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BIOREMEDIATION OF POLLUTED HABITAT IN COIMBATORE USING VERMI TECHNOLOGY

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ABSTRACT

Solid wastes encompass industrial wastes, agro wastes, municipal wastes, hospital wastes and domestic wastes. Rapid industrisilation and urbanization has resulted in the generation of large quantity of solid wastes. All high yielding crops require the application of enormous quantity of chemical fertilizers and pesticides, which has created a serious problem in the ecosystem. Now a days, earthworms has been widely used in the breaking down of this wide range of organic residues including sewage, animal waste, crop residues and industrial refuse in producing vermicompost in the name of Vermiculture technology. This epigeic species called *Eudrilus eugeniae* is an African species mostly utilized for the solid waste management and vermicompost production due to its high pollutant tolerance. Vermiculture technology is one of the important bioremediation technique for sewage treatment. In the present study the N, P and K, organic carbon and the worm population increased significantly on the 60th day when compared to 30th and initial day.

INTRODUCTION

Rapid industrisilation and urbanization has resulted in the generation of large quantity of solid wastes. Its value has been growing alarming all over the world especially in India. India is one of the largest agricultural countries in the world. It has 2% of the world's land mass and carries 17% of the human population.

The accumulation of the solid waste leads to air, water and soil pollution. Besides, to feed the tremendous explosion of human population, farmers are forced to cultivate new hybrid varieties. All high yielding crops varieties require the application of enormous quantity of chemical fertilizers and pesticides, which has created a serious problem in the ecosystem. The accumulation of wastes from a variety of sources causes various forms of environmental threats and health hazards. Wastes have polluted land, water and air and the survival of human beings is in peril.

More than 25% of the municipal solid wastes are not collected at all. 70% of the Indian cities lack adequate capacity to transport it and there are no sanitary lad-fills to dispose of the waste. The amount spent in India through municipal and cooperatives towards the solid waste management have been estimated around thousand a million Rs. per year in the last decade (Sankaran, 2001).

Domestic waste includes vegetables, fruits and food wastes. These wastes possess a serious threat and problems because it creates conditions that are favourable to the survival and growth of the microbial pathogens. Direct handling of the solid wastes can result in various types of infectious and chronic disease like typhoid fever, cholera, diarrhea, salmonellasis etc., with the waste workers and the rag pickers being the most vulnerable. In the practical term, the new paradigm promotes the 4R strategy of Reduce, Reuse, Recover and Recycle wastes to conserve resources and reduce pollution by emulating, adopting and maximizing beneficial process of an ecosystem (Mathur, 1991). So, appropriate disposal of the wastes is the most essential and beneficial, from the ecological and economic point of view.

Nowadays, earthworms has been widely used in the breaking down of wide range of organic residues including sewage, animal waste, crop residues and industrial refuse in producing vermicompost (Edwards *et al*. 1985; Dominguez, 1997; Kale, 1998. The present study has been designed to observe the biodiversity of earthworms and biodegradation of sewage of Coimbatore city.

MATERIALS AND METHODS

Earthworms were collected randomly by digging and hand sorting methods from drainage canals namely Sanganur palam, Sowripalayam, Sowripalayam pirivu, Singanallur and around the bank of Singanallur lake of Coimbatore city. The earthworms were collected in the cotton bags along with the sewage and brought to the lab. The worms were washed with tap water and distilled water for morphological examination. The worm was allowed in the common culture medium of the sewage.

The sewage was collected at different points as mentioned above and mixed together in common culture tank and the moisture level was maintained above 60% and the room temperature was 30±5° C. Two plastic tubes measuring (32 cm × 30cm) were filled with sewages in which one was maintained as control and another was introduced with worms taken from common culture medium. The sewage sample was analyzed before and after the introduction of worms for chemical parameters like pH, N, P, K and Organic carbon. The nitrogen and phosphorus contents were estimated following the method of Subbiah and Asija, (1956) and Olsen's *et al*. (1954) respectively. Similarly, the potassium and organic carbon contents were also estimated by saturation extract method Jackson (1954 and Walkely and Black, (1934) respectively. Care was also taken to avoid the entry of natural enemies like the ants, frogs and snakes by covering the top of the plastic tubs with jute cloths. After a month chemical analysis, biomass analysis and the analysis of earthworm was conducted.

RESULTS AND DISCUSSIONS

The survey of earthworm from Sanganur palam to Singanallur lake of Coimbatore city with varied pollutants like industrial, domestic and automobiles reveals that the availability of only one epigeic species called *Eudrilus eugenia*. The present study clearly shows that this exotic species possess high adaptability to different levels of pollutants in sewage and has a wide range of migration and tolerance level to pollutant as well as Anthropogenic activities and is able to withstand and survive well. This epigeic species called *Eudrilus eugeniae* is an African species mostly utilized for the solid waste management and vermicompost production. Five different spots of sewage with worms for bioremediation and population biomass were selected. The level of pH was maximum on the 30th day and minimum on 60th day after introduction of the worms (Fig. 1).

The nitrogen, phosphrous and organic carbon content was maximum on the 30th day and on 60th day and significantly more at 5% level which is due to the increase in vermicomposting period (Fig. 2, 4 & 5). Similar trend of result was observed for potassium, which might be due to the change in the distribution of potassium between non- exchangeable to exchangeable forms Srinivasa *et al*. 1997 (Fig.3). Earthworms directly recycle the nitrogen by excretion and through the turnover of earthworm tissues and indirectly improve the physicochemical nature of the soil including nitrogen fixation in cast and burrow walls. According to Lee, (1985) the earthworms consume large amount of plant organic matter that contain considerable quantities of nitrogen which get assimilated into their own tissues is returned to soil in their excretion. The phosphrous content was found increased due to mineralization of phosphate. The increased level of phosphrous may be due to the earthworm and microbial derived enzymes (Satchell and Martin, 1984). The population study of the *Eudrilus eugeniae* in the sewage (Fig. 6) revealed that on the first month (30th day) and the second month of the study (60th day) adult were decreased significantly than the starting day (initial day) and also in the juvenile population there was no significant raise found.

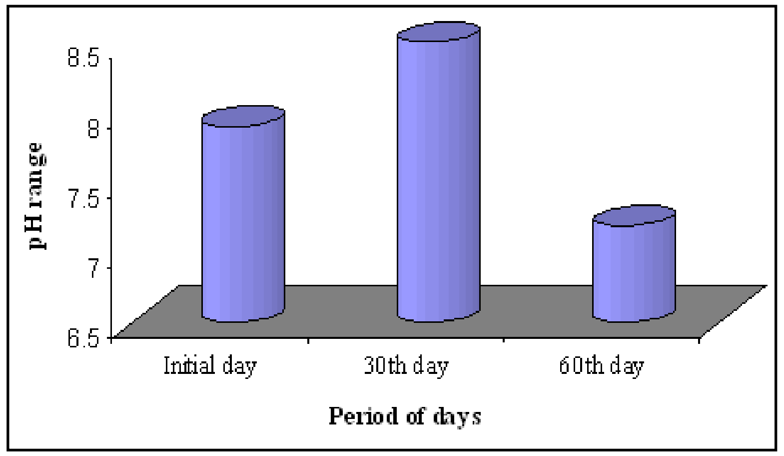

Fig. 1 pH of the vermicompost for different period in the vermicompost of *Eudrilus euginiae* sewage

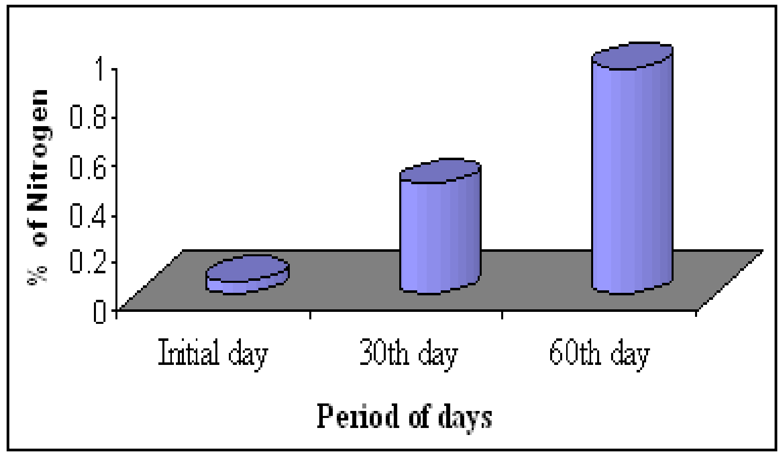

Fig. 2 Nitrogen content available in different period in the vermicompost of *Eudrilus euginiae* sewage

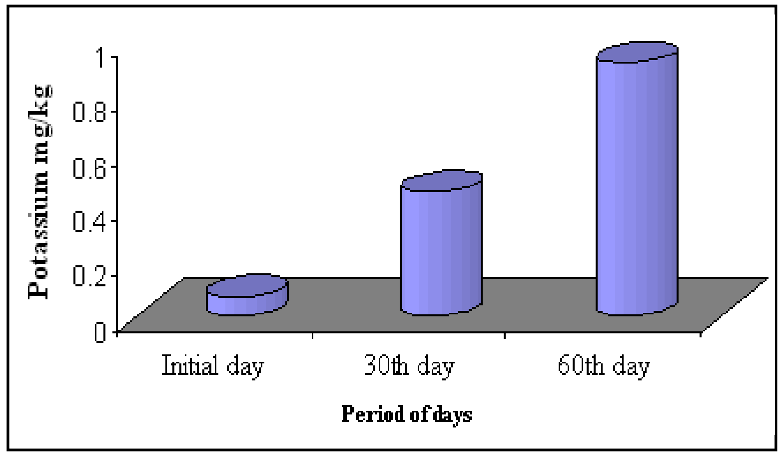

Fig. 3 Potassium content for different period in the vermicompost of *Eudrilus euginiae* sewage

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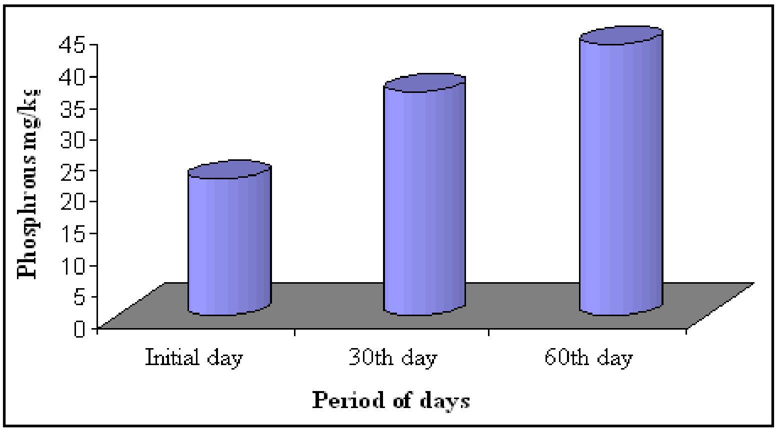

Fig. 4 Phosphrous content available different period in the vermicompost of *Eudrilus euginiae* sewage

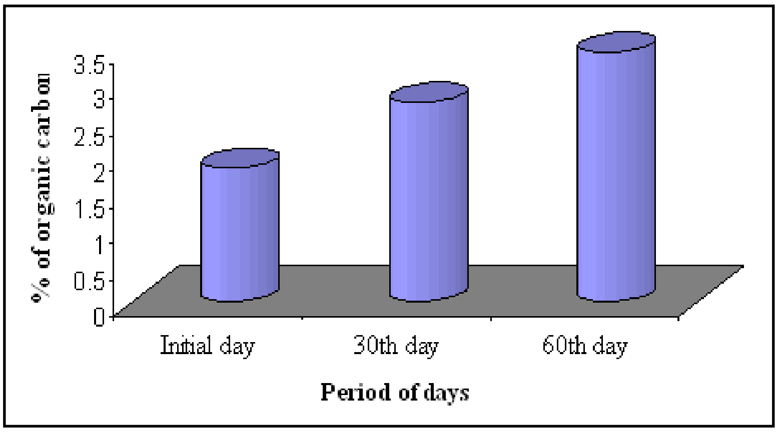

Fig. 5 Percentage of Organic carbon content available different period in the vermicompost of *Eudrilus euginiae* sewage

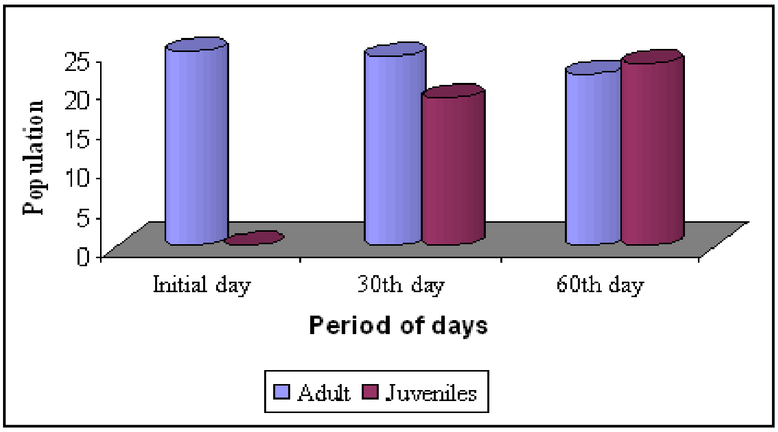

Fig. 5 *Eudrilus euginiae* population in sewage culture for different periods

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