

**EFEKTIVITAS *BACTERIOCIN-LIKE INHIBITORY SUBSTANCES*
TERENKAPSULASI DARI *Lactobacillus bulgaricus* SEBAGAI BAHAN
PENGAWET ALAMI PADA FILLET IKAN TUNA SELAMA
PENYIMPANAN**

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INTISARI

Ikan merupakan sumber protein hewani bernilai tinggi, namun mudah rusak akibat aktivitas mikroba selama penyimpanan. Penggunaan pengawet kimia sintetis dinilai kurang aman untuk konsumsi jangka panjang, sehingga mendorong pengembangan alternatif alami yang lebih sehat. Salah satu solusi potensial adalah penggunaan bakteriosin, yaitu senyawa antimikroba yang dihasilkan oleh bakteri asam laktat (BAL), khususnya *Lactobacillus bulgaricus* FNCC 0041. Penelitian ini bertujuan mengevaluasi efektivitas *bacteriocin-like inhibitory substances* (BLIS) terenkapsulasi sebagai pengawet alami pada fillet ikan tuna. Proses penelitian meliputi produksi *bacteriocin-like inhibitory substances* (BLIS) dari *Lactobacillus bulgaricus* FNCC 0041 pada medium de Man, Rogosa, and Sharpe Agar (MRSA) dan diuji kualitatif biuret untuk selanjutnya dilakukan enkapsulasi menggunakan polimer kitosan dan *Sodium Tripolyphosphate* (STPP). *Bacteriocin-like inhibitory substances* (BLIS) yang telah terenkapsulasi diaplikasikan pada fillet ikan tuna dengan konsentrasi 0,1% dan 0,3%, kemudian dianalisis pada lama penyimpanan hari ke-0, 3, dan 6 berdasarkan parameter mikrobiologis (ALT, Coliform, *E. coli*, *Salmonella* sp.), sensoris, pH, TVB-N, dan proksimat serta daya hambat terhadap mikroba indikator (*E. coli* dan *Staphylococcus aureus*). Hasil penelitian menunjukkan bahwa enkapsulasi *bacteriocin-like inhibitory substances* (BLIS) 0,1% paling efektif menekan pertumbuhan parameter mikrobiologis ALT hingga 0,54 (10^4 CFU/g⁻¹), Coliform 0 APM/g, dan hasil negatif *E. coli* serta *Salmonella* sp. pada fillet ikan tuna hingga hari ke-6 penyimpanan suhu 4°C. Sementara itu, *bacteriocin-like inhibitory substances* (BLIS) 0,1% mampu menghambat peningkatan kadar Total Volatile Base Nitrogen (TVB-N) 16,70 mg/100 g dan menjaga kestabilan pH pada rentang pH 5,7-5,9. Namun, belum secara nyata memberikan pengaruh pada uji proksimat dan sensoris fillet ikan tuna. Kesimpulannya, *bacteriocin-like inhibitory substances* (BLIS) 0,1% terenkapsulasi berpotensi sebagai pengawet alami yang efektif menekan pertumbuhan mikroba pembusuk pada fillet ikan tuna selama penyimpanan hari ke-0, 3, dan 6 pada suhu 4°C dan dapat menjadi alternatif inovatif dalam memperpanjang masa simpan produk perikanan.

KATA KUNCI: BAL, bakteriosin, enkapsulasi, *Lactobacillus bulgaricus*, pengawetan ikan

**EFFECTIVENESS OF ENCAPSULATED *BACTERIOCIN-LIKE*
INHIBITORY SUBSTANCES FROM *Lactobacillus bulgaricus* AS A
NATURAL PRESERVATIVE IN TUNA FILLETS DURING STORAGE**

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ABSTRACT

Fish is a high-value source of animal protein but is easily damaged by microbial activity during storage. The use of synthetic chemical preservatives is considered unsafe for long-term consumption, this encouraging the development of healthier natural alternatives. One potential solution is the use of bacteriocins, which are antimicrobial compounds produced by lactic acid bacteria (LAB), especially *Lactobacillus bulgaricus* FNCC 0041. Bacteriocins are known to inhibit the growth of pathogenic microorganisms that cause spoilage, so they have potential as natural biopreservative agents. This study aims to evaluate the effectiveness of encapsulated crude bacteriocin as a natural preservative in tuna fillets. The research process included the production of crude bacteriocin from *Lactobacillus bulgaricus* FNCC 0041 on de Man, Rogosa, and Sharpe Agar (MRSA) medium and qualitative biuret testing, followed by encapsulation using chitosan polymer and *Sodium Tripolyphosphate* (STPP). The encapsulated crude bacteriocin was applied to tuna fillets at concentrations of 0,1% and 0,3% and then analyzed at 0, 3, and 6 days of storage at 4°C based on microbiological (ALT, Coliform, *E. coli*, *Salmonella* sp.), sensory, pH, TVB-N, proximate parameters, and inhibitory power against indicator microbes (*E. coli* and *Staphylococcus aureus*). The results of the study indicate that encapsulation of crude bacteriocin at a concentration of 0,1% is most effective in suppressing the growth of microbiological parameters ALT to 0,54 (10^4 CFU/g⁻¹), Coliform 0 APM/g, and negative *E. coli* and *Salmonella* sp. in tuna fillets up to the 6th day of storage at 4°C. Physicochemically, bacteriocin is able to inhibit the increase in Total Volatile Base Nitrogen (TVB-N) levels <20 mg N/100 g and maintain pH stability in the range of pH 5,7-6,0. However, it has not yet had a significant effect on the proximate and sensory tests of tuna fillets. In conclusion, encapsulated crude bacteriocin has the potential as an effective natural preservative that suppresses the growth of spoilage microorganisms in tuna fillets stored at 4°C on days 0, 3, and 6. The use of encapsulated crude bacteriocin 0,1% can be an innovative alternative in extending the shelf life of fishery products.

KEYWORDS: BAL, bacteriocin, encapsulation, fish preservation, *Lactobacillus bulgaricus*