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REVIEW

DERLEME

Waste to Wealth Strategies: Recycling Poultry Manure

Mehmet YARDIMCI*

S U M M A R Y

One of the main problems of poultry industry is recycling the wastes in an environment friendly and sustainable way. Some processing ways of poultry manure are anaerobic processing, aerobic processing, dehydration and incineration. Best management practices for safe and beneficial utilization of poultry manure with minimum impact on environment, it should be handled properly. Conversion to energy, fertilizer or feedstuff for animals is main uses of poultry litter. The system selected for recycling should be based on economics, engineering, public reaction and regulation as well as factors related to agriculture.

Key Words
Biogas
Fertilizer
Poultry manure
Recycling
Waste Management

Atıktan Servete Dönüşüm Stratejileri: Kanatlı Gübresinin Geri Dönüştürülmesi

ÖZET

Kanatlı sektörünün ana problemlerinden birisi, atıkların çevreye yararlı ve sürdürülebilir şekilde geri dönüştürülmesidir. Kanatlı gübresini işlemenin bazı yolları arasında aerobik, anaerobik işlemler, dehidrasyon ve yakma sayılabilir. Gübrenin değerlendirilmesinde çevreye minimum düzeyde etkisinin olması ve hem güvenli hem de kazançlı kullanılabilmesi için doğru şekilde idare edilmesi gerekmektedir. Kanatlı gübresinin bazı kullanım alanları arasında enerjiye dönüştürülmesi, tarımda gübre olarak kullanılması veya yem olarak değerlendirilmesi sayılabilir. Geri dönüşüm için tercih edilen sistemin ekonomi, mühendislik, kamuoyu tepkisi, yasal dayanaklar ve tarım ve hayvancılıkla ilgili faktörler temelinde oluşturulması gerekmektedir.

Anahtar Kelimeler
Biyogaz
Gübre
Kanatlı Gübresi
Geri Dönüşüm
Atık Yönetimi

Afyon Kocatepe University
Faculty of Veterinary Medicine
Department of Zootechny
Afyonkarahisar-Turkey

*** Corresponding author**
Email: myardimci@aku.edu.tr
Telefon: +90 (272) 228 13 12

INTRODUCTION

Poultry manure, if properly handled, is the most valuable of all manures produced by livestock (Mitchell and Donald 1999). Conversion of poultry litter to energy can serve as a renewable energy source and provide an alternative to land application in areas where intensive poultry production is practiced (Jensen et al 2010). On the other hand, the nitrogen, phosphorus and potassium constituents of poultry manure make it a suitable fertilizer. It can also be a very useful, inexpensive feedstuff for animals (Anonymous 1990). However, poultry manure contains other excreted substances such as hormones, antibiotics, pathogens and heavy metals which are introduced through feed. Leaching and runoff of these substances has the potential to result in pollution of surface water and groundwater resources (FAO 2008). For instance, surface water may be polluted by heavy rainfall sweeping the excess animal waste into nearby ditches, streams and lakes (Bowen et al 2010). This review provides an overview for recycling poultry manure within the broader context of the agricultural system.

Handling Poultry Manure

Manure handling systems operate in a very common sequence: collection, transfer, storage, removal, transport and incorporation. The system which is selected by an operation should be based on economics, engineering, public reaction and regulation as well as numerous factors related to agriculture and the operation (Anonymous 1990).

In recent years, large concentrations of poultry on small parcels of land have made the manure disposal problem more critical. Many growers, however, either don't have enough land to spread all litter properly or aren't able to coordinate poultry house cleanout with times that litter can be directly spread. In such cases, the grower might contract with neighbors or other potential users who can use the litter when houses are cleaned. Frequently, cleaning of houses does not coincide with available open cropland or with proper field conditions that permit operation of equipment or desirable nutrient uptake. Storage must then be provided until conditions are suitable for application on land, or until litter can be picked up for use by others as fertilizer or animal feed, or can be composted (Ogejo et al 2009). The storage method must protect litter from contact with rainwater or snow; stockpiling of uncovered litter on the soil for long periods before being fed into the auger can mean a five-fold drop in the amount of nitrogen in the litter. The nitrogen lost may leach or be washed into surface drains or streams or into groundwater. Therefore, improper storage results in greater impact on reduction of water quality in the area. The cover for the manure must be completely waterproof in order to reduce moisture levels (Bowen et al 2010).

In most cases, the moisture content of the manure is the determining factor on the selection of handling equipment and facilities to be used by an operation. The manure is handled either in liquid, solid or semisolid form. Liquid manure is usually obtained by adding water to poultry manure. Solid manure is obtained by either adding litter or drying of the poultry manure. Usually, poultry manure is not handled in a semisolid state (Anonymous 1990).

In all management strategies to reduce the negative impacts of poultry wastes on environment, following issues have to be concerned;

a. Litter must be frequently collected (once a week in dry seasons and twice a week in rainy seasons) to minimize the surface coming in contact with air and stored in closed containers (bags or closed sheds)

b. Cooling animal houses by ventilation creates air movement in the house and may indirectly help to reduce the moisture content of the manure

c. Moisture content of the litter must be lowered by using best available hydrophilic products such as saw dust or peanut husk.

d. The proliferation of flies and mosquitoes must be controlled by minimizing the surface of manure in contact with air, lowering litter's water content, applying insecticides and positioning the fly screens on the windows. (FAO 2008).

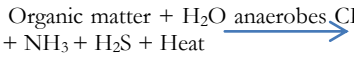
Processing Poultry Manure

The rapid increase in world population and the great developments in industrial, commercial, agricultural sectors require large quantities of energy, and create large quantities of wastes that should be disposed off with minimum negative environmental impacts and costs (Adeniran et al 2012). There are several ways in which poultry manure can be processed within this context.

a) Anaerobic Processing of Poultry Manure

Anaerobic digestion is used worldwide as a treatment for industrial, agricultural and municipal

wastes. It involves the degradation and stabilization of an organic material under anaerobic conditions by microbial organisms and leads to the formation of methane and inorganic products including carbon dioxide:



Anaerobic digestion is a relatively efficient conversion process for poultry litter producing a collectable biogas mixture with an average methane content of 60%. The methane produced by this process can be used as a fuel for boilers, as a replacement for natural gas or fuel oil and can also be fired in engine-generators to produce electricity for on-farm use or sale to electricity companies (Kelleher et al 2002). The biogas production technology differs from other technologies using renewable sources of energy for energy production because of two advantages. Firstly, biogas is a relatively clean fuel with a high content of methane which can be used for the generation of electricity and/or heat energy (Kvasauskas and Baltrėnas 2009, Taleghani and Kia 2005). Since biogas is a clean fuel it burns without leaving soot or particulate matter and also since it is lighter in terms of carbon chain length, less amount of carbon dioxide is released into the atmosphere during combustion (Arthur et al 2011). Secondly, as fertilizer that could be applied on soils is obtained from the anaerobic digestion of organic waste (Kvasauskas and Baltrėnas 2009, Taleghani and Kia 2005).

b) Aerobic Processing of Poultry Manure

Aerobic processing of poultry manure requires the presence of bacteria that need oxygen in order to decompose organic matter. The decomposition occurs when a mixture of diluted organic wastes is supplied with oxygen. When these conditions occur, the aerobic bacteria use the diluted poultry manure as a food source in various biochemical and oxidation reactions to reproduce themselves. One of the most promising ways in which to aerobically processed poultry manure is by composting it (Anonymous 1990). Aerobic composting reduces the bulkiness of the waste and yields a stabilized product suitable for handling in land application. Composting eliminates animal and human pathogens and could reduce the risks of polluting groundwater. Development of appropriate methods of composting poultry waste with suitable amendments could greatly reduce the nutrient losses and at the same time helps to minimize environmental pollution (Bolan et al 2010).

c) Dehydration of Poultry Manure

It is obvious that poultry manure would have a great potential in its drier form. Poultry manure is highest in nutrients, the driest to begin with, and can be further dried in the poultry house by several methods of ventilation and heating. There are several ways in which poultry manure can be dehydrated. These include: the deep pit system over high rise poultry buildings, the in-house manure drying system on slats, the in-house manure drying-system on belts, and the dehydration of poultry manure by mechanical dryer systems (Anonymous 1990).

d) Incineration

The burning of poultry manure is a very wasteful and ineffective way of processing the manure. The incineration of the manure allows for the escape of all the beneficial nutrients into the atmosphere. It produces air pollution due to odors and the release of particulate matter. Since poultry manure has a high organic content, incineration still yields a product which is very high in ash content. The result is that 10-30% of the initial dry matter still remains as ash. As well, collection and transportation of the manure to the incineration site make burning an expensive way to process poultry manure (Anonymous 1990), and the fuel used for incineration is a very expensive material and further increased the cost of disposal of poultry manure.

Ideas for Efficient and Profitable Management of Poultry Waste

Management of poultry waste must be integrated into a broader nutrient management programme in agriculture. Guidelines on specific land application, optimal loading rates, and permissible limits of nutrients, heavy metals, antibiotics, and coccidiostats in poultry waste, are needed. Usage of poultry waste in fish and cattle feed and in power (electricity) generation should also be given consideration for efficient and profitable management of poultry waste (Bolan et al 2010). A system for best management practices for safe and beneficial utilization of poultry manure for sustainable waste management with minimum impact on environment should be developed. This will allow technologies that provide alternative to land application of poultry wastes to be developed (Bolan et al 2010).

RESULT

Poultry manure is a preferable fertilizer, a good feedstuff and a valuable source for biogas production. Depending on the system and needs, method of recycling the poultry manure varies from farm to farm. Each method has particular advantages and disadvantages. Farmers should use the handling system which is best suited for their aims and strategies. In brief, under the correct conditions poultry manure can be easily recycled and transformed into an economic income for the sector.

REFERENCES

Adeniran KA, Ahaneku IE, Itodo IN, Rohjy HA. 2012. Relative Effectiveness of Biogas Production using Poultry Wastes and Cow Dung. Indian Journal of Energy 1 (5): 56-62.

Anonymous. 1990. A Review of Poultry Manure Management: Directions for the Future. Agriculture and Agri-Food Canada, Poultry Section.

Arthur R, Baidoo MF, Antwi E. 2011. Biogas as a potential renewable energy source: A Ghanaian case study. Renewable Energy 36: 1510-1516.

Bolan NS, Szogi AA, Chuasavathi T, Seshadri B, Rothrock MJ, Panneerselvam P. 2010. Uses and management of poultry litter. World's Poultry Science Journal, 66: 673-698.

Bowen B, Lynch B, Lynch D, Henihan AM, Leahy JJ, McDonnel K. 2010. Biosecurity on Poultry Farms from On-Farm Fluidized Bed Combustion and Energy Recovery from Poultry Litter. Sustainability, 2: 2135-2143.

FAO. 2008. Poultry production and the environment – a review, by P. Gerber, C. Opio & H. Steinfeld. In O. Thieme & D. Pilling, eds. Proceedings of the International Conference Poultry in the Twenty-first Century: avian influenza and beyond, held 5–7 November 2007, Bangkok, Thailand. Rome.

Jensen KL, Roberts RK, Bazen E, Menard RJ, English BC. 2010. Farmer Willingness to Supply Poultry Litter for Energy Conversion and to Invest in an Energy Conversion Cooperative. Journal of Agricultural and Applied Economics, 42 (1): 105–119.

Kelleher BP, Leahy JJ, Henihan AM, O'Dwyer TF, Sutton D, Leahy MJ. 2002. Advances in poultry litter disposal technology – a review. Bioresource Technology 83: 27–36.

Kvasauskas M, Baltrėnas P. 2009. Research on anaerobically treated organic waste suitability for soil fertilization. J. Environ. Eng. Land Manag, 17 (4):205-211.

Mitchell CC, Donald JO. 1999. The Value and Use of Poultry Manures as Fertilizer. Alabama Cooperative Extension System, ANR 244.

Ogejo JA, Eldridge R, Collins Jr. 2009. Storing and Handling Poultry Litter. College of Agriculture and Life Sciences, Virginia Polytechnic Institute and State University, Publication 442-054.

Taleghani GS, Kia A. 2005. Technical-economical analysis of the Saveh biogas power plant. Renewable Energy, 30(3):441-446.