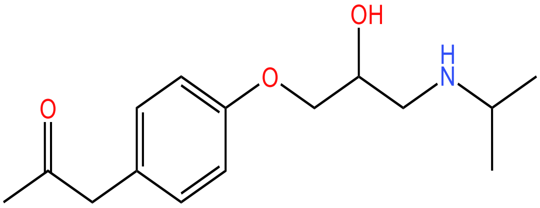


Figure 1. Chemical structure of atenolol [3]

Amlodipine (AML) is a third-generation calcium channel blocker (CCB) antihypertensive drug. Amlodipine binds to specific high-affinity binding sites on the calcium channel complex. It is safer and more tolerable than previous generations of amlodipine. It works by blocking calcium channels, thereby inhibiting the initial influx of calcium. The decrease in intracellular calcium concentration leads to reduced smooth muscle contraction and increased smooth muscle relaxation and vasodilation, which in turn leads to lower blood pressure. First discovered in 1987, the FDA initially approved Amlodipine in 1996, and the UK approved it for medical use under the trade name Norvasc in 2007. It increases the flow of oxygen to the heart muscles. Amlodipine also acts directly on the smooth muscles in the peripheral blood vessels to produce dilation in the peripheral arterial vessels, which reduces peripheral vascular resistance and blood pressure .[4]

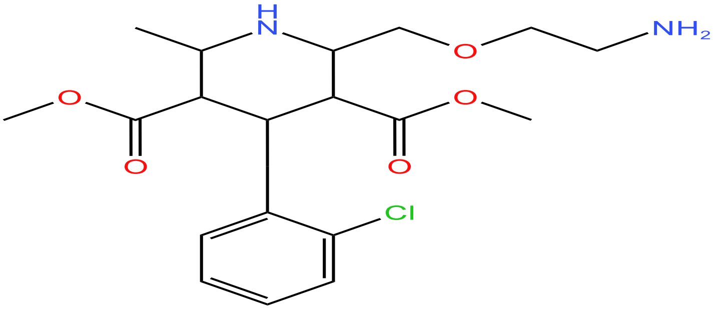


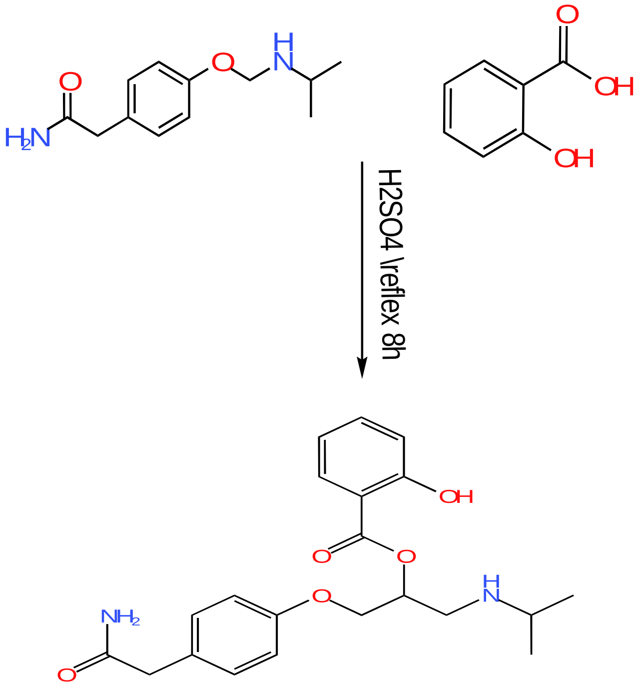
Figure 2. Chemical structure of amlodipine .[4]

Materials and Methods

The practical part

Methods for preparing atenolol with salicylic acid by esterification (A1)

mixed (2.66 g, 0.01 mol) of ALT (A2) with (1.38 g, 0.01 mol) of salicylic acid in (30 ml) of THF (dry) and then added 1 ml of concentrated sulfuric acid to the mixture. We stirred the mixture and heated it for 12 hours. We cooled the mixture, formed a white residue, filtered it, and recrystallized it with ether. Its melting point was (168-164) °C. The yield was 86%. [4]



Preparation of amylodopine derivative by chlorination of aspirin:

(2gm1 0.0 mol) of aspirin (E2) was dissolved in (5) ml of THF in a 10 ml volumetric flask, then 0.5 of SOCl was added and heated at 50°C for some time. The mixture was placed in the microwave for (8 hours (and then the product was reacted with amlodipine (1.38 gm in 0.01), cooled and 0.5 ml of TEA was added to the ice, after which a precipitate was formed. The resulting precipitate was filtered and recrystallized using ethanol, and the melting point was measured. It had a very high melting point, exceeding the values found in the device .[5]

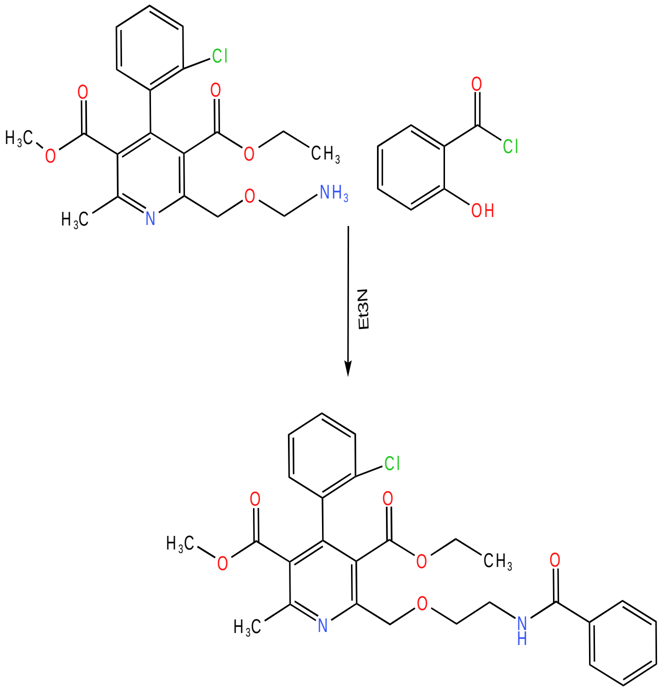
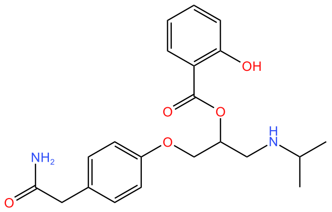
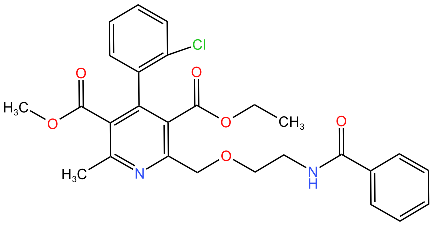


Table 1. shows some physical properties and percentages of compounds (A1-A2)

Comp.	R	Color	M.P C	Yield
A1		White	168-164	**86%**
A2		White	High percentage above 300	**84%**

Result and Discussions

Diagnosis of the atenolol salicylate ester compound (A1)

We prepared this compound by reacting atenolol with salicylic acid in the presence of concentrated sulfuric acid, using THF as a solvent for the resulting reaction. We carried out all tests and laboratory diagnostics by measuring the degree of anis and using IR-HNMR-C13. The compound was identified through the FT-IR spectrum, where a stretch band (OH) of the acid appeared at cm^{-1} (3240). The FT-IR spectrum showed the appearance of a band at the frequency cm-1 (3134) that belongs to the aromatic (C-H) group, a band at the frequency cm-1 (2995) that belongs to the aliphatic (C-H) group, a band at the frequency cm-1 (1660) that belongs to the amide carbonyl group, an overlapping band above the amide that belongs to the ester carbonyl approximately around (1700), and a band at the frequency cm-1 (1612) that belongs to the aromatic (C=C) group[6,7], as shown in Figure (3) below:

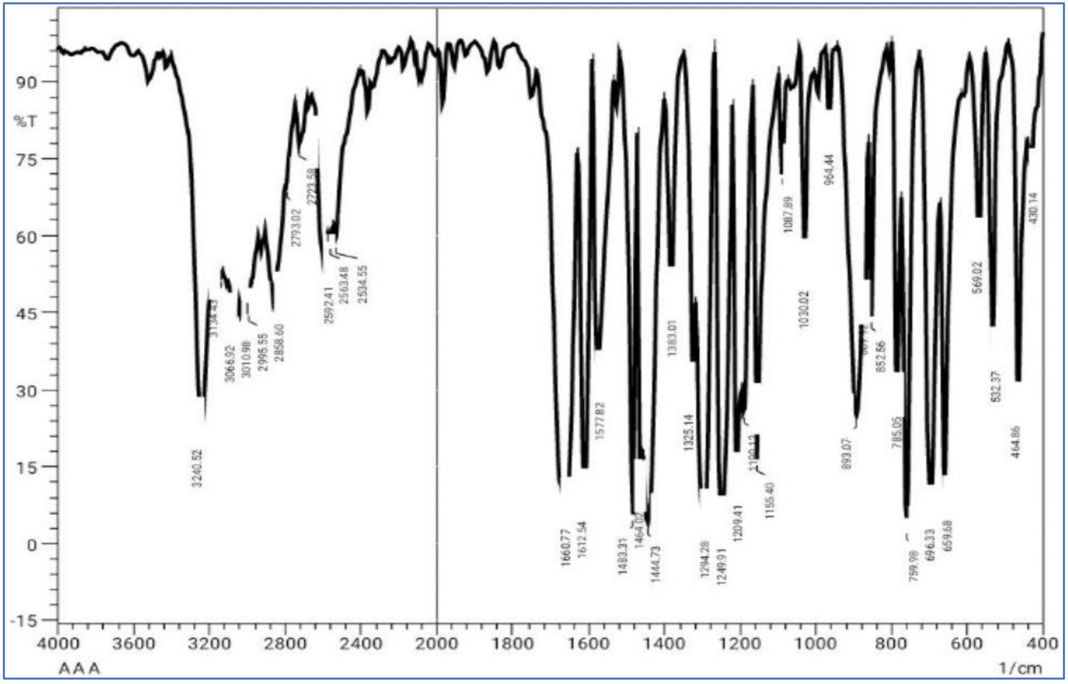


Figure 3. compound A1 shows IR values.

The 1H-NMR spectrum of the compound (1A) revealed a single signal at position (6.91) caused by the protons of (RCONR), multiple signals at positions (7.39-7.42) caused by the protons of the aromatic ring, a single signal at position (2.47) caused by the proton of (COCH), and a single signal at position (11.51) caused by the proton of the (RCOR) group[8,9], as depicted in Figure (4) below.

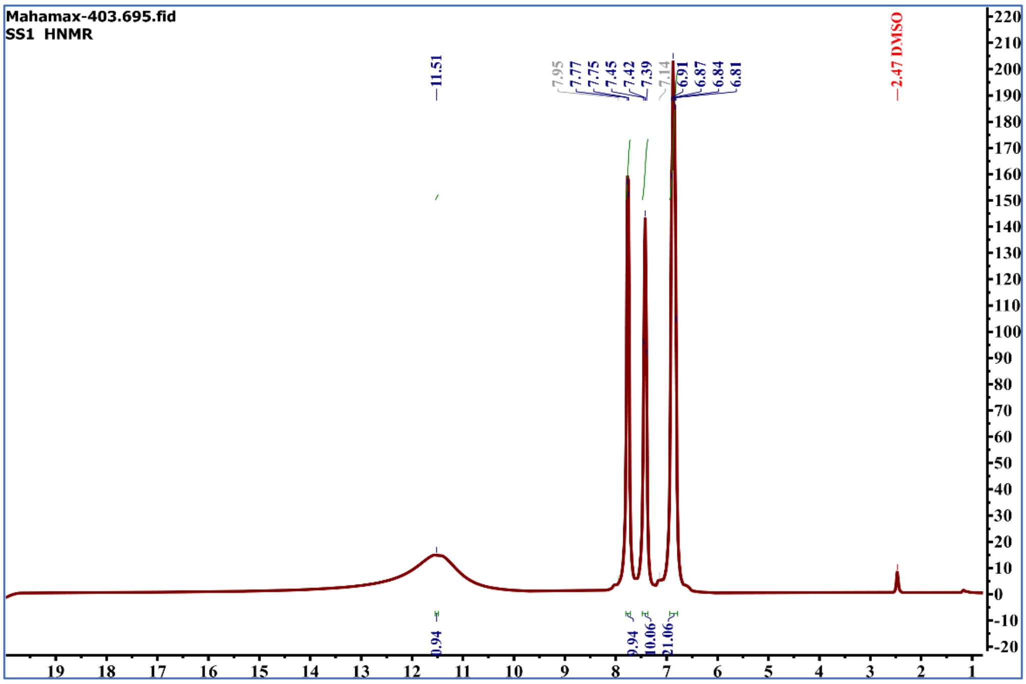


Figure 4. compound A1 by HNMR

Figure (5) below illustrates the appearance of a single band at 39.94 C-C and -CH, the appearance of two bands at 130-135 due to the aromatic ring, a band at 161 due to the ester RCOR, and multiple bands at 113, 117, and 119 due to C=C[10,11].

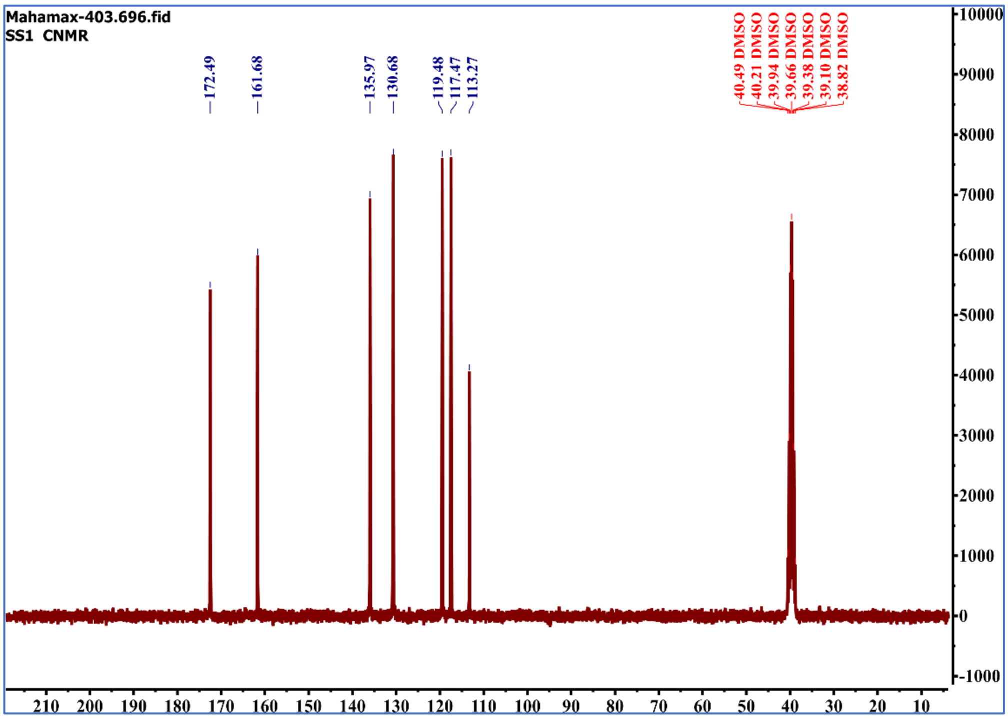


Figure 5. of compound A1 by C^{13}NMR

Diagnosis of compound A2

The resulting compound was identified by (FT-IR) spectrum, as shown in the Figure for compound (A2), as the spectrum showed an absorption band at the frequency cm-1 (3064) belonging to the aromatic (C-H) group. It was also noted that bands appeared at the frequency cm-1 (2949-2980) belonging to the stretching of the aliphatic (C-H) bonds. A band appeared at the frequency cm-1 (1695)) belonging to the (N-C=O) group. It was possible to note the appearance of bands at the frequency (1626) cm-1 belonging to the (O-C=O) group and two bands at the frequency -1 (1589-1554), which belong to the stretching of the aromatic (C=C) bond. It was noted that an absorption band appeared within the range cm-1 (3412) belonging to the proton of the (OH) N-H amide group[12,13], as shown in Figure (6) below:

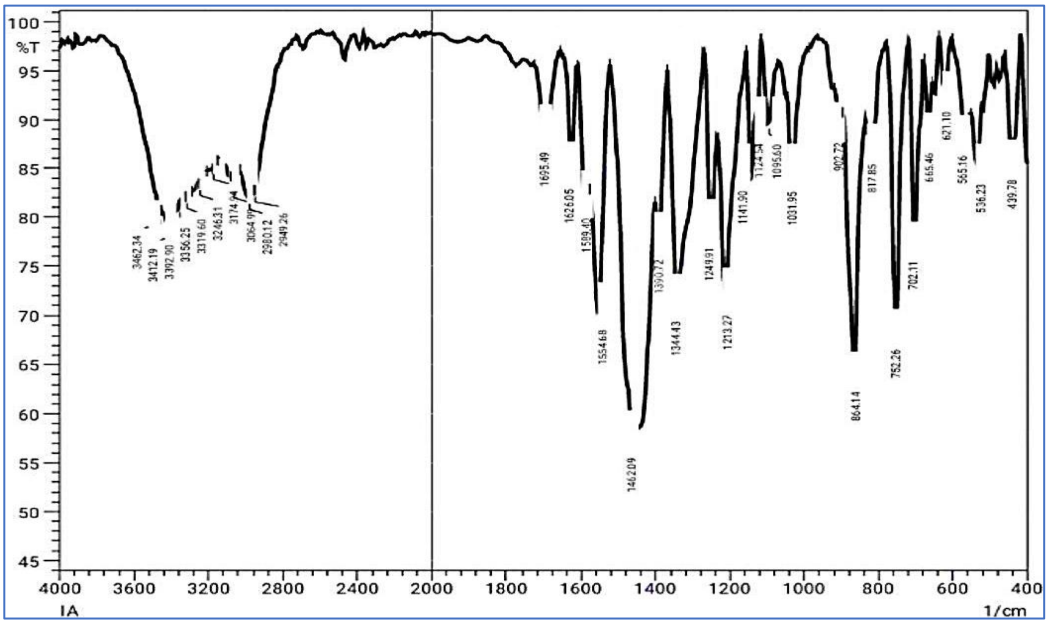


Figure 6. compound A1 shows IR values.

A signal was observed at a chemical shift of 1.04 ppm, which can be attributed to the (RCH3) group. Additionally, multiple signals appeared in the range of 7.1 to 7.2 ppm, corresponding to the protons of the aromatic ring [1]. A distinct signal was also detected at 8.25 ppm, associated with the proton of the (-N=C-H) group. Furthermore, a signal was noted at 11.87 ppm, representing the proton of the (OH) group[14,15], as illustrated in Figure 7 below.

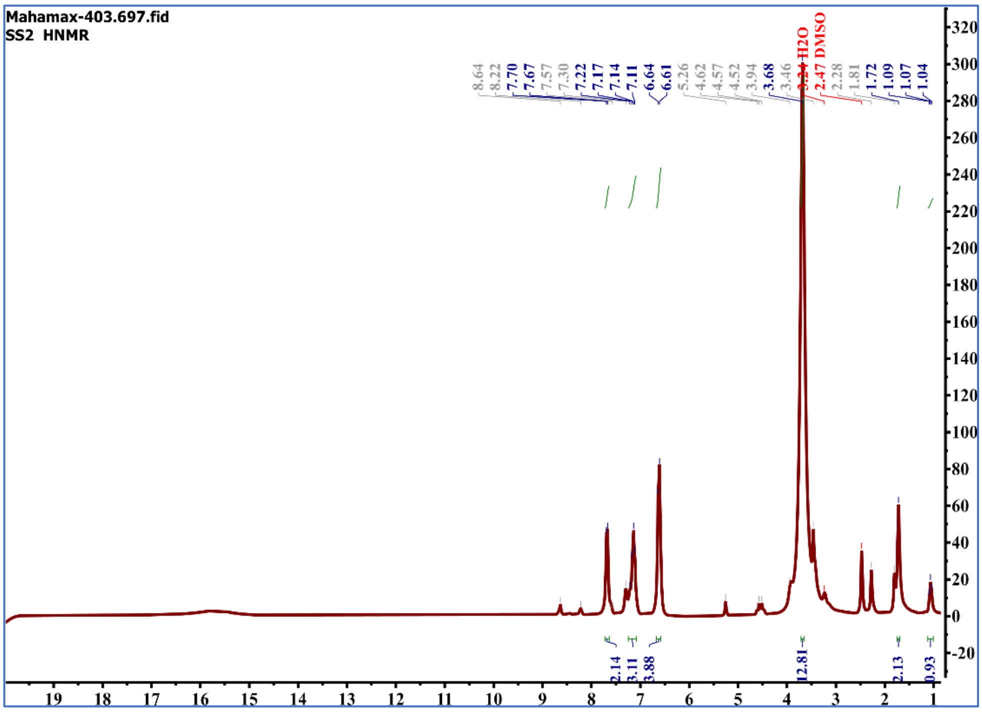


Figure 7. compound A2 by HNMR

The appearance of a single band 39.80 C-C,-CH3 and the appearance of two bands at 130-132 due to the aromatic ring a band at 162 due to the ester RCOR, and a multiple band 116.25, 116.85, 120.45 due to C=C[16,17] as in Figure (8) below

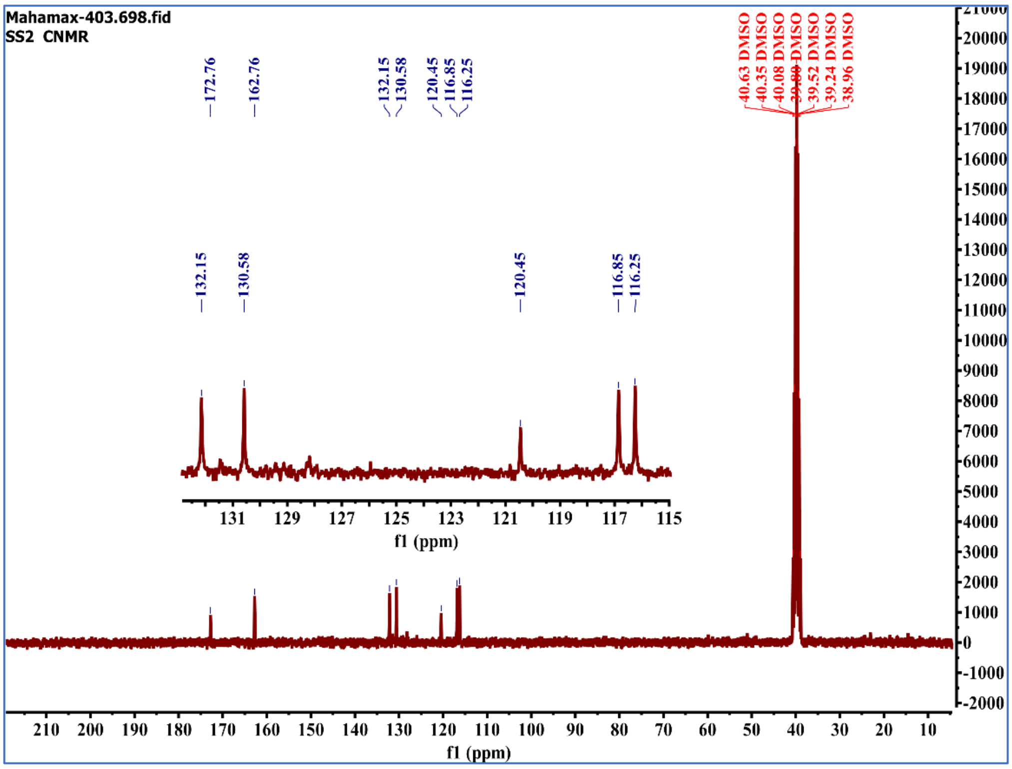


Figure 8. of compound A2 by C^{13}NMR

Conclusion

The prepared compounds showed purity as proven by spectroscopic measurements such as infrared spectra and proton and carbon NMR spectra [2]. The article discusses the preparation, diagnosis, and interactions of two medications: Atenolol and Amlodipine. It outlines their chemical synthesis processes, including esterification reactions with salicylic acid and aspirin, and describes the methods used to characterize the resulting compounds, such as FT-IR, HNMR, and C13NMR techniques. The findings highlight the purity and structure of the synthesized compounds, with detailed spectral analyses confirming their chemical characteristics. The study contributes to the understanding of how these drugs can be modified and the potential interactions with other medications, providing insight into their pharmacological profiles. The overall conclusion emphasizes the successful preparation and characterization of Atenolol and Amlodipine derivatives, showcasing their purity and the application of advanced diagnostic techniques. [20]

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