# PROSES OPTIMASI PRODUKSI BAKTERIOSIN DARI *Lactiplantibacillus plantarum* SEBAGAI ANTIBAKTERI MELALUI *RESPONSE SURFACE METHODOLOGY*

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## INTI SARI

**Proses Optimasi Produksi Bakteriosin dari *Lactiplantibacillus plantarum* Sebagai Antibakteri Melalui *Response Surface Methodology***

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**Pembimbing***

Kasus resistensi antibiotik dan kontaminasi pangan oleh bakteri patogen semakin meningkat sehingga mendorong pengembangan antibakteri alami, salah satunya bakteriosin yang dihasilkan oleh *Lactiplantibacillus plantarum*. Akan tetapi, produktivitas bakteriosin sangat dipengaruhi oleh kondisi fermentasi, sehingga diperlukan optimasi untuk memperoleh produksi yang maksimal. Penelitian ini bertujuan untuk menentukan kondisi fermentasi optimum dalam memproduksi bakteriosin oleh *Lactiplantibacillus plantarum* sebagai antibakteri serta mengevaluasi kemampuan antibakterinya terhadap *Escherichia coli* dan *Staphylococcus aureus*. Penelitian diawali dengan penentuan kurva pertumbuhan *L. plantarum* untuk memperoleh waktu fermentasi optimum. Optimasi produksi bakteriosin dilakukan menggunakan *Response Surface Methodology* (RSM) dengan rancangan *Box-Behnken Design* (BBD) melalui variasi tiga faktor, yaitu konsentrasi glukosa (1-3%), konsentrasi pepton (0,5-1,5%), dan pH media fermentasi (5,5-6,5). Aktivitas antibakteri ditentukan menggunakan metode sumur agar dengan teknik *soft agar overlay*. Konsentrasi protein bakteriosin dianalisis menggunakan metode Bradford, sedangkan aktivitas spesifik dihitung dalam satuan AU/mg protein. Kemampuan penghambatan bakteriosin selanjutnya dievaluasi melalui pengujian *Minimum Inhibitory Concentration* (MIC) menggunakan metode *broth microdilution*. Hasil penelitian menunjukkan bahwa kondisi fermentasi optimum diperoleh pada kombinasi konsentrasi glukosa 2%, pepton 1%, dan pH 6. Berdasarkan hasil penelitian dapat disimpulkan bahwa optimasi kondisi fermentasi menggunakan pendekatan RSM mampu meningkatkan produksi bakteriosin oleh *Lactiplantibacillus plantarum*. Kondisi optimum yang diperoleh menghasilkan aktivitas antibakteri yang tinggi terhadap *Staphylococcus aureus* dan *Escherichia coli*, sehingga bakteriosin berpotensi dikembangkan sebagai antibakteri alami.

**Kata kunci**: *Lactiplantibacillus plantarum*, bakteriosin, optimasi fermentasi, *Response Surface Methodology*, aktivitas antibakteri.

## ABSTRACT

**Optimization of Bacteriocin Production from *Lactiplantibacillus plantarum* as an Antibacterial Agent Using Response Surface Methodology**

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Cases of antibiotic resistance and food contamination by pathogenic bacteria are on the rise, driving the development of natural antibacterial agents, one of which is bacteriocin produced by *Lactiplantibacillus plantarum*. However, bacteriocin productivity is highly influenced by fermentation conditions, so optimization is necessary to achieve maximum production. This study aims to determine the optimal fermentation conditions for the production of bacteriocins by *Lactiplantibacillus plantarum* as an antibacterial agent and to evaluate their antibacterial activity against *Escherichia coli* and *Staphylococcus aureus*. The study began with the determination of the growth curve of L. plantarum to establish the optimal fermentation time. Bacteriocin production optimization was performed using Response Surface Methodology (RSM) with a Box-Behnken Design (BBD) by varying three factors: glucose concentration (1–3%), peptone concentration (0.5–1.5%), and fermentation medium pH (5.5–6.5). Antibacterial activity was determined using the agar well method with the soft agar overlay technique. Bacteriocin protein concentration was analyzed using the Bradford method, while specific activity was calculated in AU/mg of protein. The inhibitory capacity of the bacteriocin was further evaluated through Minimum Inhibitory Concentration (MIC) testing using the broth microdilution method. The results showed that optimal fermentation conditions were achieved with a combination of 2% glucose, 1% peptone, and a pH of 6. Based on the study results, it can be concluded that optimizing fermentation conditions using the RSM approach can increase bacteriocin production by *Lactiplantibacillus plantarum*. The optimal conditions obtained produced high antibacterial activity against *Staphylococcus aureus* and *Escherichia coli*, indicating that the bacteriocin has the potential to be developed as a natural antibacterial agent.



**Keywords:** *Lactiplantibacillus plantarum*, bacteriocin, fermentation optimization, Response Surface Methodology, antibacterial activity.