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SHORT COMMUNICATION

The Study of Solid Waste Management by Vermicomposting

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ABSTRACT
The vermicomposting is a process which is widely used for solid waste management. In this bio-conversion process, earthworms feed on the organic waste to produce more earthworms, vermicompost and vermiwash as products. Earthworms which include Eisenia Fetida, Eudrilus Eugeniae, and Drawida Willis have been widely used for vermicomposting. Vermicomposting has been done for various wastes including animal, plant, food waste and sewage waste over vermicomposting periods ranging from 24-110 days using these earthworms. The process conditions during vermicomposting ranged from 18-67°C for temperature, pH 5.7-8.2 and moisture content 10.6-80%. Vermicompost yields of 30-50% have been achieved for various organic wastes and composting periods. The vermicompost and vermiwash produced were rich in nitrogen, phosphorous and potassium (NPK). The vermicompost obtained had NPK compositions ranging from 0.3-4.19%, 0.2-1.5% and 0.2-6.17% respectively. The vermiwash obtained had NPK composition ranging from 0.12-1.57%, 0.05-7.51% and 0.41-1.24% respectively. Vermicompost and vermiwash have been applied on soybean, maize and sugar cane as bio-fertilizers. With the vermicompost, the plant growth is improved, soil quality is enhanced which help manage agricultural, domestic waste. Therefore, vermicomposting is highly nutritive organic fertilizer.
Keywords:- *Eisenia Fetida, Eudrilus Eugeniae, and Drawida Willis.*

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INTRODUCTION

India is on the path of rapid industrialization & urbanization. Better work opportunities & the dream of better lifestyle has spread rural migration. The infrastructure development of the boomed structure has not able to keep waste influx within the cities & the municipalities are straining their limits providing basic service. Solid waste has been major environmental issue in India. MSW in cities is collected by respective municipalities & transport to the outskirts of the city. The limited reviews and high amount make them ill equipped to provide high cost involved in collection, storage, transportation, processing etc as a result a substantial part of MSW generates remains unattended and grows in heaps at collection centre. There is a lack of awareness among the peoples about the proper segregation at the source. As India population has been increasing continuously, along this education system also grows continuously. Solid Waste Management is associated with the control of waste generation, its storage, collection, transfer & transport, processing & disposal in a manner that is in accordance with the best principles of public health, economics, engineering, conservation, aesthetics, public attitude and other environmental considerations. Put differently, the processes differ depending on factors such as economic status (e.g., the ratio of wealth created by the production of primary products to that derived from manufactured goods, per capita income, etc), degree of industrialization, social development (e.g., education, literacy, healthcare, etc.) and quality of life of a location. In addition, regional, seasonal and economic differences influence the SWM processes. This, therefore, warrants management strategies that are economically viable, technically feasible & socially acceptable to carry out such of the functions as are listed below-

- Protection of environmental health.
- Promotion of environmental quality.
- Supporting the efficiency & productivity of the economy.
- Generation of employment & income.

Vermicomposting has been reported to be a viable, cost effective & rapid technique for the efficient management of organic solid wastes (1). Vermicomposting, utilizing earthworms, is an eco-biotechnological process that transforms energy-rich & complex organic substances into a stabilized humus-like product (2). Vermicomposting is an important aspect, as it converts waste to wealth by using cheap eco-friendly option with activity of earthworm (3).

MATERIAL AND METHOD

The cattle dung (15 days old) was procured from nearby jamb Samarth village farm. The moisture content of the medium was maintained at about 50%.-80%, Plant waste from and the paper waste was procured from the Jalna market, District, Maharashtra, India. The procured paper was shredded before using by means of a paper shredder. Earthworms (*Eiseniafetida, Eudriluseugeniae and Perionyx excavates*) were procured from GPC Biotech India, Jalna District Maharashtra, India. For the present study, separate vermi-bed was made using 15 days old cattle dung, plant waste and paper waste for mass culture of *Eiseniafetida, Eudriluseugeniae* and *Perionyx excavates*. The culture was constantly monitored throughout the period of study with time by time spraying of water. Mature clitellate worms for experimental purpose were taken from this stock culture.

The experiments was conducted in to two parts in the present study. The first part of pre-decomposition experiment a ceramic tank of 50x45x35cm measurement was filled with a mixture (10kg) of cattle dung, plant debris and shredded paper, it was daily sprinkled with water so that it gets decomposed. Also this waste was turned up and down for proper aeration and decomposition. This experiment was continued for 10 days and second part of composting experiment was study plastic tubs were filled with the pre-decomposed mixture of cow dung and shredded paper. 50 numbers of each variety of adult, mature, clitellate worms were taken from the stock culture and were uniformly released on the top of the containers of all the three experimental containers along with plant waste.

RESULTS

This study was carried out as an experiment using the following procedure: a plastic container was prepared for vermicomposting; then, a bed was prepared in a ready container with a layer of initial bedding, sieved garden soil, and compostable waste. It was inoculated with *Eiseniafetida* earthworms. Samples were taken after 30 and 90 days of vermicomposting, and measurements were taken for the following parameters: percentage of organic matter, phosphorus, total carbon, total nitrogen, moisture content, ash, electrical conductivity, and pH. Results for percentage of organic matter, phosphorous, ash, total carbon, total nitrogen, carbon/nitrogen ratio, electrical conductivity, moisture content, and pH of mature compost after 90 days were 42 ± 2.8, 53 ± 0.17, 22 ± 0.170, 1.12 ± 0.003, 20 ± 0.25, 2.8 ± 0.6, 1, 200 ± 200 cSu, 56 ± 5.5%, 8.3 ± 0.2, respectively, and all these parameters except moisture content were compared with the standards.

DISCUSSION

Comparison of the quality of mature vermicompost (90 days) with the WHO standard for evaluating good quality compost and with the ISIRI standard for vermicompost grades 1 and 2 in terms of selected parameters of organic matter, ash, percentage of total carbon, C/N ratio, and pH was determined, resulting in good quality vermicompost (grade 1) with a confidence level of 95%. However, according to the WHO standard, the pH of the compost was evaluated as good quality, but it did not comply with first grade compost standard according to ISIRI. The total nitrogen content of the compost was in compliance with second grade compost according to standards; in terms of moisture content, it was not consistent with the first and second grade compost standards.

The results of the research by Kaviraj and Sharma (4) showed that the species of earthworms (Lampitomauritii) were capable of converting organic solid waste to manure, which is a valuable compost that can be used to modify the structure of soil. Singh *et al.* (5) indicated that the vermicompost produced from municipal waste is a significant option for solid waste management prior to land use. Also, vermicompost is rich in plant nutrients and free of pathogens, making it suitable for application in agriculture. Utilization of vermicompost in agriculture will facilitate the growth of the country's economy by reducing the use of chemical fertilizer and addressing problems associated with land degradation.

These results confirm that the quality of mature vermicompost in the study was efficient and in compliance with recognized standards to improve soil and soil fertility. It has been reported that the amounts of organic matter, nitrogen, phosphorus, pH, and the C/N ratio of production of vermicompost from municipal sewage sludge were 36.4%, 1.04%, 0.112%, 7.5, 22.6, respectively, by Parvaresh *et al*., (6). However, a comparison of those results with the findings of this study indicates that the vermicompost produced by organic household waste contained high levels of nutrients and was of better quality than the vermicompost

produced by municipal sewage sludge in terms of improving soil fertility and stimulating plant growth. Khalfi *et al*., (7) also found similar results in their study. Results showed that the C/N ratio in vermicompost was better than that produced by aerobic composting and vermicomposting sugar beet waste. In addition, the amount of nitrogen and phosphorus in the vermicompost was more than that in aerobic compost, making it more appropriate for plant growth. Moreover, some other researchers have found similar results (8, 9,10).

Gupta and Garg (11) reported a high quality compost produced by vermicomposting using initial materials of sludge mixed with cow dung (30% to 40%). The result of Hemalatha (2012) revealed that earthworms could decompose mixed municipal solid waste and industrial sludge more quickly to produce compost with low toxicity and high value, which can be used as a natural fertilizer to improve soil structure.

The American Environmental Protection Agency expressed that solid waste management options are based on four priorities: the first priority was to reduce waste at source and re-use it, and the second priority was to implement practices of recycling and composting (12). However, according to the report of the Iran Interior Ministry in 2005, most domestic solid waste constitutes compostable materials (62% to 64%), and a smaller part of it is non-compostable materials such as plastic, glass, and metals (36% to 37%) (13). Therefore, composting degradable material at source in households presents a good solution for implementing the first and second priorities, and in doing so, it eliminates municipal waste management problems. If training homeowners to adopt this practice is done properly by organizations such as municipalities, it can be a very effective step towards protecting the environment. However, the application of this practice also serves to preserve the environment and eliminate other costs incurred by waste management systems. As reducing solid waste at source (by converting degradable materials to fertilizers at the point of waste production source) can reduce collection and transportation costs of solid waste management, it would cover the entire cost of a waste management system by about 60% to 70% (12). Furthermore, homeowners can produce compost in a cost-effective way from invaluable waste material, with more economical value than chemical fertilizer or aerobic compost for agricultural purposes.

CONCLUSION

Vermicomposting is a biotechnological process involved by earthworm; the natural bioreactors playing an essential role in the breakdown of organic matter and maintaining soil fertility. The worms involved recycling of organic waste and enhanced plant growth. The importance of vermicompost is further enhanced as it has simultaneously other benefits; excess worms can be used in medicines and as protein rich animal feed. Finally we conclude that vermicompost reduced the pesticide application, low pest infestation, reduction of irrigation frequency and pesticide free high yield.

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