IJNRD.ORG ISSN : 2456-4184
INTERNATIONAL JOURNAL OF NOVEL RESEARCH AND DEVELOPMENT (IJNRD) | IJNRD.ORG
An International Open Access, Peer-reviewed, Refereed Journal

EFFECTIVE FEATHER DEGRADATION BY *Bacillus* sp. ISOLATED FROM POULTRY SOIL

Neeta.V.M.Joshi[1], Narmadha.G.S[2], Mohamed Hasan Ashar H[3]

[1]Correspnding Author, Assistant Professor, Department of Microbiology,

Scott Christian College, Nagercoil

ABSTRACT:

World-wide poultry processing plants produce million tons of feathers as a waste product annually, which consists of approximately 90% keratin. Keratin belongs to a family of fibrous, insoluble structural polypeptides, and constitutes the major component of the epidermis and its appendages such as hair, nails, feathers, wool and horns. There are several species of keratinolytic bacteria work together to breakdown the keratin by secreting the enzyme keratinase. But members of *Bacillus* sp. are the most predominant. This study was conducted to isolate the *Bacillus* sp and degrade the feathers using that microbe.

KEYWORDS: poultry waste, feather degradation, *Bacillus* sp, keratinolytic activity, keratinase.

INTRODUCTION:

Keratin belongs to a family of fibrous, insoluble structural polypeptides and constitutes the major component of the epidermis. Its appendages such as hair, nails, feathers, wool and horns are also rich in keratin. They are made up of hard keratin . It means that they have the strong disulphide bonds or high sulfur concentration. And soft keratin have lose and weak disulphide bonds and low sulfur content and they are easy to degrade. Example: skin, callus.

World-wide poultry processing plants produce million tons of feathers as a waste product annually, which consists of approximately 90% keratin. Feathers are important by product in poultryindustry as they account for 5-7% of the body weight of chicken. The degradation of keratinous material is potentially important both medically and biotechnologically. In nature, various beneficial microorganisms works together in breaking down the protein rich keratin structures by secreting extracellular enzyme keratinase. There are several species of

keratinolytic bacteria, but members of *Bacillus* sp. are the most predominant. keratinase is an enzyme which have been associated with the subtlisin family of alkaline serine or metalo-protease that are able to degrade keratins into aminoacids.

METHODOLOGY:

SAMPLE COLLECTION:

Soil sample was collected from the poultry farm at Eruvadi, Tirunelveli, Tamilnadu.

ISOLATION:

For the isolation process spread plate technique was performed using nutrient agar medium. The spread plate technique was performed by following the dilution process.

IDENTIFICATION:

First of all using the colony morphology the colonies were identified. Then gram staining, endospore staining and hanging drop methods where performed. And for biochemical identification Indole, methyl red, voges proskaue r, citrate utilizatintest, catalase, glucose fermentation test were performed.

FEATHER DEGRADATION:

After the identification of the bacteria that is *Bacillus* sp the chicken feathers were allowed to degrade at various temperature and pH like 27^{o}c, 37^{o}c, 40^{o}c and pH neutral(7), acid(5), base(9) with the help of the isolated *Bacillus* sp. For the degradation process feathers were allowed to degrade in nutrient broth inoculated with the identified Bacillus sp.

ANALYSIS OF FEATHER DEGRADATION:

Feather degradation was analyzed by weighing the feathers for the interval of every 7 days.

RESULT:

ISOLATION:

Large, irregular, white color colonies.

MICROSCOPIC OBSERVATION:

STAINING TECHNIQUES:

GRAM STAINING:

Gram positive rod shape bacteria was observed on Gram staining

ENDOSPORE STAINING:

Vegetative cells and spores were observed on Endospore staining

HANGING DROP METHOD:

Motile organism was observed on hanging drop method

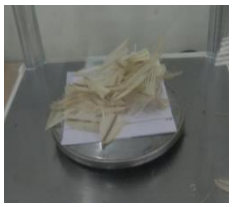
BIOCHEMICAL TEST:

TABLE 5.1

Biochemical tests	Results
Indole test	Negative
Methyred test	Negative
Vogues-proskauer	Positive
Citrate test	Positive
Catalase test	Positive
Glucose fermentation test	Gas and acid production

ANALYSIS OF FEATHER DEGRADATION:

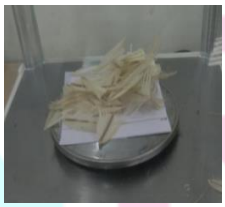
At 37°c



DAY (1g)

DAY 28 (0.497g)

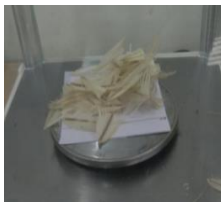
At 40°c



DAY 1 (1g)

DAY 28 (0.346g)

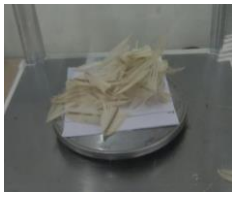
At 27°c



DAY 1 (1g)

DAY 28 (0.650)

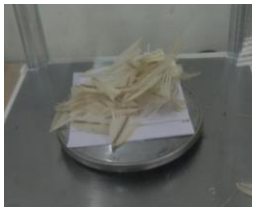
pH 5



DAY 1 (1g)

DAY 28(0.644g)

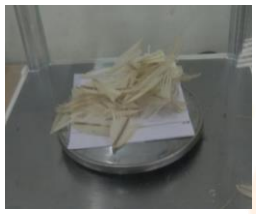
pH 7



DAY1 (1g)

DAY 28 (0.508g)

pH 9



DAY (1g)

DAY 28 (0.688g)

FEATHER DEGRADATION RATE:

The degradation rate of feathers was measured as the change in dry weight before and after degradation. The hydrolysate was passed through a filter paper to remove unhydrolyzed feathers, and the removed feathers were washed several times with deionized water to completely remove the soluble materials and bacteria, followed by drying in an oven at 65°c for 24 hours. The feather degradation rate was calculated using the following formula;

Feather degradation rate (%) = 100 × (B-A) / B

Where , B- Dry weight of feathers before decomposition

A-Dry weight of feathers after decomposition.

Feather degradation rate after 28 days in various conditions (temperature and pH) are,

For every condition B value that is, dry weight of feathers before decomposition is same. And the B value is 1000mg.

AT 27°c 35%

AT 37◦c 50.3%

AT 40◦c 65.4%

pH 5 35.6%

pH 7 49.2%

pH 9 31.2%

DISCUSSION:

In the present study, the isolates obtained from poultry soil was characterized morphologically and biochemically. Based on the comparison of biochemical characteristics with standard description the bacterial isolates were identified as *Bacillus* sp. The isolates exhibited keratin degradation activity in different pH and temperature**.**

Younes Ghasemi *et al*., (2012) demonstrated that the isolate *Bacillus* sp. MKR5 exhibited feather degradation within 24 hours at 40°c. The present study also correlated with the above work, the *Bacillus* sp. isolated from poultry soil showed the highest amount of degradation at 40°c.

Zheng Peng *et al*., (2019) degraded 50gm of chicken feather waste in batches using *B.licheniformis* BBE11-1 and *S.maltophilia* BBE11-1. In our present study, 1gm of chicken feather was degraded by using the isolated *Bacillus* sp and the morphology of the *Bacillus* species is as that of *Bacillus licheniformis*.

Manirujjaman (2016) *et al.*, reported that their isolate grew well and maximum feather degrading activity at 37°c and the pH 7.5. In the present study, maximum feather degrading activity of the organism is at 40°c and pH 7. The organism they isolated was pigment producing, rod-shaped, endospore forming, catalase positive and Gram negative bacteria. In the present study, the organism is rod-shape, endospore forming, catalase positive. But the organism is non pigment producing and Gram-positive bacteria.

REFERENCES:

Allpress *et al*., (2002). Production, purification and characterization of an extracellular keratinase from *Lysobacter* NCIMB9497

Amika Ahmed Manzum and Md Arafat A l Mamun, (2018). Isolation of *Bacillus* from soil for production of cellulose,

Gupta.R. and Ramnani.P. (2006). Microbial keratinase and their prospective applications; an overview

Kim.J.M. *et al*., (2001). Father degrading *Bacillus* species from poultry waste, 287-291. **K**orkmaz.H. *et al*., (2004). Characterization of alkaline keratinase of *Bacillus licheniformis* strain HK-1 from poultry waste

Manirujjaman. M. *et al*., (2016). Isolation and characterization of feather degrading bacteria from poultry waste.

Onifade.A.A *et al*., (1998). A review : potentials for biotechnological applications of keratin-degrading microorganisms and their enzymes for nutritional improvement of feathers and other keratins as livestock feed resources, 1-11.

Priya Ramnani *et al*., (2005). Keratinolytic potential of *Bacillus licheniformis* RG1: structural and biochemical mechanism of feather degradation.

Xu.B. *et al*., (2009). Isolation and characterization of a new keratinolytic bacterium that exhibits significant feather degrading capability.

Younes Ghasemi *et al*., (2012). Identification and characterization of feather-degrading bacteria from keratin-rich wastes.

Zheng Peng *et al*., (2019). Effective biodegradation of chicken feather waste by co-cultivation of keratinase producing strains.