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# Valorization of poultry feather with poultry litters and evaluation of effects on the microbial biota, minerals and plant growth potential

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**The persistence and accumulation of keratin-rich poultry feathers contribute to environmental pollution and inefficient waste disposal due to their resilient structure. Poultry litter, however, may serve as a co-substrate to enhance microbial biodegradation of feathers, thereby reducing greenhouse gas emissions and improving nutrient recovery. This study evaluated microbial and biochemical interactions during the co-degradation of feathers and poultry litter. Microbial counts (bacteria and fungi), mineral composition, and optimal substrate ratios were determined. Controlled degradation experiments in different ratios of poultry feathers to litters revealed that weight of feathers (5 g) and litter (5 g) supported the highest microbial activity. Bacterial counts increased from $1.3 \times 10^3$ to $3.1 \times 10^4$ CFU/ml, while fungal counts rose from $1.6 \times 10^2$ to $2.0 \times 10^5$ CFU/ml. Mineral analyses showed significant variations before and after degradation. The feather–litter mixture produced the highest phosphorus concentration post-degradation (14.710 mg/L), while feather-only treatments retained the most nitrogen (27.58 g/L) and potassium (12.760 mg/L). These results demonstrated that feathers delivered consistent nitrogen, while litter supplied phosphorus, potassium and organic carbon to the substrate, establishing a balanced setting that promoted microbial growth. By transforming feathers and litter into nutrient-rich hydrolysates, this strategy provides a sustainable alternative for soil amendment, reduces environmental pollution, and promotes circular bioeconomy practices.**

**Keywords:** Poultry feathers, keratin degradation, biofertilizer potential, soil fertility, plant growth.

## INTRODUCTION

Keratin is a structural protein found in feathers, wool, hair, nails, and skin. Its high cysteine content forms strong disulfide bonds, giving keratin exceptional stability and resistance to microbial degradation (Reddy *et al.,* 2021). While this durability is biologically advantageous, it poses challenges in waste management, as keratin-rich residues persist in natural environments (Verma *et al.,* 2021).

Keratin exists in two forms: α-keratin, present in mammalian hair and wool, which has a flexible helical structure; and β-keratin, found in bird feathers and reptilian scales, characterized by a rigid pleated-sheet structure (Sharma and Gupta, 2022). The persistence of β-keratin, in particular, makes feather waste from poultry farming a pressing environmental issue. Globally, poultry processing generates an estimated 40 million tons of chicken feathers annually, much of which is discarded (Gupta *et al.,* 2023). Similarly, wool processing, hair waste from salons, and domestic grooming activities add to the global keratin waste burden (Thompson *et al.,* 2023; Ali *et al.,* 2022).

Conventional disposal methods such as land filling and incineration have significant drawbacks. Land-filled keratin remains largely undegraded, consuming space and risking