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"Gheorghe Asachi" Technical University of Iasi, Romania

PRELIMINARY PERFORMANCE EVALUATION FOR CHICKEN MANURE TREATMENT AND VALORIZATION OPTIONS

Daniela Gavrilescu, George Bârjoveanu, Petru Apopei, Andreea Gherghel, Carmen Teodosiu*

"Gheorghe Asachi" Technical University of Iasi, "Cristofor Simionescu" Faculty of Chemical Engineering and Environmental Protection,Department of Environmental Engineering and Management, 73 Mangeron Blvd., 700050, Iasi, Romania

Abstract

A significant environmental impact associated to the intensive rearing of poultry is caused by the large quantities of chicken manure produced and the frequent use of inadequate waste treatment practices such as direct spreading on land or landfilling. Chicken manure may be valorized by using biological processes, with the condition of mixing it with additives and water to make it more susceptible to biodegradation. Material valorization of chicken manure is in line with the circular economy principles, however, the decision on which treatment is more suitable should be based on technological, environmental, and economic criteria. The main objective of this study is to evaluate aerobic (composting) and anaerobic (anaerobic digestion) technologies employed for the treatment of 10 tons of chicken manure/day based on relevant criteria such as: area requirements, greenhouse gas emissions, energy impact and economic costs. Initially, chicken manure is mixed with bulking agents (e.g. sawdust, wheat straw, lignite, charcoal) and water in order to reach a C:N ratio of 25:1 and 65% humidity. The area requirements were calculated considering three different-shaped windrows and in-vessel composting and five types of anaerobic digesters. The greenhouse gas emissions, energy impact and social and economic impact (employment, wages, and taxes) were estimated by using the Waste Reduction Model (WARM) developed by the United States Environmental Protection Agency (USEPA). The main results indicate that the minimum area requirements are met in the case of anaerobic digestion, while the best bulking agent to be used is charcoal. The chicken manure-lignite shows the best environmental performance (greenhouse gas emissions and energy impact) and the most promising economic advantages. Composting is preferred to anaerobic digestion only if biogas valorization is not prioritized.

Key words: anaerobic digestion, chicken manure, composting, waste valorization

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* Author to whom all correspondence should be addressed: e-mail: carmen.teodosiu@academic.tuiasi.ro