ABSTRAK

SINTESIS SENYAWA ETIL PIPERAT DAN STUDI KOMPARATIF AKTIVITAS ANTIBAKTERI SENYAWA METIL PIPERAT DAN ETIL PIPERAT TERHADAP BAKTERI *Pseudomonas aeruginosa* DAN *Staphylococcus aureus*

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Lada hitam (*Piper nigrum* L.) mengandung senyawa utama piperin yang memiliki berbagai aktivitas biologis, termasuk antibakteri. Peningkatan resistensi antibiotik pada bakteri patogen mendorong pengembangan antibakteri berbasis bahan alam. Penelitian ini bertujuan mensintesis etil piperat dari asam piperat hasil hidrolisis piperin serta membandingkan aktivitas antibakterinya dengan metil piperat terhadap *Pseudomonas aeruginosa* dan *Staphylococcus aureus*.

Metode penelitian meliputi isolasi piperin dari lada hitam menggunakan metode soxhletasi, hidrolisis piperin menjadi asam piperat, serta sintesis etil piperat melalui esterifikasi Steglich. Senyawa hasil kemudian dikarakterisasi menggunakan spektrofotometer UV-*Vis* dan *Fourier Transform Infrared* (FTIR) serta aktivitas antibakteri diuji menggunakan metode difusi cakram dan dilusi

Hasil menunjukkan kadar piperin sebesar 3,9%, rendemen asam piperat 73,91%, dan etil piperat 76,01%. Spektrum UV-*Vis* menunjukkan λmaks piperin pada 207–342 nm, asam piperat pada 206–343 nm, dan etil piperat pada 346 nm yang mengindikasikan sistem ikatan rangkap terkonjugasi. Analisis FTIR memperlihatkan perubahan pita amida piperin menjadi karbonil karboksilat pada asam piperat serta munculnya pita karbonil ester dan serapan C–O ester pada 1200–1300 cm^{-1} yang menandakan keberhasilan esterifikasi sintesis etil piperat. Uji aktivitas antibakteri menunjukkan etil piperat memiliki zona hambat lebih besar terhadap *S. aureus* (10 mm) dan *P. aeruginosa* (9,8 mm) dibandingkan metil piperat (7,1 mm dan 8,1 mm). Uji dilusi menunjukkan kedua senyawa menghambat *S. aureus* hingga pengenceran ke-3 (250 ppm), sedangkan terhadap *P. aeruginosa*, metil piperat hingga pengenceran ke-3 (250 ppm) dan etil piperat hingga pengenceran ke-4 (125 ppm). Hasil ini menunjukkan bahwa variasi gugus ester memengaruhi hidrofobisitas dan aktivitas antibakteri turunan piperat sebagai kandidat antibakteri alami.

Kata kunci: etil piperat, metil piperat, aktivitas antibakteri.

ABSTRACT

SYNTHESIS OF ETHYL PIPERATE AND COMPARATIVE STUDY OF THE ANTIBACTERIAL ACTIVITY OF METHYL PIPERATE AND ETHYL PIPERATE AGAINST *Pseudomonas aeruginosa* AND *Staphylococcus aureus*

By

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Black pepper (*Piper nigrum* L.) contains piperine as its main compound, which exhibits various biological activities, including antibacterial properties. The increasing resistance of pathogenic bacteria to antibiotics has driven the development of antibacterial agents derived from natural products. This study aims to synthesize ethyl piperate from piperic acid obtained through the hydrolysis of piperine and to compare antibacterial activity with methyl piperate against *Pseudomonas aeruginosa* and *Staphylococcus aureus*.

The research methods included the isolation of piperine from black pepper using the soxhlet extraction method, hydrolysis of piperine into piperic acid, and synthesis of ethyl piperate via Steglich esterification. The resulting compounds were characterized using UV-Vis spectrophotometry and Fourier Transform Infrared (FTIR) spectroscopy, and their antibacterial activity was evaluated using disc diffusion and dilution methods.

The results showed that the piperine content was 3.9%, with yields of 73.91% for piperic acid and 76.01% for ethyl piperate. The UV-Vis spectra indicated λmax values of piperine at 207–342 nm, piperic acid at 206–343 nm, and ethyl piperate at 346 nm, suggesting the presence of a conjugated double-bond system. FTIR analysis showed the transformation of the amide band in piperine into a carboxyl carbonyl band in piperic acid, as well as the appearance of a strong ester carbonyl band and C–O ester absorption at 1200–1300 cm^{-1}, confirming the successful synthesis of ethyl piperate. Antibacterial activity tests revealed that ethyl piperate exhibited larger inhibition zones against *S. aureus* (10 mm) and *P. aeruginosa* (9.8 mm) compared to methyl piperate (7.1 mm and 8.1 mm). Dilution tests showed that both compounds inhibited *S. aureus* up to the third dilution (250 ppm), while against *P. aeruginosa*, methyl piperate was effective up to the third dilution (250 ppm) and ethyl piperate up to the fourth dilution (125 ppm). These results indicate that variations in the ester group influence hydrophobicity and antibacterial activity of piperate derivatives as potential natural antibacterial agents.

Keywords: ethyl piperate, methyl piperate, antibacterial activity.