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Vermicomposting - A Boon for Minimizing Waste

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ABSTRACT
The solid waste from garbage and household materials, flowers and waste food needs proper treatment as it can contaminate groundwater resources. The most commonly used method for waste treatment is open dumping. This method is cheap but dangerous from health perspectives. Vermicomposting is one of the most practiced methods for domestic and household solid waste. In this, earthworms feed on anything that is biodegradable. Extra care is needed to prevent plant damage as high plant nutrients and plant growth stimulators can inhibit seed germination and growth to some degree. Investigations indicated increase in the parameters like total nitrogen (%), Available phosphorus (%) and Exchangeable potassium (%).Vermicomposting may supply an opportunity for employment. Many investigations have been reported on vermicomposting. The current review provides an insight on studies and research onvermicomposting.
Key words: *Incineration, anaerobic and aerobic digestion, stabilization, pre-compost, landfill.*

I. INTRODUCTION

The municipal waste treatment creates sizeable amount of waste sludge. Also the solid waste from garbage and household materials, flowers, domestic food waste needs proper treatment as it can contaminate groundwater resources. [1]Themost commonly used method for solid waste treatment is open dumping. This method is cheap but dangerous. The waste is exposed to atmosphere, which deteriorates air quality and smells very badly. Sanitary landfill is betteralternative.

Other methods such as incineration, anaerobic and aerobic digestion can be used for solid waste. [2-4]Some specific waste materials can be used for synthesis of ethanol like compounds. [5,6]Anaerobic methods reduce the volume and also provide methane gas which can be used as a fuel. [7-9]Vermicomposting is one of the most practiced methods for domestic and household solid waste. In this, earthworms feed on anything that is biodegradable. This method does not have any adverse effect on the soil. [10]The vermin-composting technology helps in organic waste management. The method is in accordance with the principles of sustainable development. [11]

II. VERMICOMPOSTING- A BOON FOR WASTE MINIMIZATION AND SOIL QUALITY

Manafet.al.carried out investigation on influences of bedding material in vermi- composting process. [12]They considered the parameters like the growth rate (pH), number of worm, number of cocoons and worm biomass. They carried out Dunken test which demonstrated that newspaper bedding was more influential in worm biomass production. They also observed that sawdust bedding was better forcocoons production and number of worm. Quaik et.al. review edpotentialof vermicomposting leachate as organic foliar fertilizer and nutrient solution in hydroponic culture. [13]According to them, a green technology that produces vermicompost, which has been proven to be effective as a plant nutrient supplement. According to them, extra care is needed to prevent plant damage as high plant nutrients and plant growth stimulators can inhibit seed germination and growth to somedegree. Subbulakshmi and Thiruneelakandan observed that vermicomposting improves the soil structure, enhancing soil fertility, moisture holding capacity and in turn increase the crop yield. [14]According to them earthworm can solve various environmental problems from waste management to landfertility.

Albasha et.al. carried out investigation on kitchen waste treatment by vermicomposting with Earthworm, EudrilusEugeniae. [15]They mixed a mixture of kitchen waste and cow dung. They obtained good quality of compost in 60 days. During vermicomposting, they observed increase in the parameters like total nitrogen (%), available phosphorus (%) and exchangeable potassium (%). Also they observed a decrease in pH.Sarma et.al. conducted studies on the efficiency of the low cost vermicomposting unit as compared to conventional units. [16]They conducted experiments at Dryland Technology Park, (All India Coordinated Research Project for Dryland Agriculture)BiswanathChariali Center Biswanath College of Agriculture, Assam. They used locally available low cost materials such as bamboo, dried banana leaves for fabrication of Low cost

vermicomposting units. They used five replicated randomized block designs consisting of 4 treatments. They carried out experiments with four pathways, namely Vermicomposting in concrete tanks (Control)(T1), Vermicomposting in low cost vermincomposting unit[2.5 m(L) X 1.2 m(B) X 0.76 m(D)](T2), Vermicomposting in low cost vermincompostingtanks[2.5 m(L)X1.2m(B)X0.46](T3),Vermicompostin g in low cost vermincomposting tanks with dimension 2.5 m(L) X 1.2 m (B) X 0.76 m(D),(T_4). According to them, by adopting the low cost technology, the farmers can get substantial benefit and augment farm income.

Dominguez and Gomez-Brandon studied composting with earthworms. They explored recycling organic wastes. [17]They investigated the ability of E. Andrei to alter the structure and activity of microbial communities through the gut associated processes. Also their investigation included the effectiveness of the active phase of vermicomposting for the short-term stabilization of a plant residue. They observed decrease in population of bacteria in cow manure after transit through the earthworm gut. Also they found that microbial activity was reduced by 30 percent after transit of the organic material through the gut of the earthworm E. Andrei. Mupondi et.al. evaluated the effectiveness of different precomposting periods on the sanitization and vermi-composting of dairy manure–waste paper mixtures. [18]They found that within seven days of precomposting. over 95% of fecal coliforms, Escherichia coli and of E. coli 0157 were eliminated. Also they found that with increase in pre-composting time, microbial biomass carbon and water soluble carbon of waste mixtures decreased. They concluded that a pre-composting period of 1 week was ideal for the effective vermicomposting of dairy manure–waste paper mixtures. According to Londhe and Bhosale, existing waste dumping sites are full beyond capacity. [19]Also these sites lead to unhealthy conditions.They considered vermi-composting as a better alternative. Recycling of different type of organic waste was tried by them. They monitored temperature on weakly basis. After 45 day composting, they observed increase in nutrient content. Ndegwa and Thompson investigated vermi-composting of bio-soilds for effect of C-to-N ratio. [20]According to them, differentearthworm

species impact differently by C-to-N ratio and feed mixture type. They established a suitable C-to-N ratio for vermi-composting of fresh bio-solids. Highest stability of the product was obtained at C-to-N ratio of 25.

Koffet. al.discussed household composting with worms. [21]According to them, vermicompostis primarily earthworm excrement.Itcanimprovesoil"sbiological, chemical, and physical properties. According to their studies, plant growth regulators that can enhance plant growth are also present in vermicomposts. Quaikand Ibrahim carried out a review on potential of vermicomposting derived liquids in agricultural use. [22]According to them, use of the liquid byproducts has potential to provide green technology solution. Liquid contain vermicomposting leachate, urine, cow dung, green forageetc.m which have high nutrient value. Aaloket. al. discussed vermicomposting as a better choice for solid waste management. [23]They explained various aspects such as vermiculture, vermicomposting and vermiconvertion. According to them, vermicomposting in developing countries could prove to be useful. Also they pointed out that vermicomposting may supply an opportunity for employmentin areas where creation of low or semi-skilled jobs is considered advantageous. Kashemet.al.,in their work, compared the effect of vermicompost and inorganic fertilizers on vegetative growth and fruit production for tomato. [24]They observed that there was considerable effect on factors shoot length, number of leaves, dry matter weight of shoots and roots, fruit number and fruit weight after the application of vermicompost and NPK fertilizer in the growth media. They also observed that as compared to the plants grown in the inorganic fertilizer amended soil pots, the growth performance of tomato was better in the vermicompost amended soil pots. Bakar et.al. carried out investigation on vermicomposting of vegetable waste (VW) spiked with multiple sources of agro- industrial waste. [25]They precompostedthe waste for 18 days followed by 70 days vermicomposting. Due to the multiple increase of earthworm biomass and number, amendment was required. 50 percent of VW was found to be best amendment for vermiculture by them.

Suthar and Singh used two epigeic earthworms for vermicomposting of domestic waste. [26]They observed maximum mineralization and decomposition rate in experimental container with P. sansibaricu than that of P. excavates. Also they observed that, P. sansibaricus process showed about 6% more total nitrogen. They also observed the parameters like mean individual live weight, maximum individual growth rate (mg wt./worm/day), number of cocoons and reproduction rate (cocoon/worm/day). These values were higher for bedding with P. sansibaricus. Accordningto Nagavallemma et.al. the degradation of soil is a major concern. [27]They observed that the water holding capacity and nutrient supplying capacity of soil can be enhanced by amending with good quality organic soil additives. They used dry organic waste containing sorghum straw and rice straw (after feeding cattle), dry leaves of crops and trees, pigeonpea (Cajanuscajan) stalks, groundnut (Arachishypogaea) husk, soybean residues, vegetable wastes, weed (Parthenium) plants before flowering, fiber from coconut (Cocosnucifera) trees and sugarcane (Saccharumofficinarum) trash. Also animal manures, dairy and poultry wastes, food industry wastes, municipal solid wastes, biogas sludge and bagasse from sugarcane factories worked as handy for vermicomposting. Thiruneelakandan and Subbulakshmi pointed out the fact that chemical fertilizers reduce land productivity. [28]According to them, green manures are effective

alternatives to chemical fertilizers. Use of organic inputs like well decomposed organic manure or vermicompost can help in improving the soil fertility. Soil amendment by using vermicomposting for main fields is very effective alternative to improve soilquality.

Sequeira and Chandrashekar investigated biodegradable residential solid waste for vermicomposting. [29]They divided this waste as food waste, paper waste, vegetable waste and garden trimmings with grass and leaves. In converting residential waste into vermicompost, Eudrilus species were found to be very effective. According to their studies, even dilute cow dung slurry is sufficient to practice vermicomposting in a small scale. Chan et. al. investigated greenhouse gas (GHG) emissions from three different home waste treatment methods namely aerobic composting, anaerobic digestion and vermicomposting. [30]They observed that the aerobic composting bins released lower amounts of CH_4.The vermicomposting released intermediate amount of methane and anaerobic method released maximum amount of methane. Vermicomposting released least amount of N_2O.According to them, compared to centralized composting and anaerobic digestion facilities, landfilling and incineration; home composting has potential for reducing GHGemissions.

III. CONCLUSION

Vermicomposting is one of the most practiced methods for domestic and household solid waste. In this, earthworms feed on anything that is biodegradable. Extra care is needed to prevent plant damage as high plant nutrients and plant growth stimulators can inhibit seed germination and growth to some degree. It has advantages over anaerobic digestion. In anaerobic digestion the foul smell causes irritation to people in nearby locality. Aerobic digestion method is time consuming, costly and needs more space. Additional advantage of improving the soil fertility and soil amendment makes this method moreacceptable.

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