

## EFIKASI NANOENKAPSULASI EKSTRAK DAUN SUNGKAI (*Peronema canescens* Jack) SEBAGAI ADITIF PAKAN ALAMI AYAM BROILER

### INTISARI

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Tujuan penelitian ini adalah untuk mendapatkan formulasi optimal dari nanoenkapsulasi ekstrak daun sungkai (NEDS) yang stabil, mengetahui potensi dari NEDS sebagai antibakteri, serta mengetahui efek pengaplikasian NEDS pada ayam broiler secara *in vivo*. Penelitian dibagi menjadi tiga tahap. Tahap pertama meliputi formulasi, optimasi, dan karakterisasi NEDS. Ekstrak dengan rasio 1:5 menghasilkan rendeman tertinggi (32,60%;  $P < 0,01$ ), kadar fenol 81,32 mg/mL dan tanin 36,73 mg/mL ( $P < 0,05$ ), serta berbagai metabolit bioaktif seperti fenolik, terpenoid, vitamin, steroid, dan alkaloid (LC-HRMS). Formula optimum tersusun atas 67,74% kitosan, 17,97% ekstrak daun sungkai, dan 14,29% sodium tripolyphosphate dengan ukuran partikel 178,73 nm, PDI 0,48, dan zeta potensial +38,30 mV. NEDS menunjukkan aktivitas penghambatan terhadap *Escherichia coli*, *Salmonella Typhimurium*, dan *Staphylococcus aureus*. Penyimpanan satu bulan di suhu ruang direkomendasikan efektif dalam menjaga stabilitas NEDS. Tahap kedua menggunakan RAL pola searah dengan lima perlakuan dan enam ulangan yaitu kontrol negatif (akuades), ekstrak daun sungkai, kitosan, NEDS, dan kontrol positif tetrasiklin (50 ppm). NEDS memberikan hambatan kuat terhadap *Salmonella Typhimurium* (16,66 mm) dan *Staphylococcus aureus* (17,36 mm), dan kontrol positif (22,35 mm pada *Escherichia coli*). MIC NEDS tercatat 687,5 ppm untuk *Escherichia coli* dan *Staphylococcus aureus*, serta 343,75 ppm untuk *Salmonella Typhimurium*. Penghambatan biofilm tertinggi terjadi pada dosis MIC ( $\pm 85-90\%$ ), diikuti 0,5xMIC dan 0,25xMIC. Dosis 0,25xMIC dan 2xMIC ditetapkan sebagai dosis minimum dan maksimum untuk uji *in vivo*. Tahap ketiga menggunakan RAL pola searah dengan enam perlakuan dan enam ulangan pada 288 ayam jantan selama 35 hari. Perlakuan meliputi kontrol negatif, kontrol positif (25 mg/L zinc bacitracin), serta NEDS dosis 8,5; 17; 34; dan 68 mL/L. NEDS memperbaiki FCR ( $P < 0,001$ ), meningkatkan bobot badan, bobot akhir, dan indeks performa ( $P < 0,05$ ), serta memperbaiki kesehatan usus melalui peningkatan lebar vili dan apikal vil ( $P < 0,05$ ), jumlah *Escherichia coli* usus menurun ( $P < 0,01$ ), kolesterol menurun ( $P < 0,001$ ), LDL menurun ( $P < 0,05$ ), dan kualitas daging meningkat ( $P < 0,001$ ) dibandingkan kontrol positif dan negatif. Pemberian NEDS tidak memengaruhi titer antibodi Avian Influenza dan Newcastle Disease. Rekomendasi formulasi NEDS dengan dosis 68 mL/L melalui air minum berpotensi sebagai *growth promoter* alami pada ayam broiler. Kesimpulan akhir penelitian yang telah dilakukan bahwa nanoenkapsulasi ekstrak daun sungkai terbukti efektif sebagai aditif pakan alami yang berpotensi meningkatkan performa dan kesehatan ayam broiler.

Kata kunci: Antibakteri, Ayam broiler, Ekstrak daun sungkai, Fitobiotik, Nanoenkapsulasi

## EFFICACY OF NANOENCAPSULATED SUNGKAI (*Peronema canescens* Jack) LEAF EXTRACT AS A NATURAL FEED ADDITIVE BROILER CHICKENS

### ABSTRACT

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This study aimed to obtain an optimal and stable formulation of nanoencapsulated sungkai leaf extract (NEDS), to determine its antibacterial potential, and to evaluate the effects of NEDS application on broiler chickens in vivo. The research consisted of three stages. The first stage involved formulation, optimization, and characterization of NEDS. The extract with a 1:5 ratio produced the highest yield (32,60%;  $P < 0,01$ ), phenol content of 81,32 mg/mL and tannin content of 36,73 mg/mL ( $P < 0,05$ ), along with various bioactive metabolites such as phenolics, terpenoids, vitamins, steroids, and alkaloids (LC-HRMS). The optimum formula consisted of 67,74% chitosan, 17,97% sungkai leaf extract, and 14,29% STPP with particle size of 178.73 nm, PDI 0.48, and zeta potential +38,30 mV. NEDS demonstrated inhibitory activity against *Escherichia coli*, *Salmonella typhimurium*, and *Staphylococcus aureus*. Storage at room temperature for one month is recommended as effective for maintaining NEDS stability. The second stage used a completely randomized design (CRD) with a unidirectional pattern consisting of five treatments and six replications: negative control (distilled water), sungkai leaf extract, chitosan, NEDS, and positive control tetracycline (50 ppm). NEDS produced strong inhibition against *Salmonella Typhimurium* (16.66 mm) and *Staphylococcus aureus* (17.36 mm), while the positive control showed 22,35 mm inhibition against *Escherichia coli*. The minimum inhibitory concentration (MIC) of NEDS was recorded at 687,5 ppm for *Escherichia coli* and *Staphylococcus aureus*, and 343.75 ppm for *Salmonella Typhimurium*. The highest biofilm inhibition occurred at the MIC dose ( $\pm 85-90\%$ ), followed by  $0,5 \times \text{MIC}$  and  $0,25 \times \text{MIC}$ . The doses of  $0,25 \times \text{MIC}$  and  $2 \times \text{MIC}$  were determined as the minimum and maximum doses for the in vivo trial. The third stage used a CRD with a unidirectional pattern consisting of six treatments and six replications in 288 male broilers for 35 days. Treatments included a negative control, a positive control (25 mg/L zinc bacitracin), and NEDS at doses of 8,5, 17, 34, and 68 mL/L. NEDS improved FCR ( $P < 0,001$ ), increased body weight, final weight, and performance index ( $P < 0,05$ ), and enhanced gut health by increasing villi width and apical villi height ( $P < 0,05$ ). Intestinal *Escherichia coli* counts decreased ( $P < 0,01$ ), cholesterol decreased ( $P < 0,001$ ), LDL decreased ( $P < 0,05$ ), and meat quality improved ( $P < 0,001$ ). NEDS administration did not affect Avian Influenza and Newcastle Disease antibody titers. The recommended formulation of NEDS at a dose of 68 mL/L administered through drinking water shows potential as a natural growth promoter in broiler chickens. Based on the overall conclusions of the study, nanoencapsulation of Sungkai leaf extract has been proven effective as a natural feed additive with the potential to improve broiler performance and health.

Keywords: Antibacterial, Broiler chicken, Sungkai leaf extract, Phytobiotic Nanoencapsulation