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Synthesis of Heterocyclic Compounds Via Chalcone Derivatives and Study Activity of Some these Compounds as Pesticides (Anti-Dubas)

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Abstract

In this research, we synthesized oxazine and thiazine derivatives (3-6). These derivatives of chacone compounds (1 and 2) that synthesized from 4- hydroxyacetophenone and aldehyde derivatives such as, 4-bromobenzaldehyde and 4- chlorobenzaldehyde. These derivatives of chalcone (1-2) reacted with urea to produce oxazine derivatives as 4-[4-amino-6-(4-subsutitedphenyl)-2H-1,3-oxazin-2-yl] phenol (3 and 4) and thiourea to produce 4-[4-amino-6-(4-subsutitedphenyl)-2H-1,3-thiazin-2-yl] phenol (5 and 6). These derivatives were characterization by spectroscopy methods such as, FTIR and 1HNMR. Some compounds (3 and 5) that synthesized tested as Pesticides (anti-dubas) through the spray method and these derivatives killed Dubas and we noted the compound 5 was more active from compound 3 because compound 5 have been S atom in his structure that bonded in active group in dubas by effect on Cholinesterase enzyme in the insect.

Keywords: Chalcone, Oxazine, Thiazine, Insects, Insecticides

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Introduction

As a result of their high reactivity and wide range of reactions, chacone derivatives are easily made, frequently used, and extremely useful intermediates in organic synthesis (Zhuang et al., 2017). These molecules have extensive applications in a wide range of industries and pharmaceutical applications in medical filed (Barrantes et al., 2021).

Oxazines have been heterocyclic molecules of carbon which have a ring structure with both an oxygen and a nitrogen atom (Lihumis et al., 2022). Thiazine has three isomers: 1,2,1,3 and 1,4-thiazine since it is a heterocyclic molecule with four carbon atoms and one each of nitrogen and sulphur in a different position (Morak-Młodawska et al., 2019). Both oxazine and thiazine derivatives have been several applications in medical and industries fields (Sadhu & Mitra, 2023).

Because they can eat plant leaves, stems, roots, and other parts, insects pose a serious threat to agriculture because they might harm or even kill plants while doing so. Pesticides must be used to properly protect crops from various pests, some of which only eat specific crops. According to Borrer & Delong (1954) Before pesticides were widely used, insects frequently destroyed a significant portion of the crops that were grown, causing losses (Gupta, 2019). Insecticides are compounds that kill insects or stop them from acting in ways that are unwanted or dangerous (Gupta, 2019). Some have an impact on neurons by interfering with the normal

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sodium/potassium equilibrium and reducing the flow of nerve impulses. Some of them act on the GABA (gamma-aminobutyric acid) receptor to prevent chloride ions from entering the neurons, which causes a hyperexcitable condition defined by tremors and convulsions.

In this study, we successfully synthesized and characterized many different kinds of novel thiazine and oxazine derivatives. Our research focuses on the development of chalcone derivative compounds that could be used in a variety of products, including agricultural chemicals such as insecticides.

Experimental Procedure

Sigma-Aldrich and BDH were used to purchase all of the chemicals and reagents. They weren't further purified; they were used as received.

The process of generating the chalcones derivatives [1-2] (Mandge et al., 2007; Nasir Abbas Bukhari et al., 2012).

Chalcone synthesis by claisen schimidt Reaction to Condensation reaction (Sabre, 2022). Both, firstly, 200 ml of methanol, and secondly Sodium hydroxide (22 gm) that dissolved in 250 ml of distal water. The mixture added to a flask (500 ml) and stirred in an ice bath for 15 minutes. A combination of 0.01 moles of 4-substitutedbenzaldehyde (4-chlorobenzaldhyde and 4-bromobenzaldehyde) and 0.01 moles of 4-hydroxyacetophenone.

Synthesis of 4-[4-amino-6-(4-subsutitedphenyl)-2H-1,3-oxazin-2-yl]phenol (3 and 4) (Didwagh & Piste, 2013).

A combination of produced chalcons consisting of 0.01 mol of (1 and 2), 0.02 mol of urea, and 7 mL of sodium hydroxide were dissolved in ethanol and stirred for about 12 hours using a magnetic stirrer. Then, after an hour of continuous stirring, 25ml of cold distilled water was added. following 24 hours in the refrigerator. The precipitate was made from ethanol and then recrystallized.

Synthesis 4-[4-amino-6-(4-subsutitedphenyl)-2H-1,3-thiazin-2-yl]phenol (5 and 6) (Didwagh & Piste, 2013; Didwagh & Piste, 2013).

A mixture of chalcons synthesized 0.01 mol of (L1 and L2) and 0.02 mol of thiourea were dissolved in ethanol and 7 mL of sodium hydroxide were stirred about (12 h) with magnetic stirrer. Then, after an hour of continuous stirring, 25 cc of cold distilled water was added. following 24 hours in the refrigerator. The precipitate was made from ethanol and then recrystallized.

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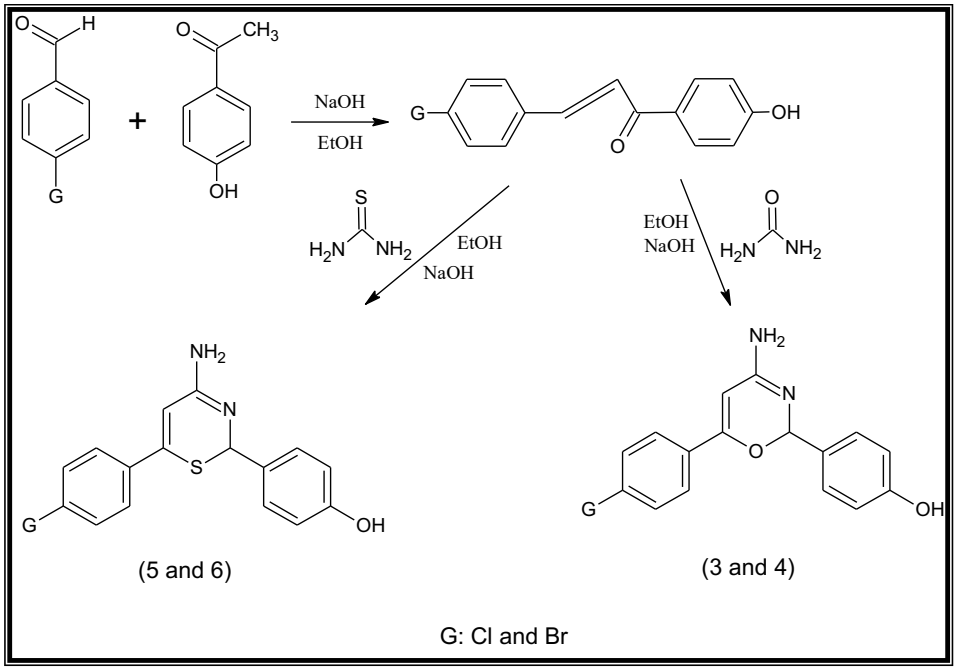

Figure 1. Routs of synthesized oxazine and thiazine.

Anti-Dubas Activities

The synthesized derivatives 3 and 5 are used as Pesticides through the spray method, the concentration of derivatives 3 and 5 is 5000 ppm. The Al Muthanna Agriculture Department's performed this study. These derivatives that synthesized affect the Cholinesterase enzyme in the insect, meaning that they affect the insect's nervous system, which leads to the death of the insect. Cholinesterase is an enzyme that helps your nervous system work the way it should

Table 1. Anti-Dubas activity.

Compounds No.	Time that killed Dubas (Sec.)	Note
3	45	Killed Dubas
5	30	Killed Dubas

Results and Discussion

Synthesized of oxazine (3 and 4) via reacted chalcones (1 and 2) with urea in presence of sodium hydroxide and urea. Synthesized of thiazine (5 and 6) via reacted chalcones (1 and 2) with thiourea in presence of sodium hydroxide and urea.

The derivative (1) that shows as figure 2 and have been color: brown. Yield: 73%. Melting point: 108 °C. MWt: 303.15. FT-IR (cm^{-1}): 3325 υ(hydroxyl), 3089 $\upsilon(C\text{-}H)_{Aromatic}$, 2936 & 2897 $\upsilon(C\text{-}H)_{Aliphatic}$, 1688 υ(C=O), 1600 $\upsilon(C{=}C)_{Alkene}$, 1582 $\upsilon(C{=}C)_{Aromatic}$ (Sharma, 1981).

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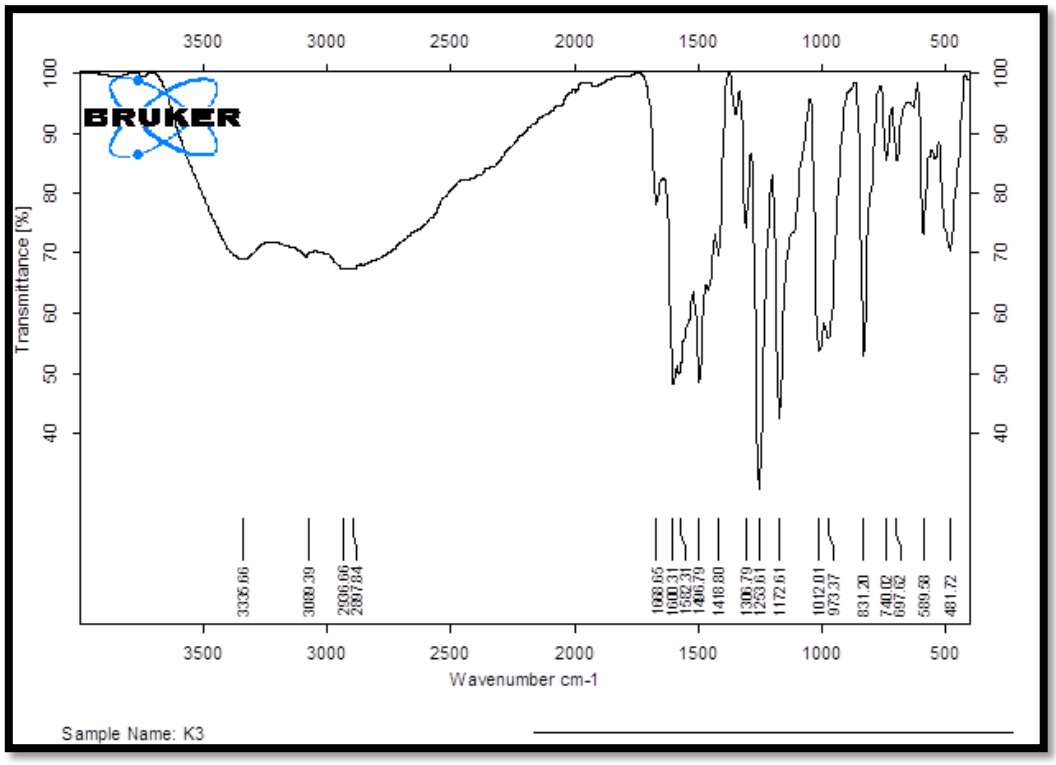

Figure 2. FTIR of derivative 1.

The derivative (2) that shows as figure 3 and have been color: light brown. Yield: 71%. Melting point: 103 °C. MWt: 258.62. FT-IR (cm^{-1}): 3347 υ(O-H), 3057 $\upsilon(C\text{-}H)_{Aromatic}$, 2940 & 2839 $\upsilon(C\text{-}H)_{Aliphatic}$, 1666 υ(C=O), 1602 $\upsilon(C{=}C)_{Alkene}$, 1576 $\upsilon(C{=}C)_{Aromatic}$. (Sharma, 2007)

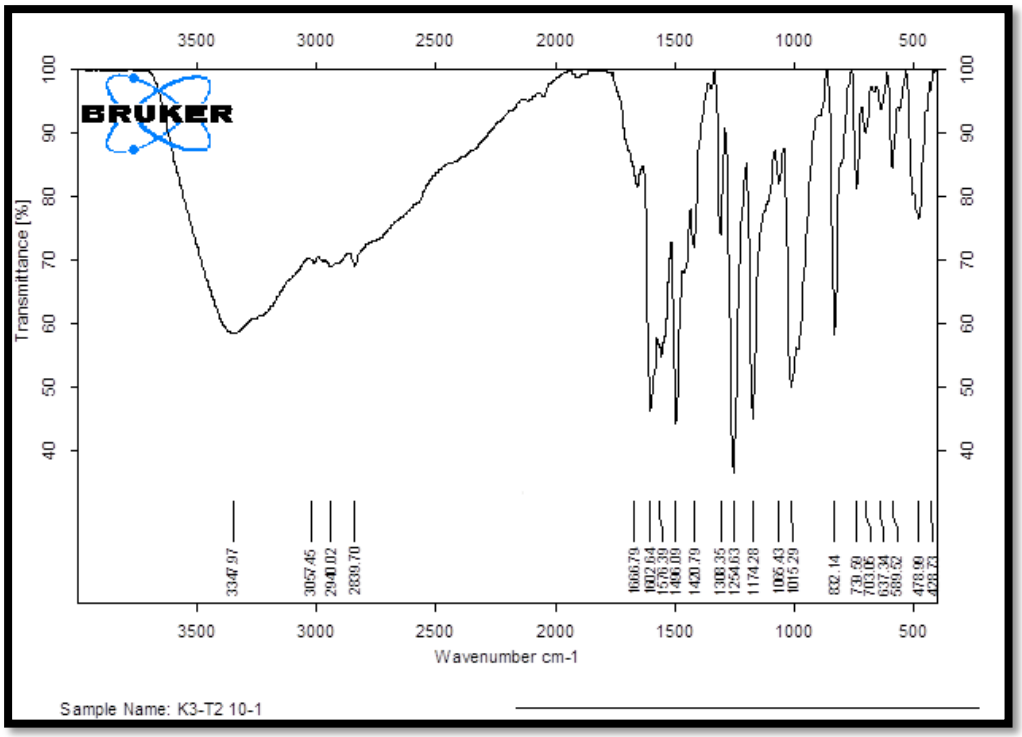

Figure 3. FTIR of derivative 2.

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The derivative (3) is 4-[4-amino-6-(4-bromophenyl)-2H-1,3-oxazin-2-yl]phenol that shows as figure 3 and have been color: light red. Yield: 76%. Melting point: 195 °C. MWt: 345.19. FT-IR (cm^{-1}): 3338 υ(O-H), 3029 υ(C-H)$_{Aromatic}$, 1563 υ(C=N), 1593 υ(C=C)$_{Aromatic}$ (Figure 3). ^{1}H NMR (400 MHz, DMSO-d_6, ppm) δH: 10.13 (2H, s, OH), 9.17 (H, s, -NH), 6.6-7.8 (9H, m, Ar-H), (Figure 4) (Katz, 1998).

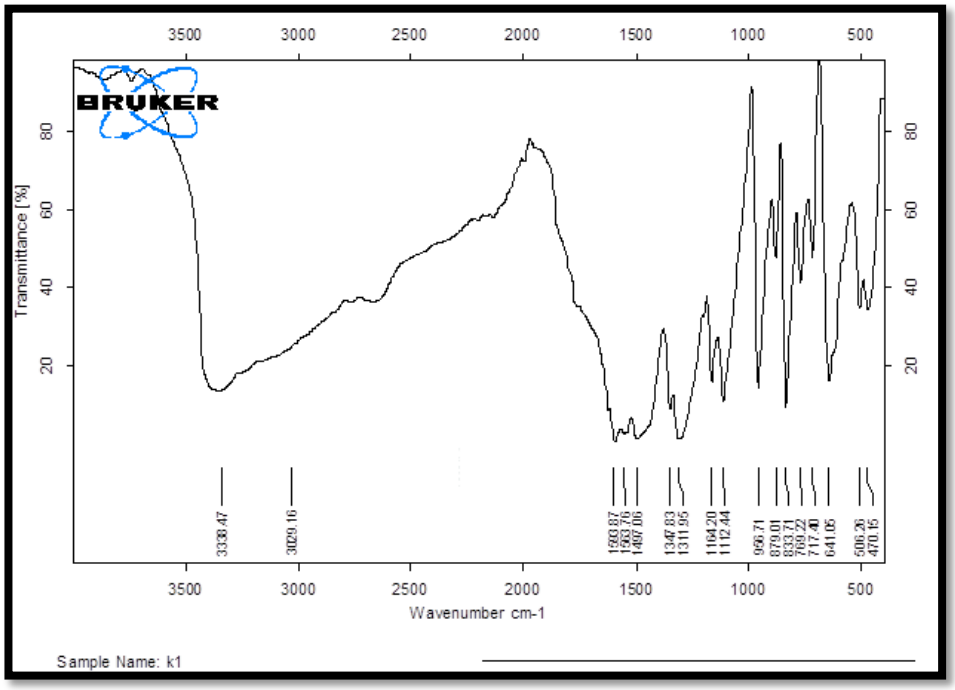

Figure 4. FTIR of derivative 3

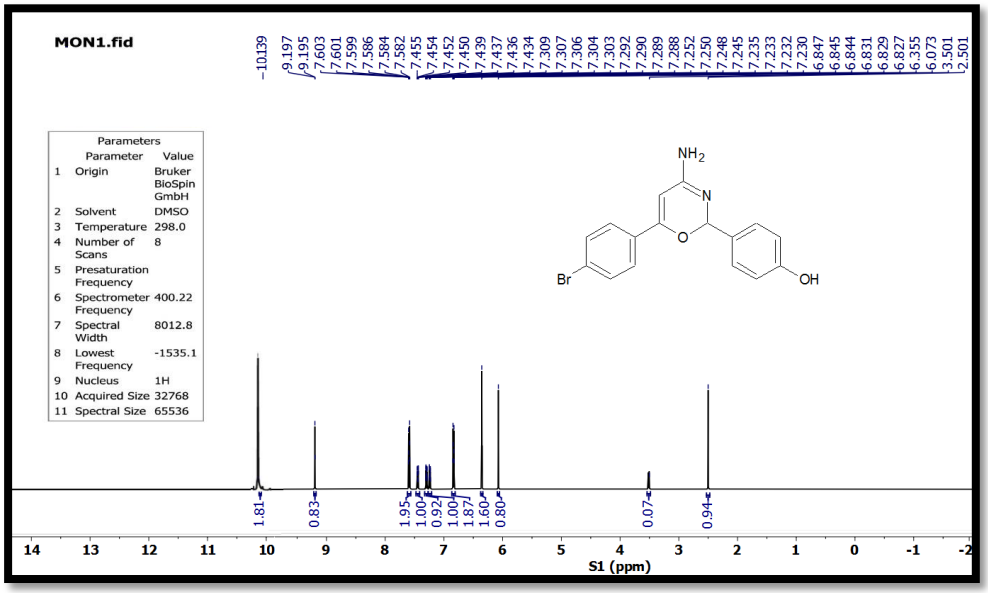

Figure 5. ^{1}HNMR of derivative 3.

The derivative (4) is 4-[4-amino-6-(4-chlorophenyl)-2H-1,3-oxazin-2-yl]phenol have been color: red. Yield: 76%. Melting point: 184 °C. MWt: 300.07. FT-IR (cm^{-1}): 3336 & 3290 υ(N-H_2), 3071 υ(C-H)$_{Aromatic}$, 1558 υ(C=N), 1602 υ(C=C)$_{Aromatic}$ (figure 6). ^{1}H NMR (400 MHz,

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DMSO-d_6, ppm) δH: 10.26 (2H, s, OH), 9.11 (H, s, -NH), 6.9-7.8 (9H, m, Ar-H) as shown in figure 7 (SCHMIDT, 1972).

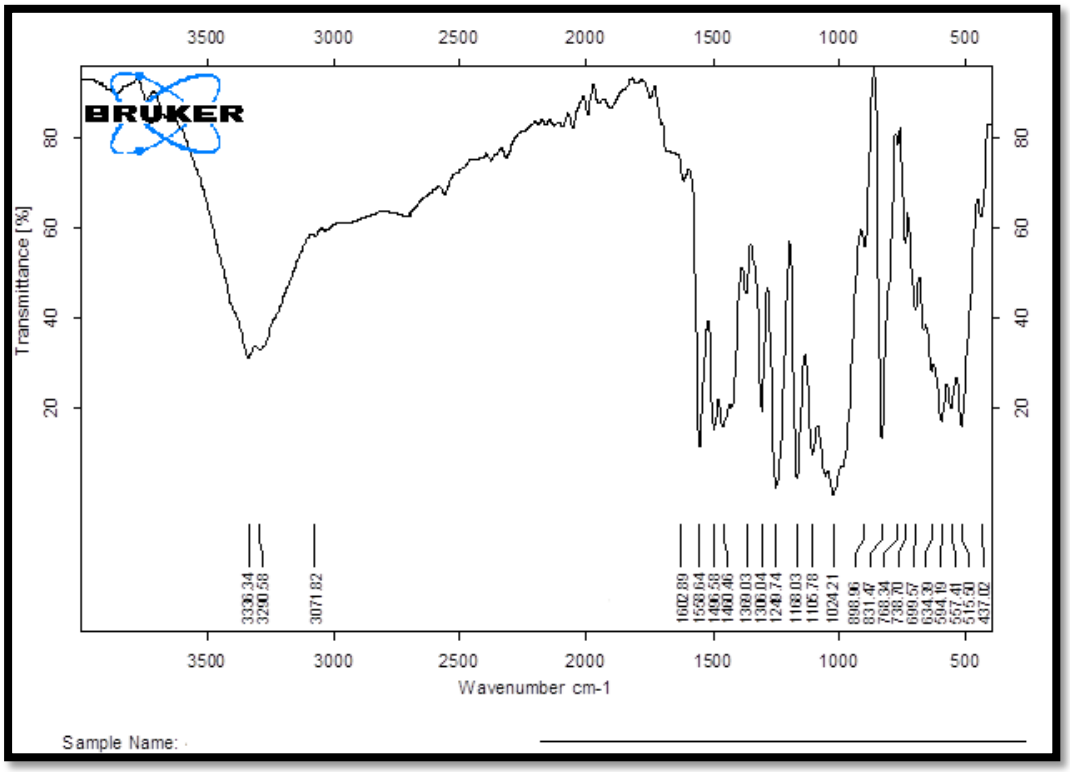

Figure 6. FTIR of derivative 4.

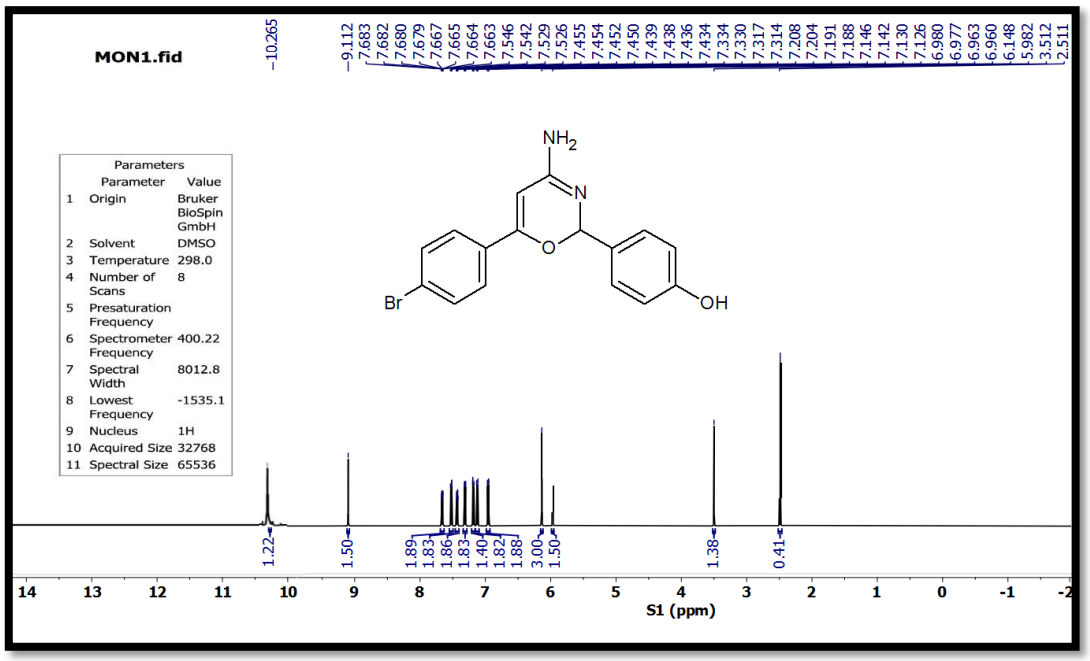

Figure 7. ^{1}HNMR of derivative 4.

The derivative (5) is 4-[4-amino-6-(4-bromophenyl)-2H-1,3-thiazin-2-yl]phenol have been color: yellow. Yield: 71%. Melting point: 214 °C. MWt: 361.25. FT-IR (cm^{-1}): 3334 (hydroxyl), 3018 (C-H) Aromatic, 1566 (C=N), 1606 (C=C) Aromatic (figure 8). ^{1}H NMR

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(400 MHz, DMSO-d6, ppm) δH: 10.98 (2H, s, OH), 9.25 (H, s, -NH), 6.7-7.9 (9H, m, Ar-H) as shown in figure 9.

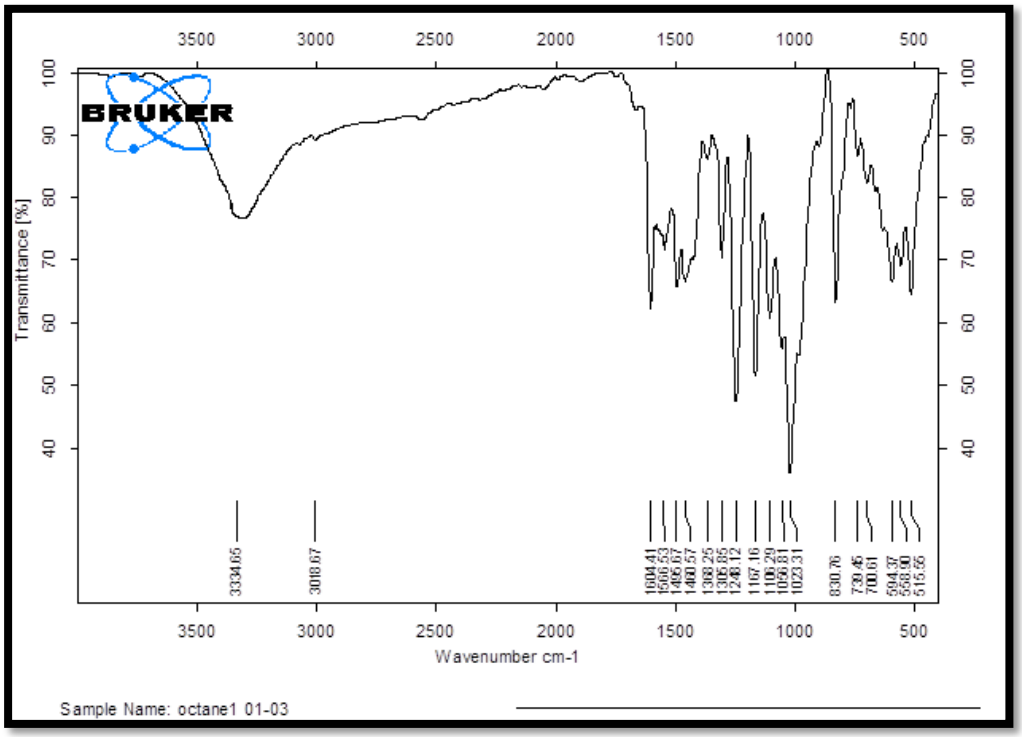

Figure 8. FTIR of derivative 5.

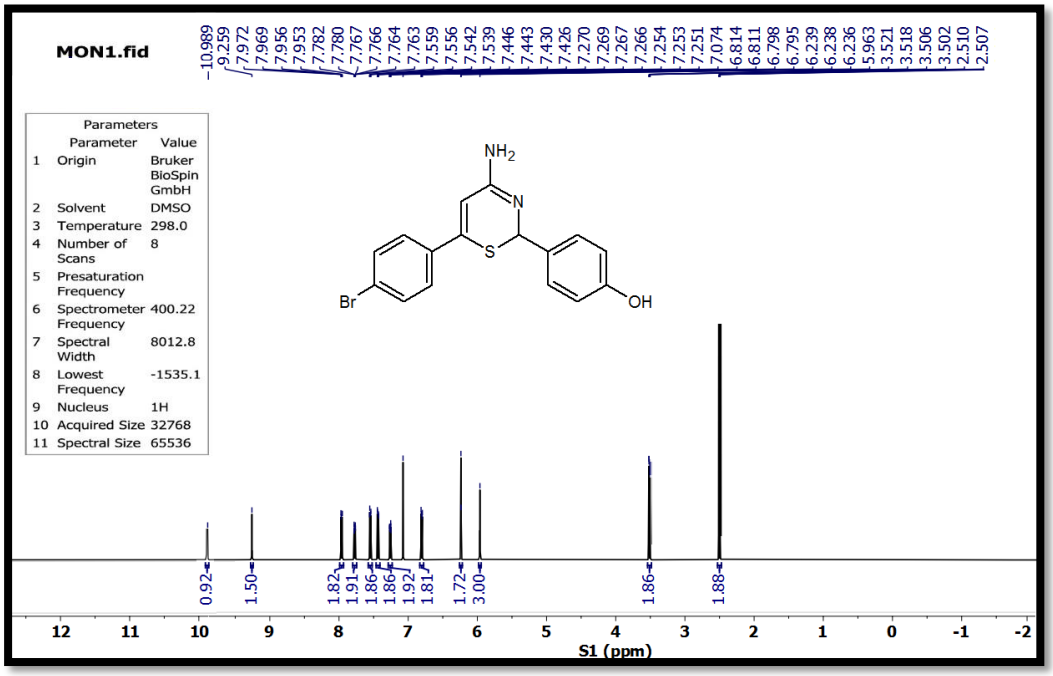

Figure 9. [1]HNMR of derivative 5.

The derivative (6) is 4-[4-amino-6-(4-chlorophenyl)-2H-1,3-thiazin-2-yl]phenol have been color: black. Yield: 71%. Melting point: 246 °C. MWt: 316.80. FT-IR (cm^{-1}): 3397 (hydroxyl), 3012 (C-H) Aromatic, 1573 (C=N), 1606 (C=C) Aromatic (figure 8). ^{1}H NMR (400 MHz,

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DMSO-d6, ppm) δH: 9.89 (2H, s, OH), 9.52 (H, s, -NH), 7.1-8.2 (9H, m, Ar-H) as shown in figure 11.

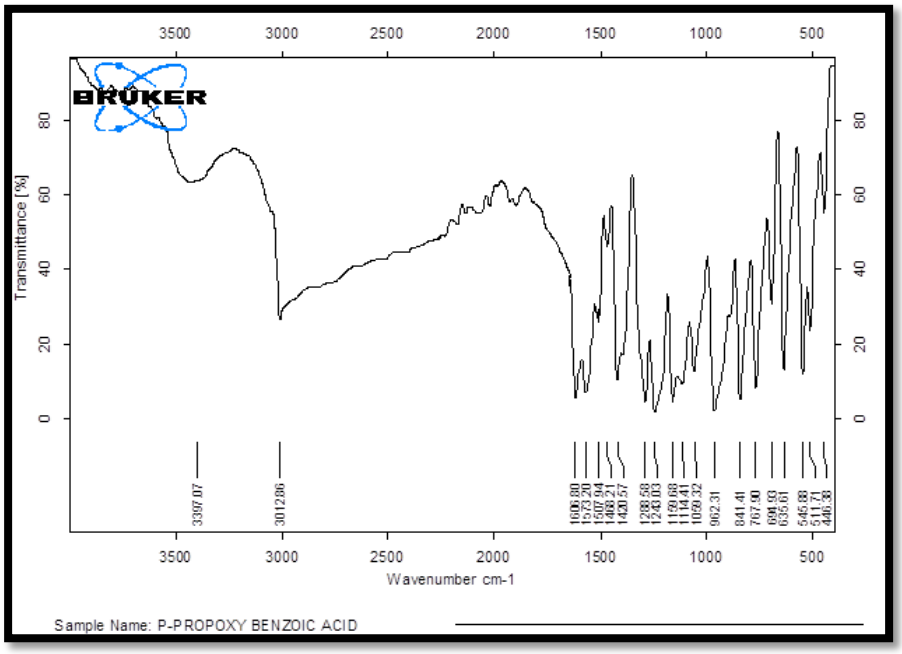

Figure 10. FTIR of derivative 6.

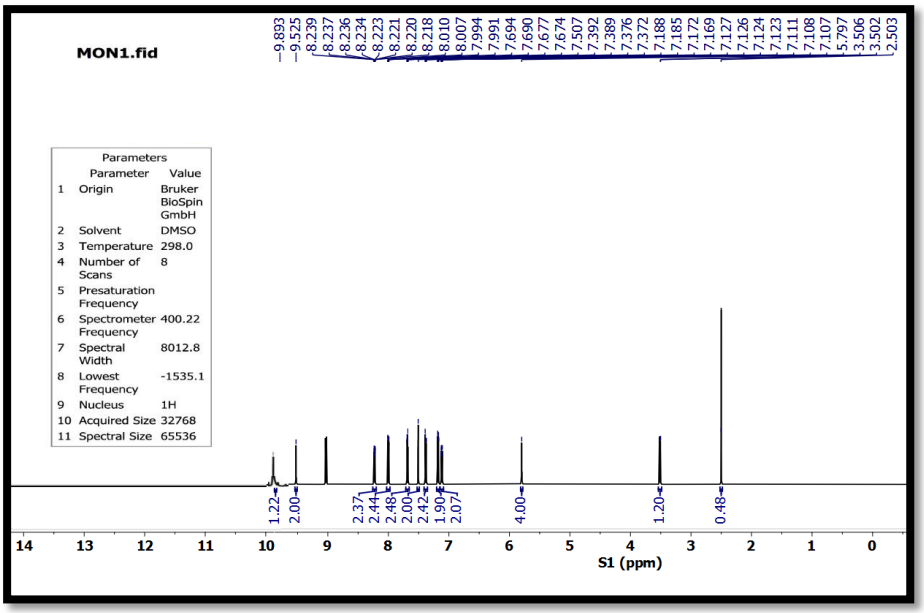

Figure 11. [1]HNMR of derivative 6.

Conclusion

We synthesized oxazine and thiazine derivatives (3-6) via chacone compounds (1 and 2). These derivatives were characterization by spectroscopy methods such as, FTIR and 1HNMR. Some compounds (3 and 5) that synthesized tested as Pesticides (anti-dubas) through the spray method and these derivatives killed Dubas and we noted the compound 5 was more active from compound 3 because compound 5 have been S atom in his structure that bonded in active group in dubas by effect on Cholinesterase enzyme in the insect.

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