

Intisari

Isolasi dan Karakterisasi Bakteri Keratinolitik untuk Mendegradasi Bulu Ayam sebagai Bahan Baku Sumber Protein Pakan Ikan

Limbah bulu ayam berpotensi dimanfaatkan sebagai bahan baku pakan ikan alternatif karena memiliki kandungan protein kasar yang tinggi, namun pemanfaatannya masih terbatas akibat dominasi protein keratin yang sulit dicerna. Penelitian ini bertujuan untuk mengeksplorasi dan mengkarakterisasi bakteri keratinolitik yang mampu mendegradasi bulu ayam. Sampel diisolasi dari tanah kandang ayam, bulu ayam, dan air limbah tahu, kemudian dilanjutkan dengan uji aktivitas enzim kualitatif meliputi proteolitik pada media *Skim Milk Agar*, selulolitik pada media CMC, lipolitik pada media yang mengandung Tween-80, dan keratinolitik pada media yang mengandung keratin powder. Isolat dengan aktivitas keratinolitik diuji kemampuannya mendegradasi bulu ayam melalui pengukuran total protein terlarut menggunakan metode Bradford, derajat hidrolisis menggunakan metode berat sisa, serta aktivitas keratinolitik kuantitatif menggunakan substrat keratin. Identifikasi bakteri dilakukan secara fenotipik melalui pengamatan morfologi koloni, pewarnaan Gram, uji KOH 3%, oksidase, dan katalase, serta secara molekuler menggunakan amplifikasi dan sekuensing gen 16S rRNA. Hasil penelitian memperoleh 15 isolat bakteri, dengan 12 isolat menunjukkan aktivitas keratinolitik. Isolat TK3D memiliki total protein terlarut tertinggi sebesar $134,20 \pm 9,90$ $\mu\text{g/mL}$. Isolat AT1B memiliki derajat hidrolisis tertinggi sebesar $88,20 \pm 0,01$ % dan aktivitas keratinolitik tertinggi sebesar $64,48 \pm 0,24$ U/mL. Berdasarkan identifikasi molekuler, isolat TK3D dan TK3A memiliki kemiripan 100% dengan *Serratia marcescens*. Isolat AT1B, AT1C, dan AT2A mempunyai kemiripan <97% dengan *Bacillus* sp. Hasil dari penelitian ini diharapkan mampu mendapatkan kandidat bakteri keratinolitik lokal yang efektif untuk mendegradasi bulu ayam sehingga dapat meningkatkan nilai nutrisi limbah bulu ayam sebagai bahan pakan ikan yang ekonomis dan ramah lingkungan.

Kata kunci: bakteri keratinolitik, bulu ayam, keratinase, pakan ikan

Abstract

Isolation and Characterization of Keratinolytic Bacteria to Degrade Chicken Feathers as Protein Source of Fish Feed Ingredient

Chicken feather waste can serve as an alternative fish feed ingredient owing to its high crude protein level; nonetheless, its application remains constrained due to the predominance of keratin protein, which is challenging to digest. This study seeks to investigate and delineate keratinolytic bacteria that can decompose chicken feathers. Samples were extracted from chicken coop soil, chicken feathers, and tofu wastewater, subsequently undergoing qualitative enzyme activity assays: proteolytic on Skim Milk Agar, cellulolytic on CMC media, lipolytic on Tween-80 media, and keratinolytic on keratin powder media. Isolates exhibiting keratinolytic activity were evaluated for their capacity to digest chicken feathers by measuring total dissolved protein via the Bradford method, assessing the degree of hydrolysis by the residue weight method, and quantifying keratinolytic activity using a keratin substrate. Bacterial identification was conducted phenotypically through the examination of colony morphology, Gram staining, 3% KOH test, oxidase and catalase tests, and molecularly via amplification and sequencing of the 16S rRNA gene. The investigation yielded 15 bacterial isolates, of which 12 exhibited keratinolytic activity. Isolate TK3D exhibits the greatest total dissolved protein concentration at $134.20 \pm 9.90 \mu\text{g/mL}$. Isolate AT1B exhibits the highest hydrolysis rate at $88.20 \pm 0.01\%$ and the greatest keratinolytic activity at $64.48 \pm 0.24 \text{ U/mL}$. According to molecular identification, isolates TK3D and TK3A exhibit 100% identity with *Serratia marcescens*. Isolates AT1B, AT1C, and AT2A exhibit less than 97% similarity to *Bacillus* sp. This study aims to identify efficient local keratinolytic bacterial candidates for the degradation of chicken feathers, enhancing the nutritional content of chicken feather waste as a cost-effective and eco-friendly fish feed ingredient.

Keywords: chicken feather, fish feed, keratinase, keratinolytic bacteria