Chapter 31
Biological Alchemy:
Gold From Garbage or Garbage Into Gold

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ABSTRACT

The story of garbage processing is changing globally and is being considered as a potential option in the hierarchy of integrated solid waste management that involves stabilization of organic material by the joint action of earthworms and microorganisms. Vermicomposting is an economically viable technique in which the job is done by certain species of earthworms that enhances the process of waste conversion and produces a better end product vermicompost. Vermicompost is highly nutritive fertilizer and more powerful growth promoter over the conventional compost. It is rich in nitrogen, phosphorus and potassium commonly referred as NPK, micronutrients, growth hormones and enzymes. Its commercialization is a good business opportunity and is emerging as an industry itself. The farmers need to raise the crops by organic farming that will reduce the cost and will decrease the impact on environment. The present chapter is an attempt to highlight different approaches of converting waste into vermicompost and the importance of vermicomposting as compared to synthetic fertilizers.

INTRODUCTION

Different types of inorganic and organic waste is a worldwide menace and it is becoming more and more difficult to manage this problem day by day due to rapid increase in population and industrialization which leads to decrease in land space and as well as changes in our life style (Singh et al., 2011). Nowadays most of the waste generated is either disposed of in an open dump in developing countries

DOI: 10.4018/978-1-5225-9621-9.ch031

or in landfills in the developed ones. However, land filling and open dumping requires a lot of land and could also result in several environmental problems.

A sustainable approach to handle this will be to treat and reprocess organic waste on-site, and to produce useful products. Composting is the most economical and sustainable option for organic waste management as it is easy to operate and can be conducted in contained space provided it is managed properly to produce a good quality produce (Thyagarajan et al., 2010). Composting is a natural process of organic waste treatment which is currently practiced with various modifications (Nair, Vanja, & Anda, 2006).

The composting of waste by earthworms is a simple biotechnological process, in which certain local species of earthworms are used to enhance the process of waste conversion and produce vermicompost (Nagavallemma et al., 2004). Vermicomposting of different types of solid wastes, prior to land application may be a sustainable waste management technique, as the vermicast and vermiwash obtained at the end of vermicomposting process is rich in plant nutrients and is devoid of pathogenic organism. Utilization of vermicompost produced from urban/municipal solid waste in agriculture will facilitate in growth of organic farming and countries economy by lowering the consumption of inorganic fertilizer and avoiding land degradation and soil toxicity problem. Vermicomposting of urban/MSW can be an excellent and best sustainable practice, as it will be helpful in recycling valuable plant nutrients (Singh et al., 2011). Process of vermicomposting differs from composting in many ways (Gandhi, Sangwan, Kapoor, & Dilbaghi, 1997). It is a process in which earthworms and microorganism need moderate temperature 10-32°C (not atmospheric temperature but temperature within the pile of moist organic material) which is known as mesophilic process. Earthworms, through a unique type of biological process, are capable of transforming garbage into 'gold' (Vermi, 2001; Tara Crescent 2003).

Vermicomposting involves the stabilization of organic solid waste through earthworm consumption that converts the waste into earthworm castings. Vermicomposting is the method of combined activity of microorganisms and earthworms. Vermicompost is one of the richest soil conditioners there and improves soil structure and increases its water holding capacity. It brings beneficial microbial activity to plants and provides essential nutrients, available over a long period of time. Plants that receive vermicompost are more productive and resistant to parasites and disease (Singh, 2009). It is proving to be highly nutritive 'organic fertilizer' and more powerful 'growth promoter' over the conventional composts and a 'protective' farm input (increasing the physical, chemical & nutritive value of soil by improving its microbial content, which restore its natural fertility) against the 'destructive' chemical fertilizers which has destroyed the soil properties and decrease its natural fertility over the years. It is rich in NKP (nitrogen 2-3%, potassium 1.85-2.25% and phosphorus 1.55-2.25%), micronutrients, and beneficial soil microbes and also contains 'plant growth hormones and enzymes (Katiyar, Jat, & Singh, 2013).

The earthworm choice for vermicomposting is the key step as it affects the rate of waste stabilization. The different type of earthworms can be used for waste management and sludge stabilization all over the world. The earthworm's species having the capability to colonize organic throw away naturally, high rates of organic matter consumption, digestion and assimilation, able to tolerate a wide range of environmental stress, having high reproductive rates by producing large number of cocoons having short hatching time, rapid growth and maturation rate of hatchlings to adults (Domínguez & Edwards, 2004) are suitable to be used in vermicomposting process. Earthworms sustain aerobic conditions in the waste mixture, ingest solids, and convert a share of the organic matter into biomass and respiration products (Benitez, Nogales, Elvira, Masciandro, & Ceccanti, 1999). Earthworms expels the residual partially stabilized matter as discrete material commonly known as vermicasting (Benitez et al., 1999). The amount turned over by earthworm depends on the availability of total suitable organic waste. If the