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Bin Composting of Poultry Waste

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***Abstract*— The disposal of poultry waste in India is one of the major tasks, as it is directly disposed free to atmosphere or buried directly. Direct burying the poultry waste may be a proper method for disposal of poultry waste but it has its own drawbacks such as the waste may be tackled by stray dogs, scavengers and other animals. Bin Composting is the ultimate solution to protect the waste from scavengers and best way to compost poultry waste. Compost is a rich source of nutrients with high organic matter content and use of compost can be beneficial to improve organic matter status. Physical and chemical properties of soil can be improved by using compost, which may ultimately increase crop yield. These important parameters are proper turning of compost, temperature, pH and moisture percentage of the compost heap. So the use of compost is the need of the time and beneficial to improve organic matter status. In this paper the management of poultry flesh (bin composting), poultry carcass (burying), egg shells and feathers is discussed.**

Keywords: Poultry Waste; pH; Bin Composting; Carcass.

I. INTRODUCTION

Due to the demand for poultry products the poultry waste generated is in large amounts as a byproduct of commercial poultry processing causing pollution load on the urban environment to unmanageable and alarming proportions. The existing poultry waste disposal is done directly in open areas almost all over the country under unsanitary conditions leading to pollution of water sources and spreading communicable diseases, foul smell and odors, the release of toxic metabolites, unaesthetic ambiance, and eye sore etc.

In India poultry farming is done on contract basis. Farmer buys young chicks from the company and grows them until they are matured for almost 40 to 45 days. The poultry chickens are kept in congested areas and the litter is also not cleaned periodically in rural areas, due to which there is much possibilities of disease in the bird. Some chicken do not survive the harsh conditions and they die. As the farmer is not available 24x7 on the farm the dead poultry is kept unnoticed, once the farmer gets to now about the dead bird he has to wait to inform the number of dead birds to the company's supervisor. The supervisor visits every alternate days and only after the inspection the farmer has to dispose the dead bird otherwise the farmer has to pay for the dead poultry. In this total process the dead poultry is kept in the poultry farm itself along with the live ones. If the reason of death of bird is serious then its dead body may start decomposition over the farm itself and there is much possibilities that the live chicken may also get affected hence proper actions should be taken for the disposal of poultry waste and bin composting is one of the best alternative to manage such waste.

Composting is a microbiological and non-polluting method for conversion of poultry waste into organic fertilizer. During composting, mixed microbial populations convert organic wastes into humus, which has significant value in agriculture. Anaerobic composting enhances gentrification processes and emits several greenhouse gases to the atmosphere. It improves the physical characteristics of wastes. During composting, various microorganisms promote biodegradation of toxic compounds.

The objective of this paper is to study the performance of the aerobic composting of poultry wastes in controlled conditions which may prove to control the environmental pollution and the end product will be useful to the people.

II. PRINCIPLE OF COMPOSTING

Bin Composting the poultry waste is a controlled natural disintegration process that changes over natural issue to a steady, humus-like item. The procedure relies on microorganisms which use decomposable natural waste both as a vitality and nourishment source. The "controlled" idea of treating the waste recognizes it from other natural procedures, for example, spoiling and rottenness.

Dampness substance will to a great extent decide if the procedure will be "anaerobic" (without oxygen) or "aerobic" (with oxygen). For dead winged creature transfer, oxygen consuming systems are favored in light of the fact that they are quicker and produce fewer scents and other frightful highlights. Perfect dampness content for oxygen consuming treating the soil is around 60 percent. At a 70 percent dampness content, the procedure starts to go anaerobic. A dampness substance of 50 percent or underneath will hinder the treating the soil procedure. High dampness level can be controlled when working with a wet waste by utilizing some additional straw, litter, or other building operator. Low dampness substance is expanded by sprinkling the heap with a deliberate measure of water.

The carbon: nitrogen proportion (C: N) additionally influences the rate of natural compost. Carbon: nitrogen proportions of 15:1 to 35:1 are worthy. On the off chance that the C: N proportion is under 25:1, life forms can't use the majority of the nitrogen accessible, and nitrogen is then lost as smelling salts. This, thusly, brings about an unsavory smell, conceivable air contamination, and loss of potential manure esteem. At the point when the C: N proportion surpasses 30:1, the rate of fertilizing the soil diminishes. Inorganic nitrogen, for example, urea or ammonium nitrate can be blended with the carbonaceous

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material to bring down the C: N proportion to 30:1, or beneath.

Table 1: Model dimension for composting

Sr.No	Particulars	Model size (inch)	Steel used size(mm)
1.	Plastic bin of 200 lit	26 X 26 X 15	8

Temperature is a decent pointer of natural movement in the manure heap, and is effectively estimated. A few days after squanders are blended and put in heaps, thermophilic organisms should start to overwhelm. These creatures incline toward a temperature of 100 degrees F to 150 degrees F. As conditions in the heap change, for instance, because of an ominous dampness content, change in the C: N proportion, or diminishing oxygen supply, the temperature may drop and the microbial populace will move back to a system of lower temperature organisms.

For whatever length of time that the heap temperature is expanding, it is functioning admirably and ought to be disregarded, Subsequent to turning, the heap ought to react to the blending and joining of oxygen, and temperature ought to again cycle upwards. In a perfect world, the turning procedure ought to be proceeded until the warming reaction does not happen once more, showing that the fertilizer material is biologically steady.

III. POULTRY COMPOSTER DESIGN

Depending upon the size of compost 200lt plastic water tank, considering the latchet and temperature is used as a compost bin. The bin will insure the safety of compost and organic matter from crawling and stray animals. Holes for oxygen and air along with proper insulation with thermal foil paper for temperature control is also been considered while preparing the compost. Provision of hole for inserting thermometer for temperature monitoring is also done.

Following are some modifications made to the compost bin,

i. Use of a plastic bin as a compost holding material is adopted to seal the heat within the container and reduce the heat loss effect.
ii. The organisms require oxygen to survive and further decompose the matter hence 1cm (3 on each face) holes at the bottom and top are provided. The holes at bottom helps in circulating cool air in the bin and as the density of hot air is low is releases from the top holes.
iii. The compost material is not completely rested on the bottom; a gap of 5cm is kept between the bottom of plastic bin and compost with the help of steel reinforcement of 8mm bars. This gap provides air flow for proper composting in the bin, which is not achieved in direct burying of waste for compost in ground.
iv. The steel reinforcement is covered with steel mesh so as to support the compost material in place.
v. A plastic lid covers the top of bin to secure safety from stray animals.

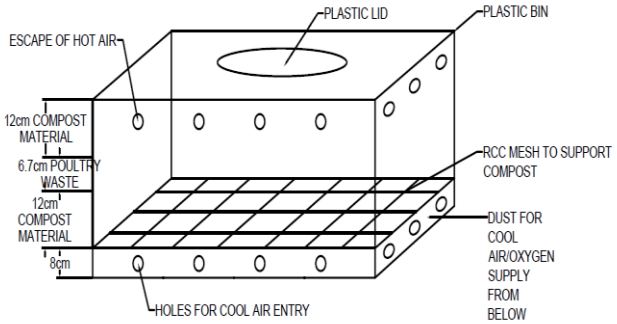

Image 1: Compost Bin Model

IV. MATERIAL AND METHODOLOGY

The poultry waste (i.e., dead birds, egg shells, poultry litter), has been selected as composting material along with the use of fallen tree leaves and dry grass as bulking material, for carrying out the study work of aerobic composting. The C/N ratio was adjusted by using the (Table 1).

Table 2: C/N Ratio and Material used for the compost.

Sr. No.	Material in compost	Weight in kg	C/N Ratio	Remark
1	Egg Shells	1	-	Rich in Calcium
2	Saw Dust	3	250:1	-
3	Grass clippings and greens	20	12:1	-
4	Cow dung	12	25:1	Extra 4kg added on day 14
5	Cows Urine	6lit	0.8:1	Extra 1lit added on day 14
6	Poultry Litter	6	8:1	-
7	Rice Shells	6	80:1	-
8	Chicken	2	High in Nitrogen	-

***on the bases of C/N ratio of various materials, a C/N 35:1 ratio was used in composting process. Extra material was added later to balance the ratio.**

Use of carbon as compared to nitrogen is high so as to limit the foul smell caused during the decomposing process of dead bird. With time the nitrogen levels reduced hence extra materials rich in nitrogen were added on 14th day of compost.

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Procedure:

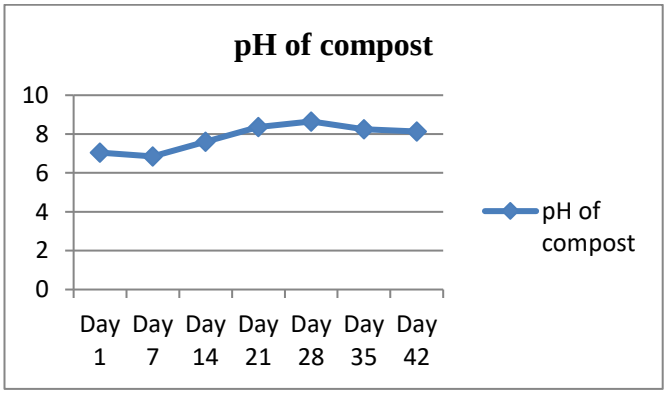
a. All the compost material was collected in adequate amount to balance the C:N ratio of the compost, the temperature of each material was equal to the ambient temperature.
b. The dead poultry birds were collected from the farm, the reason for death of birds was unknown and the birds were kept for 2 days for the inspection purpose in the farm, hence before using birds for composting they were boiled for 10 minutes so as to insure that the harmful bacteria are reduced to some extent.
c. A 2cm thick layer of saw dust at the bottom and top of compost was applied so as to control the foul odor caused by decomposition of bodies.
d. The carcass was cut down to small pieces for rapid decomposition process and was buried under 15cm thick layer of compost material and also had a 15cm layer beneath.
e. The lid was closed and the compost process, after 8th day the oxygen and temperature levels reduced in the bin reducing the decomposing rate hence for every 6 or 7 the compost needed to overturn.
f. Daily monitoring temperature, moisture content and pH was done.

V. OBSERVATIONS AND TEST RESULTS

Daily monitoring temperature, moisture content and pH was done and macro and micro nutrients in the soil were tested after 42 days.

Table 3: Observed pH Value during Composting

No. of Days	1	7	14	21	2	35	42
pH of Compost	7.05	6.85	7.60	8.37	8.65	8.25	8.14

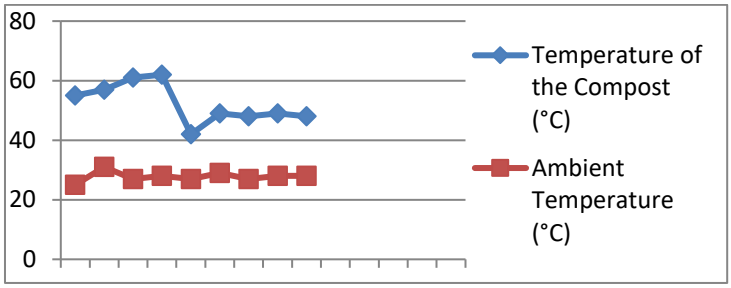


Graph 1: Change in pH During the Process

The rise in temperature was caused due to carbon dioxide released by the bacteria during decomposition process. Lower temperature indicates the unfavorable conditions for microorganisms.

Table 4: Observed Temperature Value during Composting

No. of Days	2	4	6	8	14	21	28	35	42
Temperature of the Compost (°C)	55	57	61	62	42	49	48	49	48
Ambient Temperature	25	31	27	28	27	29	27	28	28

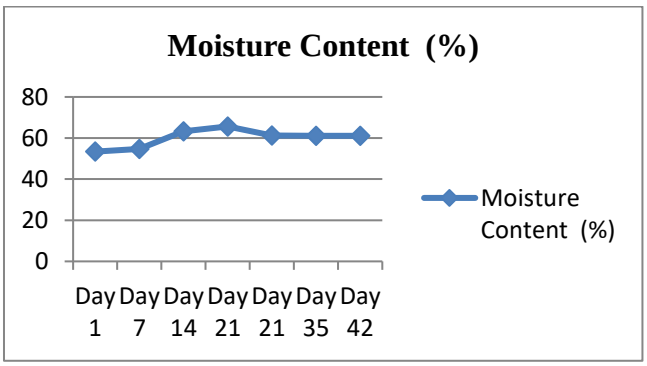


Graph 2: Observed Temperature Value during Composting

The temperature between day 8 and day 14 was drastically reduced due to insufficient oxygen at the center of bin which required overturning of the compost. The reason for temperature difference was also due to reduction in nitrogen content and reduced bacterial growth. To increase the nitrogen, nitrogen rich cow dung and cows urine were added on day 14 to maintain the C/N ratio. After day 42 the temperature further started reducing.

Table 5: Observed Moisture Content Value during Composting

No. of Days	1	7	14	21	28	35	42
Moisture Content (%)	53	55	63	66	61	61	61



Graph 3: Observed Moisture Content (%)Value during Composting

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*All the values are in % except pH

Table 6: Comparison of Chemical Characteristics of Finished Compost and Standard Compost

Sr. No	Parameters	Value of Finished compost for 42 days	Standard Compost
1	*pH	6.80	–
2	Organic carbon	39.223	8 – 40
3	Organic matter	45.635	25 – 50
4	Nitrogen	3.015	0.50 – 3.40
5	Phosphorous	1.852	0.50 – 3.50
6	Potassium	1.204	0.50 – 2.00
7	Cobalt	0.0006	In std. limits
8	Manganese	0.0042	In std. limits
9	Nickel	0.0017	In std. limits
10	Zinc	0.0040	In std. limits
11	Iron	BDL	–
12	Copper	0.0271	In std. limits

VI. CONCLUSION

It is concluded that the composting of the poultry waste through aerobic composting by using a bin for 2 birds is a simple method to process and operate which is nuisance free, environmental friendly, aesthetically good looking, economical in long term and socially acceptable as the final product has good fertilizer value. It can be made on large scale for huge poultry farms. At the end the remains in the waste were feathers and bone. If the feathers are removed in rotating drums before boiling only the bones are remained after the process which can be disposed at landfills.

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VII. BIBLIOGRAPHY

[1] D.Thyagarajan, M.Barathi, R.Sakthivadivu , " Scope of Poultry Waste Utilization", Director of Distance Education, Senior Research Fellow, Assistant professor, TANUVAS e-ISSN: 2319-2380, p-ISSN: 2319-2372. Volume 6, Issue 5 (Nov. - Dec. 2013), PP 29-35.

[2] Phil Glatz *, Zhihong Miao and Belinda Rodda, "Handling and Treatment of Poultry Hatchery Waste", SARDI Livestock Systems, Davies Building, Roseworthy Campus, SA 5371, Australia. ISSN 2071-1050, Sustainability 2011, 3, 216-237.

[3] N. Prasanthi1, S. Bhargavi1, P.V.S. Machiraju2, "Chicken Feather Waste – A Threat to the Environment", Asst. Professor, Department of BS & H, Pragati Engineering College, Surampalem, Andhra Pradesh, India1 Professor in chemistry, Department of BS & H, Pragati Engineering College, Surampalem, Andhra Pradesh, India2, Vol. 5, Issue 9, September 2016

[4] Gary A. Flory, "Evaluation of In-Vessel Composting for Poultry Mortality" , Virginia Department of Environmental Quality,4411 Early Road,,P.O. Box 3000, Harrisonburg, VA 22801.

[5] Thomas Bass, Livestock Environment Associate Specialist, MSU Extension; Julia Dafoe, Research Associate, Montana Agricultural Research Station; and Joel Schumacher, Extension Economics Associate Specialist " Manure Composting for Livestock & Poultry Production" **Reviewed** April 2017 812SA.

[6] Eldridge R. Collins, Jr., Extension Agricultural Engineer., " Composting Dead Poultry", College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, 2009, publication 424-037.

[7] Willekens N Bharathy, R Sakthivadivu, K Sivakumar, V Ramesh Saravanakumar, "Disposal and utilization of broiler slaughter waste by composting", Veterinary College and Research Institute Namakkal, Tamil Nadu, India. Vet. World, 2012, Vol.5(6): 359-361.