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Statistical Optimisation of *Streptomyces* sp. DZ 06 Keratinase Production by Submerged Fermentation of Chicken Feather Meal

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Abstract: This study focused on the isolation of actinobacteria capable of producing extracellular keratinase from keratin-rich residues, which led to the selection of an actinobacterial strain referenced as *Streptomyces* strain DZ 06 (ES41). The Plackett–Burman screening plan was used for the statistical optimization of the enzymatic production medium, leading to the identification of five key parameters that achieved a maximum activity of 180.1 U/mL. Further refinement using response surface methodology (RSM) with a Box–Behnken design enhanced enzyme production to approximately 458 U/mL. Model validation, based on the statistical predictions, demonstrated that optimal keratinase activity of 489.24 U/mL could be attained with 6.13 g/L of chicken feather meal, a pH of 6.25, incubation at 40.65 °C for 4.11 days, and an inoculum size of 3.98 × 10^7 spores/mL. The optimized culture conditions yielded a 21.67-fold increase in keratinase compared with the initial non-optimized standard conditions. The results show that this bacterium is an excellent candidate for industrial applications when optimal conditions are used to minimize the overall costs of the enzyme production process.

Keywords: keratin residues; chicken feather meal; keratinase activity; actinobacteria; biodegradation; Plackett–Burman; response surface methodology

1. Introduction

The poultry industry is the main driver of global meat production [1]. This sector continues to grow and industrialize in many parts of the world. The increase in population, purchasing power, and urbanization have been powerful drivers of growth for this sector. The latest forecast of the Food and Agriculture Organization of the United Nations (FAO) predicts that world poultry meat production is expected to reach 146 million tonnes in 2024, increasing by 0.8% year-on-year [2]. The Agricultural Outlook 2024–2033 of the