Journal of Environmental Health and Sustainable Development

Is Vermicomposting the Best Option for Eliminating Antibiotic Resistance Genes (ARGs)?

Farnaz Ghandehari Yazdi [1], Ali Asghar Ebrahimi [1]*

[1] *Environmental Science and Technology Research Center, Department of Environmental Health Engineering, School of Public Health, Shahid Sadoughi University of Medical Sciences, Yazd, Iran.*

ARTICLE INFO

LETTER TO EDITOR

Article History:
Received: 12 February 2024
Accepted: 20 April 2024

Corresponding Author:
Ali Asghar Ebrahimi

Email:
ebrahimi20007@gmail.com

Tel:
+98 35 31492273

Citation: Ghandehari Yazdi F, Ebrahimi AA. ***Is Vermicomposting the Best Option for Eliminating Antibiotic Resistance Genes (ARGs)?.*** J Environ Health Sustain Dev. 2024; 9(2): 2235-6.

Uncontrolled increase and growth of antibiotic resistance genes (ARGs) is one of the critical issues facing human societies, which stems from the use of animal fertilizers. Animal manures contain significant amounts of diverse antibiotic-resistant genes, contributing to the rise of resistant bacteria in the soil and environment [1]. In China alone, an estimated 3.8 billion tons of animal dung are generated yearly, with a substantial portion used as fertilizer [2]. The utilization of animal manure in agricultural products is the primary contributor to the expansion of ARGs in soil. Over the past three decades, the abundance of ARGs has increased significantly on farmlands fertilized with manure [3]. These resistant genes can cause substantial economic losses as bacteria develop resistance to antibiotics over time, leading to antibiotic resistance [4]. Moreover, these genes can enter crops through agricultural soils, which contaminate products and underground water, and pose a threat to human health [5]. Fertilization and irrigation are identified as two major contributors to the spread of resistant genes in soil and other environments [6].

Various purification methods such as aerobic composting, anaerobic digestion, advanced oxidation, disinfection, transformation into biochar, and co-digestion with lignite have been explored; but, they are often overlooked due to their complexity, high costs, and negative effects [5, 7]. Identifying an alternative method capable of efficiently managing livestock waste without disseminating ARGs in agricultural production is of crucial significance [3]. Fortunately, vermicomposting emerges as a new and eco-friendly method that can help mitigate harm. Earthworms play a vital role in this process, altering physical and chemical characteristics of fertilizers through activities such as eating, secretion, and digging. They enhance the biodegradation of organic substances, including antibiotics and pathogenic microorganisms [7].

Researchers in China conducted a large-scale study on an arable land with different regional characteristics and concluded that vermicompost is an effective method for altering the pattern of ARGs. It can reduce the transmission of mobile genetic elements (MGEs) and high-risk ARGs, a type of antibiotic-resistant gene. Also, it is

[DOI: 10.18502/jehsd.v9i2.15841]

recommended that future studies focus on raising awareness regarding the effects of different vermicompost application conditions (e.g., planting type, crop rotation, and pollutants) on ARGs in soil to determine the value of vermicompost in actual agricultural production [3].

Vermicomposting is currently one of the most effective and environmentally friendly methods for removing antibiotic resistance genes. However, for better results, further research and knowledge is needed to determine optimal conditions for applying vermicomposting.

References

1. Mu M, Yang F, Han B, et al. Vermicompost: In situ retardant of antibiotic resistome accumulation in cropland soils. J Environ Sci. 2024;141:277-86.
2. Lin D, Huang D, Zhang J, et al. Reduction of antibiotic resistance genes (ARGs) in swine manure-fertilized soil via fermentation broth from fruit and vegetable waste. Environ Res. 2022;214:113835.
3. Mu M, Yang F, Han B, et al. Insights into the panorama of antibiotic resistome in cropland soils amended with vermicompost in China. Sci Total Environ. 2023;868:161658.
4 . Sarwar T, Khan S. Chapter Twelve-Antibiotics and antibiotics resistance genes in poultry and animals' manure and their effects on environment and human health. In: Huang K, Ahmad Bhat S, Cui G, editors. Fate of Biological Contaminants During Recycling of Organic Wastes: Elsevier; 2023. p. 229-58.
5. Zhao Z, Yu C, Yang C, et al. Mitigation of antibiotic resistome in swine manure by black soldier fly larval conversion combined with composting. Sci Total Environ. 2023;879: 163065.
6. Mu M, Yang F, Han B, et al. Implications of vermicompost on antibiotic resistance in tropical agricultural soils – A study in Hainan Island, China. Sci Total Environ. 2023;891:164607.
7. Yang F, Wang X, Tian X, et al. Cow manure simultaneously reshaped antibiotic and metal resistome in the earthworm gut tract by metagenomic analysis. Sci Total Environ. 2023;856:159010.

[DOI: 10.18502/jehsd.v9i2.15841]