

## **ABSTRAK**

### **PENGARUH PENAMBAHAN ION LOGAM DIVALEN ( $\text{Fe}^{2+}$ , $\text{Cu}^{2+}$ , DAN $\text{Zn}^{2+}$ ) TERHADAP PRODUKSI HIDROLISAT PROTEIN DARI LIMBAH BULU AYAM OLEH BAKTERI ISOLAT B-9-6**

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Bulu ayam merupakan limbah dari rumah potong ayam (RPA) yang mengandung 80-90% protein berupa keratin. Protein keratin pada bulu ayam sulit terdegradasi secara alami. Protein keratin dapat didegradasi oleh enzim keratinase menghasilkan hidrolisat protein yang dapat dimanfaatkan lebih lanjut. Penambahan ion logam divalen secara umum dapat meningkatkan produksi dan aktivitas keratinase dengan berperan sebagai kofaktor, namun pada konsentrasi tertentu ion logam divalen juga dapat berperan sebagai inhibitor enzim keratinase. Penelitian ini bertujuan untuk mengetahui pengaruh penambahan ion logam divalen  $\text{Fe}^{2+}$ ,  $\text{Cu}^{2+}$ , dan  $\text{Zn}^{2+}$  terhadap produksi hidrolisat protein oleh bakteri isolat B-9-6. Parameter yang dianalisis meliputi pertumbuhan bakteri, persen degradasi bulu ayam, kadar hidrolisat protein, kadar asam amino yang dibebaskan, dan aktivitas enzim keratinase. Hasil penelitian menunjukkan bahwa penambahan ketiga jenis ion logam divalen dengan konsentrasi 1 mM menghambat proses degradasi dan secara umum menurunkan kemampuan produksi hidrolisat protein dari bulu ayam. Persen degradasi yang diperoleh pada kultur tanpa penambahan ion logam yaitu sebesar 56,56%, sedangkan dengan penambahan ketiga ion logam tersebut diperoleh secara berturut-turut nilai sebesar: 33,43%; 28,59%; dan 26,4%. Pertumbuhan bakteri tertinggi diperoleh pada kondisi kultur dengan penambahan ion logam  $\text{Fe}^{2+}$  yaitu sebesar 2,065. Kadar hidrolisat protein tertinggi diperoleh pada kondisi kultur tanpa penambahan ion logam yaitu sebesar 1.497,14 ppm. Kadar asam amino tertinggi diperoleh pada kondisi kultur tanpa penambahan ion logam yaitu sebesar 1.096,15 ppm. Nilai aktivitas enzim tertinggi terdapat pada kultur dengan penambahan ion logam  $\text{Fe}^{2+}$  yaitu sebesar 19,35 U/mL.

**Kata kunci:** Bulu ayam, biodegradasi, hidrolisat protein, isolat bakteri B-9-6, dan ion logam divalen.

## **ABSTRACT**

### **EFFECT OF ADDING DIVALENT METAL IONS ( $\text{Fe}^{2+}$ , $\text{Cu}^{2+}$ , AND $\text{Zn}^{2+}$ ) ON PROTEIN HYDROLYSATE PRODUCTION FROM CHICKEN FEATHER WASTE BY BACTERIAL ISOLATE B-9-6**

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Chicken feathers are waste from chicken slaughterhouses that contain 80-90% protein in the form of keratin. Keratin protein in chicken feathers is difficult to degrade naturally. Keratin protein can be degraded by keratinase enzymes to produce protein hydrolysates that can be utilized further. The addition of divalent metal ions can generally increase the production and activity of keratinase by acting as a cofactor, but at certain concentrations divalent metal ions can also act as inhibitors of keratinase enzymes. This study aims to determine the effect of the addition of divalent metal ions  $\text{Fe}^{2+}$ ,  $\text{Cu}^{2+}$ , and  $\text{Zn}^{2+}$  on the production of protein hydrolysates by bacterial isolate B-9-6. Parameters analyzed included bacterial growth, percent degradation of chicken feathers, protein hydrolysate content, liberated amino acid content, and keratinase enzyme activity. The results showed that the addition of all three types of divalent metal ions at a concentration of 1 mM inhibited the degradation process and generally decreased the ability to produce protein hydrolysates from chicken feathers. Percent degradation obtained in cultures without the addition of metal ions is 56.56%, while with the addition of the three metal ions obtained consecutively values of: 33.43%; 28.59%; and 26.4%. The highest bacterial growth was obtained in culture conditions with the addition of  $\text{Fe}^{2+}$  metal ions, which amounted to 2.065. The highest protein hydrolysate content was obtained in culture conditions without the addition of metal ions, which amounted to 1,497.14 ppm. The highest amino acid content was obtained in culture conditions without the addition of metal ions, which amounted to 1,096.15 ppm. The highest enzyme activity value was found in the culture with the addition of  $\text{Fe}^{2+}$  metal ions, which amounted to 19.35 U/mL.

**Keywords:** Chicken feathers, biodegradation, protein hydrolysate, bacterial isolate B-9-6, and divalent metal ions.