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# ACTIVITY TEST OF DIBUTYL TIN (IV) N-ETHYL BENZYLE DITHIOCARBAMATATE COMPOUNDS AGAINST *Staphylococcus epidermidis* AND *Staphylococcus aureus*

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**Abstract:**

The compound organotin (IV) complex divagate is widely used as an anticancer, antibacterial, and antifungal. This compound was successfully synthesized to find a picture of the structure and antibacterial activity against Staphylococcus epidermidis and Staphylococcus aureus bacteria. This compound was synthesized by the in situ method, namely by adding ethanol to ethyl benzyl + carbon disulfide + dibutyl tin (IV) dichloride, then identification was carried out using FTIR, IH NMR, and 13C NMR, then the antibacterial activity test was carried out using the disc diffusion method with concentrations of 60 ppm, 70 ppm, and 80 ppm and using NA (Nutrient Agar) media. The results of this study obtained 2.15 g of synthetic powder, then from the analysis of compound molecules using FTIR were obtained 1419.61 $cm^{-1}$ (C-C), 1479.40 $cm^{-1}$ (C=C), 2922.16 $cm^{-1}$ (C-H), 2954.95 $cm^{-1}$ (N-H), 960.55 $cm^{-1}$ (C=S), 1176.58 $cm^{-1}$ (C-N), 567.07 $cm^{-1}$ (Sn-C), 360.69 $cm^{-1}$ (Sn-S). ). The results of the analysis from the 13C NMR test were obtained 11.89-14.02 ppm ($CH_3$ aliphatic), 26.57-48.63 ppm ($CH_2$), 56.92 ppm (CN), 127.66-135.76 ppm ($C_6H_5$-aromatic), 201.75 ppm ($CS_2$) and the results of antibacterial activity tests against Staphylococcus epidermidis and Staphylococcus aureus at concentrations of 60 ppm received the strong category.

**Keywords:** Synthesis of Compounds, Dithiocarbamate, Antibacterial, Staphylococcus epidermidis, Staphylococcus aureus.

## 1. Introduction

Infectious diseases are still a dominating problem in the health sector. Infectious diseases are one of the diseases that are quite easy to transmit and can be caused by bacteria, viruses, fungi, and parasites. Infections that often attack humans, especially on the skin, are infections caused by the bacteria Staphylococcus epidermidis and Staphylococcus aureus (Diyantika et al., 2017). (acne vulgaris) is a skin disease caused by the bacteria

 

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Staphylococcus Epidermidis and Staphylococcus Aureus. Acne is a chronic inflammation of the pylosebaseus unit which is characterized by the presence of blackheads, papules, pustules, nodules, cysts, and scars. In Indonesia, around 95-100% of men and 83-85% of women aged 16-17 years suffer from acne. The prevalence of acne in adult females is around 12% and in adult males is 3%. Acne is one of the skin problems in adolescence with a higher prevalence in women than men in the age range of 20 years or more (Saragih et al., 2016).

Staphylococcus epidermidis and Staphylococcus aureus bacteria are bacteria that cause acne by producing lipase that breaks down free fatty acids from skin lipids and fatty acids (Saragih et al., 2016). One way that can be done to inhibit exposure to bacteria in living things is to make an antibacterial material or substance. Various studies have been conducted to test the activity of compounds that are active antibacterial, including one of which is sourced from organotin (IV) compounds. This organotin (IV) dithiocarbamate compound has been widely used in the pharmaceutical and medical fields. Organotimine (IV) compounds have been proven to show effects on a variety of therapeutic activities that can produce effectiveness in dealing with various tumor cells and show good biological activity as antibacterial, antitumor, schizonticidal, antimalarial, and as a biocide in agriculture. The ligands of dithiol also have a significant effect on biological systems by acting as enzyme inhibitors because the metal binds to 3-6 ligands (Adeyemi et al., 2018).

Diiovalate compound is a material that has great potential in agriculture, industry, and medicine. The use of this dithiocarbamate compound depends on the chelating properties of the ligand in carbamate against metal ions. The diiocarbamate complex is known for its outstanding structural features and varied industrial and biological applications. Recent literature surveys prove several reports of antifungal, antibacterial, anticancer, anti-alkylation, and apoptosis-inducing activity of the metal thiocarbamate complex and its mixed ligands (Anggraini et al., 2020). In a previous study conducted by (Hadijah et al., 2021) it was reported that the compound synthesis of dibutyltin (IV) N-benzyl methyl ditiocarbamate had been tested against gram-negative bacteria, namely Escherichia coli in the 18.20 mm inhibition zone and Staphylococcus aureus gram-positive bacteria in the 14.71 mm inhibition zone with a dose of 0.05 grams, this result is comparable to a study conducted by (Anggraini

 

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et al., 2020) reporting that the compound has antibacterial activity in Salmonella typhi bacteria with inhibition of 27.33 mm at a concentration of 90 ppm and Escherichia coli bacteria with inhibition of 26.48 mm at a concentration of 90 ppm.

Until now, there has been no research that examines the antibacterial activity of dibutyl tin (IV) N-ethylbenzyl diiocarbamate which produces antibacterial activity with a very strong category. Based on the above background, researchers are interested in conducting research on the synthesis of dibutyl tin (IV) N-ethylbenzyl diiocarbamate compounds and testing their antibacterial activity against Staphylococcus epidermidis and Staphylococcus aureus.

## Research Method

This research was carried out experimentally by conducting an activity test of the N-ethylbenzyl dithiocarbamate compound in Staphylococcus epidermidis and Staphylococcus aureus bacteria replication 3 times. This study was conducted from May to July 2023 with the compound synthesized, namely Dibutyl Tin (IV) N-Ethyl Benzyl Dithiokarbamat using the FTIR, NMR, and disc paper methods as an antibacterial activity test method with a good clear zone and knowing that the compound Dibutyl Tin (IV) N-ethylbenzyl diiocarbamate has antibacterial activity against Staphylococcus epidermidis and Staphylococcus aureus bacteria.

| Wave Number Absorption Area ($cm^{-1}$) (Silverstein *et al*, 2005) | Wave number ($cm^{1}$) | Functional groups |
|---|---|---|
| C=C(1500 – 1900) | 1479,40 | C=C |
| C–H(3000–2850) | 2922,16 | C-H |
| N–H(2700 – 3800) | 2954,95 | N-H |
| C=S(950 – 1050) | 960,55 | C=S |
| C–N(1250–1000) | 1176,58 | C-N |
| Sn–C(605-515) | 567,07 | Sn-C |
| Sn-S(350-450) | 360,69 | Sn-S |

The results of the proton ($^{1}H$) FT-NMR spectrum data, it was obtained in the range of 0-2 ppm which is the region of aliphatic protons (Silverstein et al., 1991), in the range of 0.90-

 

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2.16 ppm which is the absorption region of $CH_3$ protons, in the range of 3.75-3.85 ppm which is the absorption region of $CH_2$ protons, while for protons ($^1H$) FT-NMR in the range of 2-5 ppm which is the region of aromatic protons with a range of 5.00-5.14 ppm which is the absorption region of aromatic $CH_2$ protons, in the range of 7.27-7.36 ppm is the area of CH-aromatic absorption. In the $^{13}C$ FT-NMR test, the compound dibutyl tin(IV) N-ethylbenzyl diiocarbamate was obtained in the range of 11.89-14.02 ppm for carbon absorption in $CH_3$, in the range of 26.57-48.63 ppm for $CH_2$ carbon absorption, in the range of 56.92 ppm for C-N carbon absorption, in the range of 127.66-135.76 ppm for C-aromatic absorption, and in the range of 201.75 ppm for the $CS_2$ region.

Based on the results of the FT-IR and FT-NMR $^1H$ and $^{13}C$ spectrums, it can be described with the structure of the compound that is synthesized, namely the compound Dibutyl Tin (IV) N-ethylbenzyl Dithiokarbate as shown in Figure 1- 3.

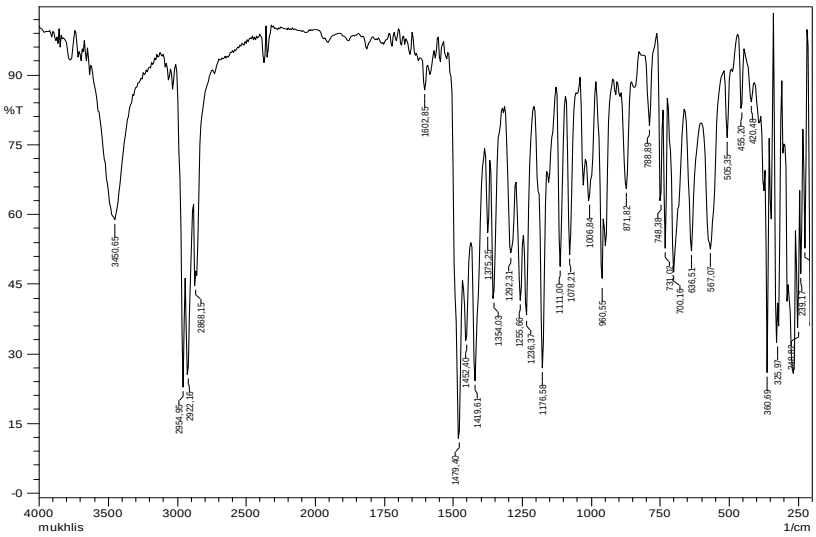


**Figure 1**. FTIR Spectrum Compound Dibutyltin (IV) N-ethylbenzyl Dithiocarbamate

The NMR proton results showed the peak of the spectrum of the compound dibutyl(IV)N-ethylbenzyl dithiocarbamate corresponding to the estimated structure of the desired structure, where the peak of the methyl, benzyl, and butyl molecules matched the estimated dibutyltinium(IV)N-ethylbenzyl diiocarbamate. The peak of the NMR proton spectrum can be seen in figure 2.

 

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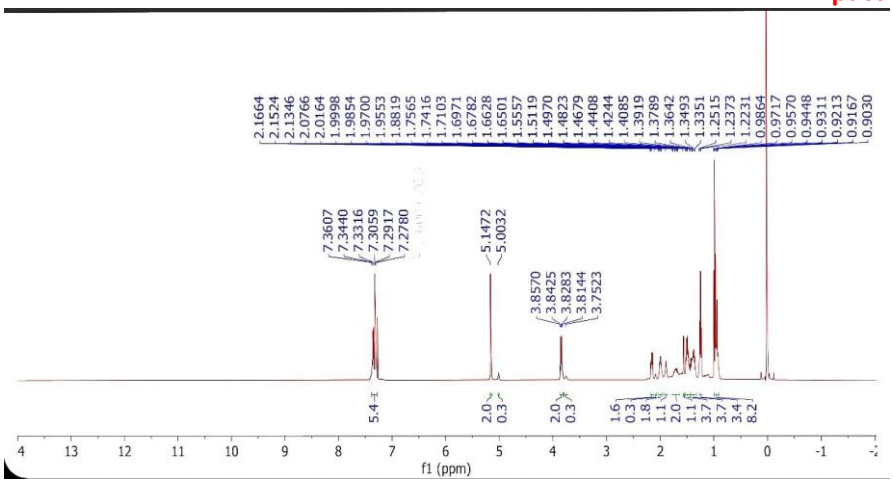


**Figure 2**. Spectrum proton NMR compound dibutyl tin(IV) N-ethyl benzyl Dithiocarbamate

**Table 1.** Proton NMR results of the compound dibutyltin(IV)N-ethyl benzyl dithiocarbamate

| Proton Shift Region (ppm) (Silverstein *et al*, 2005) | Results of Compound Analysis Dibutyl Tin (IV) N-ethyl benzyl Dithiocarbamate |
|---|---|
| 0–2 ppm (aliphatic) | 0,90-2,16 ppm ($CH_3$) |
| 2-5 ppm $CH_2$ aromatic | 3,75-3,85 ppm ($CH_2$) |
| 6-9 ppm CH aromatic | 7,27-7,36 ppm (CH aromatic) |

Figure 3 explains the results of the peak carbon spectrum of the compound dibutyl tin(IV) N-ethylbenzyl diiocarbamate producing peaks of methyl, butyl, benzyl and carbon disulfide according to the desired carbon peak, so that the estimated structure of the compound dibutyl tin(IV) N-ethylbenzyl diiocarbamate is estimated to contain the octahedron structure.

 

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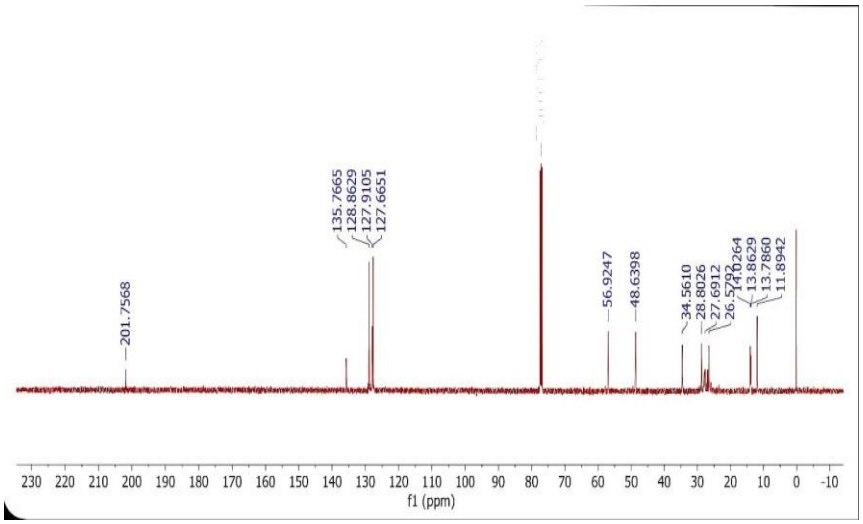


**Figure 3**. Spectrum Carbon($C^{13}$) NMR compound dibutyl tin(IV) N-ethyl benzyl Dithiocarbamate

The compound Dibutyl Tin (IV) N-Ethylbenzyl Dithiokarbamat has antibacterial activity against Staphylococcus epidermidis and Staphylococcus aureus bacteria at concentrations of 60 ppm, 70 ppm, and 80 ppm. The results of the Antibacterial Activity Test on the compound Dibutyl Tin (IV) N-Ethylbenzyl Dithiocarbamate against Staphylococcus epidermidis bacteria at a concentration of 80 ppm were categorized as strong) because it produced an average diameter of the inhibition zone of 16.13 mm, while the results of the Dibutyl Tin (IV) N-Ethylbenzyl Dithiokarbamame compound against Staphylococcus aureus at a concentration of 80 ppm were categorized (Strong) because it produced an average diameter of the inhibition zone of 16.05 mm. The results of the anti-bacterial activity test can be seen in Figures 4 and 5.

 

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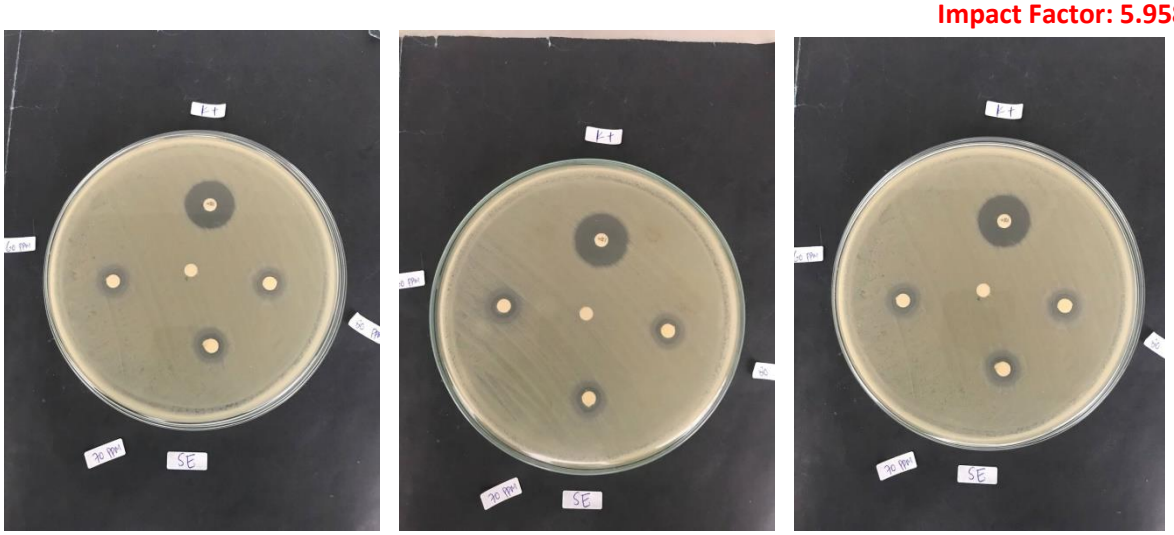

Figure 4. Anti-bacterial Inhibition zone results of Dibutyl Tin (IV) N-Ethyl Benzyl Dithiocarbamatate Compounds Against Staphylococcus epidermidis

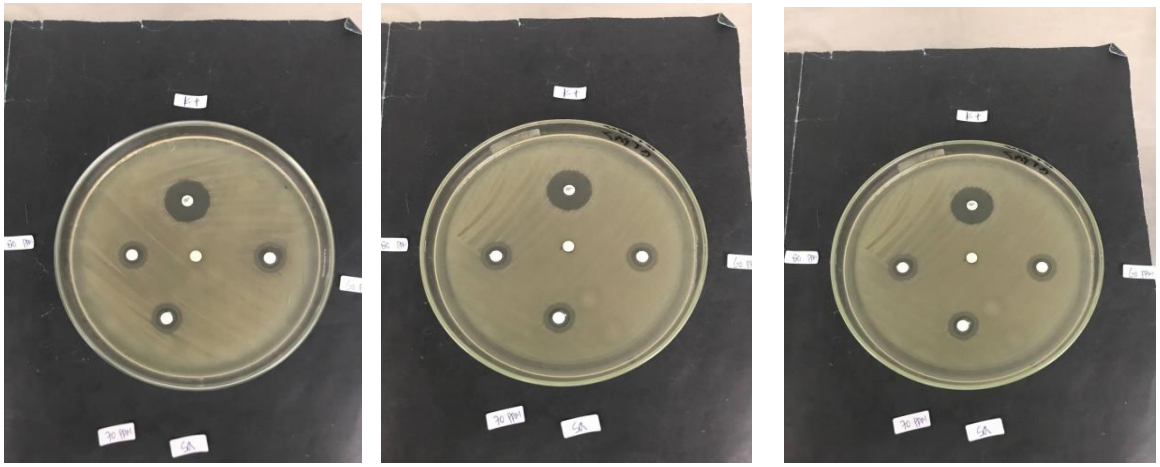

Figure 5. Anti-bacterial Inhibition zone results of Dibutyl Tin (IV) N-Ethyl Benzyl Dithiocarbamatate Compounds Against Staphylococcus aureus

## Conclusion

The compound Dibutyl Tin (IV) N-Ethylbenzyl Dithiocarbamate has antibacterial activity against Staphylococcus epidermidis bacteria with a strong category at a concentration of 60 ppm and against Staphylococcus epidermidis bacteria at a concentration of 80 ppm categorized (Strong).

 

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