Bioconversion of Kitchen Waste and Flower Wastes into Compost by Vermicomposting

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ABSTARCT

Waste materials in recent years have been increasing day by day and it is a major threat to the environmental issue. To solve the problem in one way, the waste materials are utilized fruitfully by using Eudrilus eugeniae. The vegetable and food and flower waste were subjected to vermicompost separately and along with the treatment. In these treatments, the vermicompost materials were analysed the micro and macronutrients to understand the impact on the bioconversion of waste into compost. The Nitrogen level was increased in the flower waste compost by 28.5% whereas it was decreased in the vegetable waste by 28.6%. Similarly, a decreasing trend of Phosphorus was observed in both the compost. Besides Nitrogen and Phosphorus, Potassium showed a significant increase in all the treatments. However, insignificant changes in Zinc, Manganese and Copper were observed in the compost of flower and vegetable waste. In the case of Ferrous, a significant increase was observed. The physical properties such as the Electrical Conductivity (EC) and pH of the vermicompost showed almost equal to the control. Based on observation, the nutrients of the compost of waste have been stabilized by the earthworm, E. eugeniae.

Keywords: Eudrilus eugeniae, Vermicompost, Vegetable and Food and Flower waste.

INTRODUCTION

A rapidly increasing population and high rate of industrialization have increased the problem of solid waste management. The large amount of solid waste and sludge produced by anthropogenic sources is becoming a serious problem. Proper waste management is very crucial and has become the major challenge in many countries. Vermicomposting has become an appropriate alternative for the safe hygienic and cost effective disposal of wastes. Earthworm is an eco-biotechnological process that transforms energy rich and complex organic substances into stabilized vermicompost. Recycling of wastes using earthworm has become an important component of sustainable agriculture which has a multidirectional impact in terms of safe disposal of wastes preventing environmental pollution besides yielding nutrient rich material. The environmentally acceptable vermicomposting technology using earthworm can well adopt for converting waste into wealth. The earthworms have been fortunate to degrade wastes and turn them into a fertilizer which is popularly termed as vermicomposting; thus acquired product is recognized as vermicompost. It is the resourceful technique to renovate the biological wastes (human discarded, kitchen surplus, animal left-over etc.) into a biological fertilizer. Edwards and Burrows reported that vermicompost has an abundant fine structure it is highly saturated with nutrients that are freely available for plants intake. Even vermicompost is rich in both the bacterial components and fungal profusion than the outmoded muck. Earthworms are used for refining and preserving soil fertility, change of organic waste into useful fertilizer, for livestock then used as bait for fish. Vermicomposting is a mesophilic process led to an everlasting generation of wastes, carried out by earthworms. Disposal and environmental organic waste followed by excretion of friendly management of these wastes are castings through the worm's metabolic becoming a serious global problem.

Histological Studies of Earthworm Eudrilus eugeniae

The cross section of Fore gut (anterior and clitellar region), Mid gut (middle region), Hind gut (posterior region) of control, food and vegetable and flower waste treatments of higher proportion were taken to study the anatomical features of Eudrilus eugeniae. In the control animal, the epidermis of the Eudrilus eugeniae

consists of an epidermal epithelium and an overlying fibrous cuticle. Below the epidermis, circular and longitudinal muscles were intact and from the body wall the coelom was clearly seen. Along with this, luman, blood vessels, chloragogen cells were seen clearly. Below the epidermis, the pigment cell was numerous. The tartrazine treated section of clitellar region showed less change when compared to control. The size of the blood vessel was reduced. The cuticle, epidermis and circular muscles were not changed in the experiment.

LITERATURE REVIEW

An experiment was done by Mitali Makhania and Amita upadhyay, 2015 to generate organic nutrients by flower waste composting. It mainly focused on the physio-chemical parameters during the composting process. Heap type composting method was adopted at room temperature and the parameters like Temperature, pH, Electrical Conductivity, Moisture Content, Volatile Solids were analyzed. It was found that the temperature was raised during 4-5 days and then decreased gradually. The pH decreased within 7-8 days and increased within 12 days. Minor fluctuations were observed in electrical conductivity. The moisture content increased within 7 days and then started to decrease. The volatile solids decreased significantly during 4-6 week. It was also observed that covering the heap with polythene sheet helps in fungal growth and increase in temperature.

Ravinder Kohli and Hussain, 2016 worked on Vermicomposting process with Eudrilus eugeniae earth worm species. Portable HDPE vermi beds were used with 200 earthworms and the moisture content was maintained at 60%. At the end of 45 days of vermicomposting process, parameters like C/N ratio, pH and electrical conductivity(EC) were determined. It was found that the reduction of pH from alkaline to neutral condition, EC increased on 15th day and reduced on 35th and 45th day of composting and C/N ratio decreases and shows enhanced mineralization efficiently.

Shobha Shouche et al, 2011, studied the changes in physical parameters during vermicomposting of flower wastes. Flower wastes were chopped to finer pieces and different proportions of flower waste and cattle dung was filled in plastic bins. Variation of parameters like moisture content, temperature and pH were observed. It was concluded from the study that the parameters changed in the beginning and it became constant at the end of composting.

It reported that application of sheep-manure vermicompost in tomato crop increased the plant heights and crop yield. Addition of sheep-manure vermicompost decreased soil pH and acidity. The tomatoes harvested from the vermicompost applied agricultural fields had higher carbohydrate content. Arancon et al. (2008) reported that application of vermicomposts produced enhanced germination, growth and flowering of petunia plant. The effects of neem (*Azadirachta indica*) vermicompost were studied on the growth and yield of Brinjal (*Solanum melongena*) by Gajalakshmi and Abbasi 2004. Sangwan et alconducted a pot culture experiment to assess the quality of vermicompost produced from filter cake mixed with cow and horse dung on the growth and productivity of marigold. The filter cake + cow dung and horse dung vermicomposts have higher manurial value and synergistically affected the growth and productivity of crop. Addition of 10 and 20 % pig manure-based vermicompost in media mixes had positive effects on plant growth (Bachman and Metzger 2008). Roberts et al. (2007) investigated the effect of *Dendrobaena veneta*-derived vermicompost on the germination, growth, yield, marketability and vitamin C content of tomatoes. The results showed that vermicompost significantly increased germination rates (176 %) and improved the marketability of fruits at 40 and 100 %

Materials And Methods

Collection of Earthworms

The earthworm Eudrilus eugeniae, were collected form Chithathur, Thiruvanamalai Dt, Tamil Nadu. The collection of earthworm was brought to laboratory for acclimatization. The present study was carried out between 2021. The selected Flower and food and Vegetable waste were collected from thanjavur market, and food waste was collected in a hotel at thanjavur, and it was mixed thoroughly with 2 kg of soil. This mixture was placed in the form of heaps under shady place. Watering was done regularly twice in a day in order to maintain the optimum temperature and moisture. This set up was maintained for 30 days. Suitable control was maintained. Similarly flower waste and food and vegetable waste was also taken separately in another pot. The waste mixtures were allowed to pass through earthworm guts for vermicomposting. The moisture content of the organic substrates in each pot was maintained between 60% and 65% throughout the study period by sprinkling water after every 24 hours. The experiment was conducted by randomized design with three replications. In the vermicompost materials the experimental set up was maintained till 25 days. The compost material was selected for the analysis to micro and macro nutrient such as PH, nitrogen (N), total phosphorus (P), total potassium (K) Zinc (Zn), Manganese (Man), Iron (Fe), and Copper (Cu).

Eudrilus eugeniae

This species is used in some vermicomposting systems around the Mediterranean region and in some areas of eastern Asia.

Temperature range-minimum 45°f, maximum-90° and ideal range 70°-80° f.

Reproductive rate-approximately 7 young per worm per week under ideal conditions.

Average number of young per cocoon-approximately 2.

Time to emergence from the cocoon-approximately 15-30 days under ideal conditions.

Time to sexual maturity- approximately 30-95 days under ideal conditions.

GRAPHS AND ANALYSIS

The vegetable and food and flower waste of different proportions were mixed with vermin bed and seen the efficiency of the earthworm in the conversion of vegetable and food and flower waste into minerals on 25 day. The experimental setup was arranged which as follows; control, vegetable and food and flower waste of known weights taken separately. The weight of vegetable and food and flower waste was 100 gms. Mean number of days required for the biotransformation of waste into vermicompost was 25

days. The nutrient status of vermicomposting depends on the type of waste material processed by earthworms. An increase in the values was observed in the following parameters such as total Nitrogen (N), Total Phosphorous (P), and Total Potassium (K), in the different treatments of vegetable and flower waste when compared to control, however the significant decrease was observed in treated vegetable and food and flower wastes.

Physico-Chemical properties

The cow dung used as the inoculants in the vermicomposting process enhanced the quality of feeding resource attracting the earthworms and accelerated the breakdown of wastes resulting in the reduction of increasing certain nutrients. The analysis of Nitrogen (N), Phosphorus (P), Potassium (K), Iron (Fe), Manganese (Mn), Zinc (Zn), Copper (Cu), Electrical Conductivity (EC), and pH were analyzed on 25 days in the control and treated vegetable and food and flower waste. In the control, the N value was 70% and this level decrease in the treated where as in the other treatment, the level of N was increased gradually.

The vermicompost was dark brown in colour and homogenous after 45 days of earthworm's activity. The changes in worm biomass for all the treatments over the experimental period were observed. At the end of the 25th day, the earthworm biomass had increased in all the treatments. A decrease in the value of N was observed in the vegetable waste. Nitrogen when compared to control. In the flower waste treated, this is increased 28 %. Similarly phosphorous was also decreased in vegetable treatment whereas P revealed significant correlation in 100 gm treatment vegetable and food and flower waste. In contrast to NPK showed in significant when compared all other treatments. The analysis of Fe, Mn, Zn, Cu were also increased same level in the treatment with 100 gms of vegetable wastes..Similarly the same trend was also observed in the flower waste. Similar by Fe, Mn, Zn, and Cu were also showed significance of 100gm treatments. And in the food waste it has been increased much more when compare to flower and vegetable waste On 25 days analysis, Fe showed increase in all the treatments when compared to control. Mn also indicated the slight increased in all treatments on 25day. Similarly Zn and Cu were also increased significantly in the 100 gms of vegetable waste treatments at p

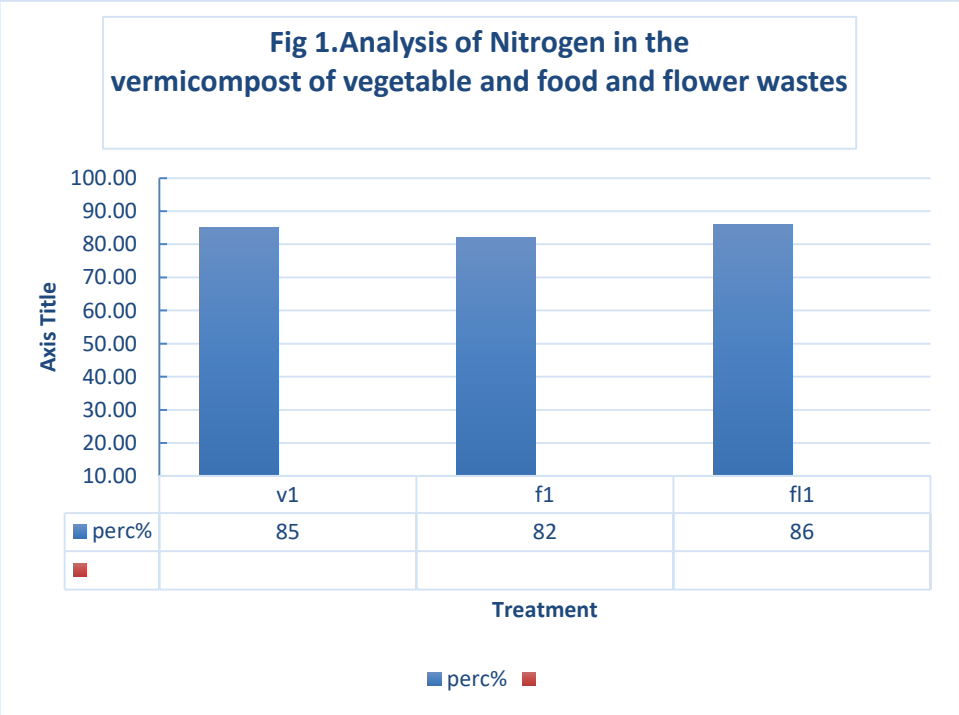


Fig 2.Analysis of phosphorus in the vermicompost of vegetable and food and flower wastes

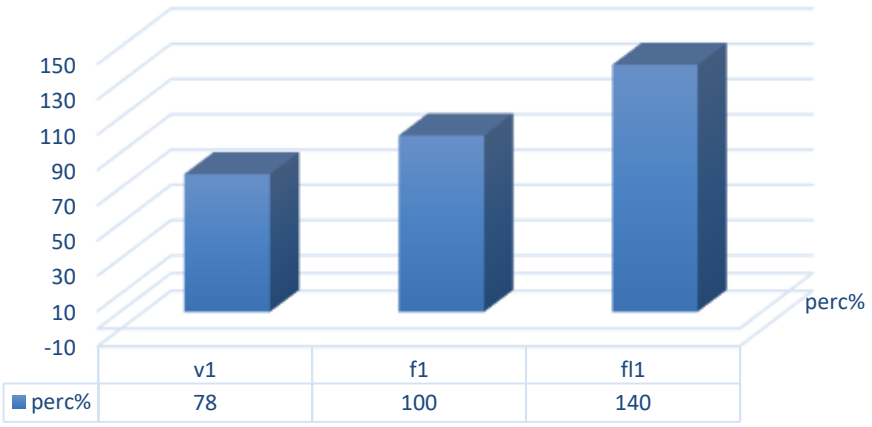
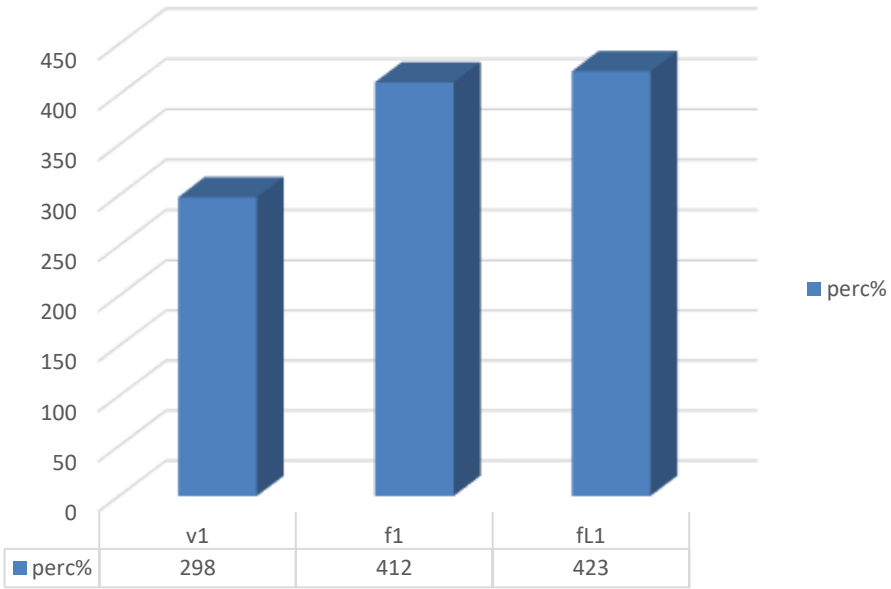
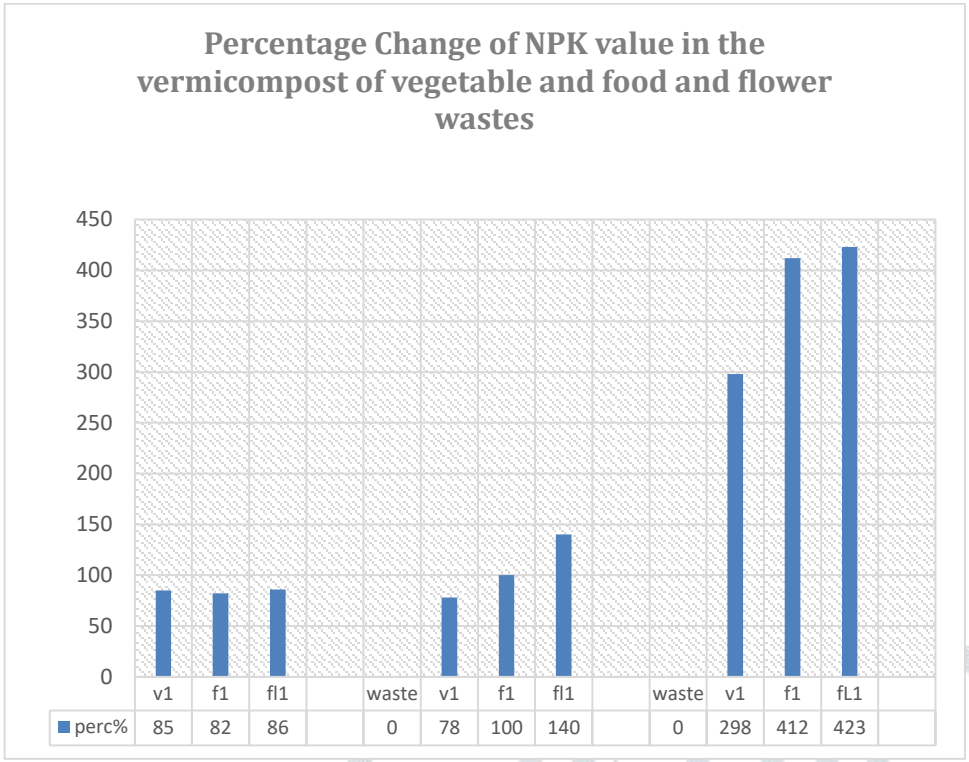


Fig 3.Analysis of Potassium in the vermicompost of vegetable and food and flower wastes




Percentage Change of NPK value in the vermicompost of vegetable and food and flower wastes
450
400
350
300
250
200
150
100
50
0
v1 f1 fl1 waste v1 f1 fl1 waste v1 f1 fL1
perc% 85 82 86 0 78 100 140 0 298 412 423

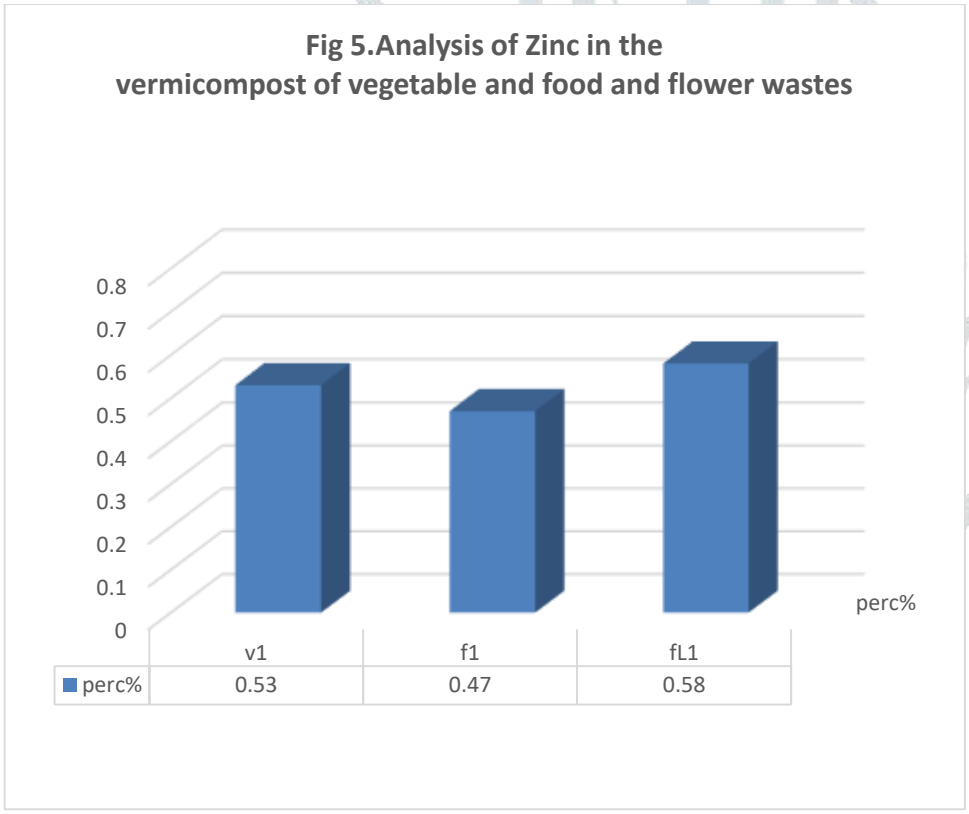
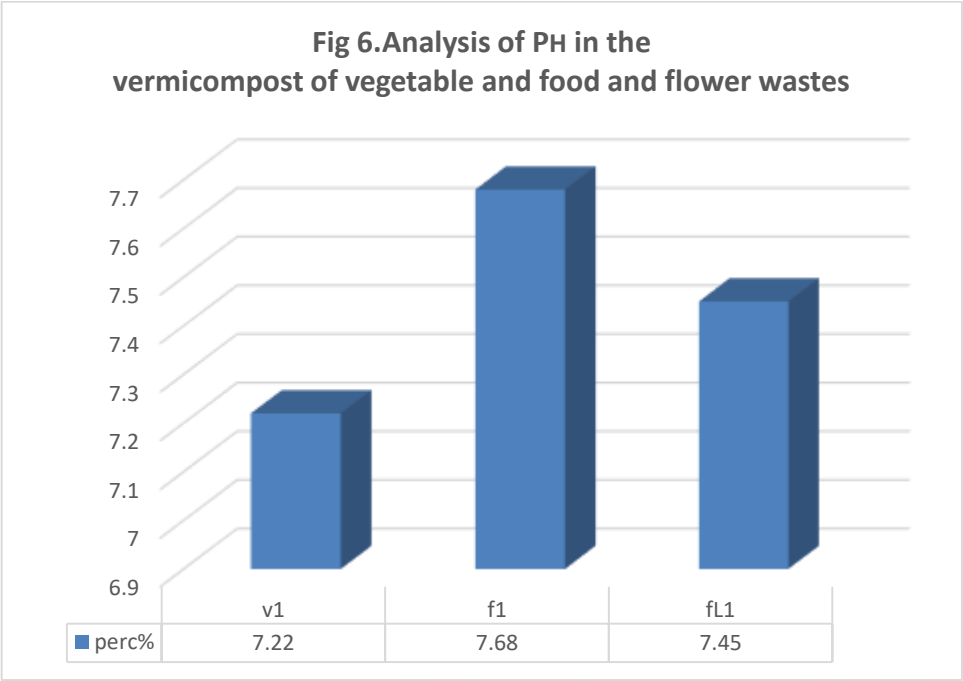
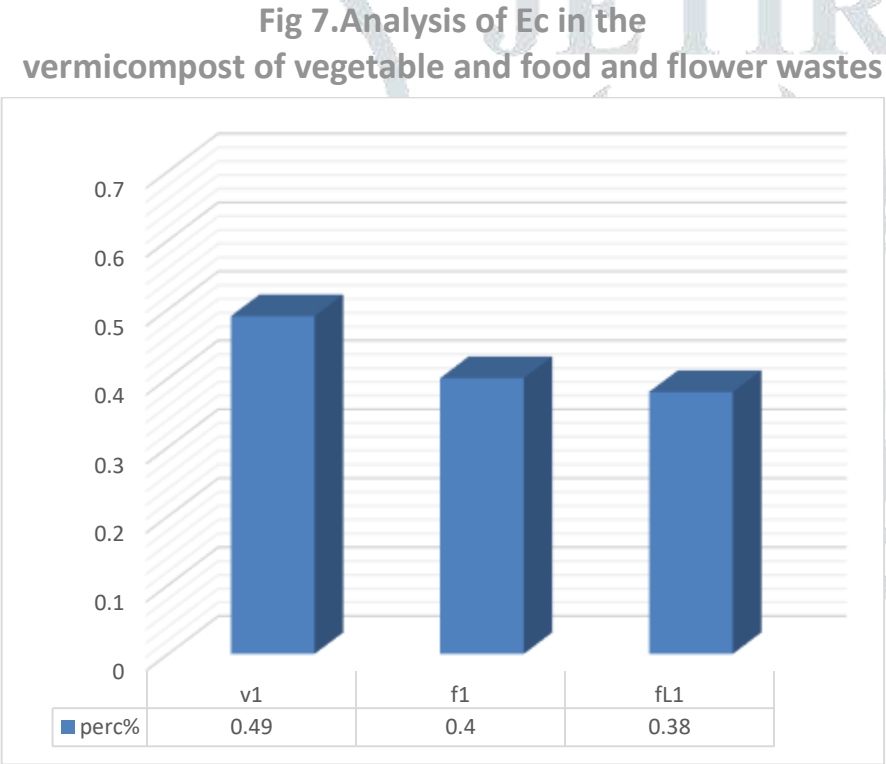


Fig 5.Analysis of Zinc in the vermicompost of vegetable and food and flower wastes
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
perc%
v1 f1 fL1
perc% 0.53 0.47 0.58





Physico–chemical properties of the soil mixed with different vegetable and flower waste were analysed on 25 days along with control and experiment. The EC was increased from 100gm treatment including tartrazine treated vegetable wastes. However the was two increase in to flower waste. The increase in all the treatments were statistically significant at $P<0.01$ level (Fig. 1 to 13). Among the different treatments on 25 days, pH value was normal and no change was observed in the tartrazine treatments and indicated statistically insignificance. In this study, a reduction in the pH was recorded at the end of the experiment. The variability in pH could be due to the production of organic acids during organic waste decomposition. During their study on the vermicomposting some organic residues may be produced that could have lowered pH level at the end of experiment. The analysis on 25 days showed reduction of pH value in all the treatments, and showed in significance. The bioconversion of these waste will be completed in about 25-35 days or even a lesser than this time limit.

RESULT AND CONCLUSION

In the present study a high degree of organic matter stabilization has been achieved in vermicompost preparation. On the basis of observation, the maturity and organic matter stabilization is found to be higher with vermicompost prepared from vegetable and flower wastes using *Eudrilus eugeniae*. This study demonstrates the role of earthworms and microbial population which could facilitate rapid decomposition and the rate of mineralization of wastes. The analysis clearly confirms the higher degree of degradation. The mineralization also showed high degree in the compost material. The potential of the species is observed in the analysis of micro and macro nutrients. Similarly, the physical properties also showed promising results in the present work. In the modern context, the formation of wastes increased at large level which can be utilized in a fruitful way by using earthworm for the conversions of varieties of waste into compost material. The present set of investigation is aimed in this direction and the results are encouraging. Researchers reported that the passage of organics through the earthworm's gut significantly alters the physical structure of the material. Large particles are broken down into numerous smaller particles, with a resultant enormous increase in surface area. Soil pollution bio- indicators are essential to establish environmental standards. Earthworms and hypogenous micro arthropods were chosen to test ecological risks derived from soil amendment. The objective of culturing earthworms in revealed that the earthworm could live in the vegetable and flower waste. In the present investigation the *Eudrilus eugeniae*, was subjected to various concentrations of vegetable and food and flower waste. It has been observed that the waste is toxic to earthworms observed only miner damages. Earthworm can be used to dispose of all sorts of vegetable and flower wastes. The processing of waste by earthworm would help to reduce a major environmental problem, the mounting solid wastes.

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