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Production of organic fertilizer with Macro-Micronutrients from the solid waste generated at home

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ABSTRACT

The implementation of a treatment method for the proper management of organic waste is of great importance as this would be possible to obtain benefits that help the improvement of human activities such as agriculture, where land use does sometimes excessive, causing wear and loss of production capacity, which leads to the generation of infertile soils with problems of recruitment, both water and nutrients, and therefore the loss of the organic layer which is indispensable for sustaining plant life. Humus contains vermicompost obtained from the micro (Fe, Mn, Cu, Zn and Na) and macro (N, P, K, S, Ca and Mg) nutrients that are essential for growth and development of all types of plants (fruits and vegetables included). It argues that vermicomposting replace the urea which is commonly used as fertilizer, and humus that has no chemical process gives us both nutritional benefits and costs. The control of pH of the organic waste is one of the most important parameters for the survival of this worm as it should be between 6 and 8 with a temperature of not less than 18 º C and no more 25 ° C, therefore it is need to regulate these conditions. For this reason, it is of great importance the use of organic and inorganic materials in order to regulate it, thus ensuring an effective way to maximize the life and livelihood of the worm, resulting in better performance in the production of humus which is very important to create organic compost. In this regard, we propose the use of 3 basic inorganic solid materials and manure of cattle to regulate the pH of the compost and provide the means necessary for the survival of the worm.

Key words: compost, nutrients, humus, worm, solid waste.

INTRODUCTION

Litter is an important factor in environmental pollution caused by excessive consumption in big populations with increased birth rates, resulting in the generation of millions of tons of organic waste, mainly from household waste [1-2]. The implementation of a treatment for the proper management of organic waste is of great importance, because of the benefits that will help to improve human activities like agriculture, and the mitigation of negative impacts on the ground, preventing the wear and loss of the production capacity, that leads to the generation of infertile soils with problems of recruitment of both, water and nutrients, and therefore, the loss of the organic layer

which is indispensable to sustain plant life [3-4]. One effective method to regenerate the soil is the vermicompost, which is based on the utility of an invertebrate worm called *Eiseniafoetida*, also known as the California red worm [5-6]. This worm is known for its ability to accelerate the degradation of organic matter turning it into a product with high nutritional value for plants and soil biota, producing a soil with a composition in micro (Fe, Mn, Cu, Zn and Na) and macro (N, P, K, S, Ca and Mg) nutrients that are essential for the growth and development of all kind of plants[7-8]. In this work, we propose the replacement of the commonly used urea as a fertilizer by the vermicompost, due to the absence of a chemical process with undesirable side effects and its nutritional benefits and high cost.

MATERIALS AND METHODOS

Worm-composting

The earthworm is an animal elongated, cylindrical body, ringed and length, in the adult, varies between 5 and 45 cm. (Figure 1), depending on the species. His body is covered by a thin cuticle that protects it from drying out [7].

All rings(segments or metameres) are the same except the first (prostomium)which contains the mouth and the last (pygidium) where the anus. At the stage of sexual maturity appears differentiated glandular zone called clitellum and is related to reproduction and setting of the buds (Figure 2) [7].

The external and internal morphology in systematic is used to classify different species of earthworms. Theparameters that theclassification based onexternal morphologyare: number of setae number of body segments, with the position of the clitellum regarding the prostomium and the characteristics of this [9].

The mainmorphological feature ofthe species most usedin the worm are as follows: *Eiseniafoetida* or Californian red worm, which is the species most used in vermin culture usually in adult hood, a length between5 and9 cmwith a diameter between3 and5 mm purple andredin optimal conditionscan reach1 to1.2 gr in weight. The number of segmentsvariesfrom 80 to120 withan averageof 95. As adultshave alumpclitellumorsaddleshaped locatedbetween segments24 to32.In theclitellumtheir sexual organsare located, both male and female[7].Theorganic wasteis an importantfactorofenvironmental pollution, every day accumulatelarge volumes witha widevariety of materials,we must recognize thatthe garbage generatedin homes isfully sustainable. Inthe present study wedeveloped the method ofcomposting, (Figure 3)shows the selectionof organic wastegenerated in households, (Figure4) shows thequarteredof the waste, (Figure 5)shows thequarteredofwaste andmixedoxideof5%magnesiumto cushionthe pHof the waste, (Figure 6) shows the trench outlined in the study area and the deposit of the precomposta. (Figure7) showsthe study area, which should be conditioned and protected from temperature, protected from sun, rain and interperiean drodents.

Selection and standardization of organic wastes using the official standard, by cracking. For the preparation of organic waste precomposta, was used part of the Mexican Official Standard NMX-AA-15 Method of cracking. Semarnat 2007[10]. That generally consists of: Garbage collection is concentrated, is classified in organic organic waste is separated as shown in (Figure3), recommended that thisclassification is carriedout inthe concrete floor, deployed the quartering methodas shownin (Figure 4), in the trenchorganic wasteis deposited at the heart of California red worm as illustrated in (Figure 8).

RESULTS AND DISCUSSION

Compost isan excellentproduct resulting from theingestion and digestionof organic wastegeneratedby the wormCalifornia thisis a bio-organic fertilizerkindofspongy,soft, light, granular, dark, with a pleasant odorin (Figure9) illustrates thematerial.(Figure 10) shows the different stages that were carried out for obtaining compost, obtaining the product in time of 2.5 to 3 months on average, this organic fertilizer is determined physical and physicochemical properties in the laboratory by manual of chemical analysis techniques for Worm Humus[11-13]. It has awide rangeof macronutrients, such as N, P, K, S, Ca y Mg among the most important, as well as micronutrients: Fe, Mn, Cu, Zn y Na among the mostoutstanding, as shownin Table 1. Supervise their applications in greenhouses, gardens and green areas of the homes which will be attached to this study[14-15]. All these are fundamental for growth and development of all types of plants(fruits and vegetables included) [16-17]. Hasoptimum phyto-hormonal activity, and an appropriate pH to improve conditions in the crop of vegetables and fruits[18-19].Compost increases

the permeability and retention of soil moisture, which favors the reduction ofwater consumption bycrops,in turn providesfavorable conditionsof substances produced bysecondary metabolismof bacteria that are stimulatedin biological processesof plants, the same way you can deploy cow dung which alter degradation time of the same [20-21]. The obtained organic fertilizer can be applied in greenhouses, gardens and green spaces at home, with liberty and this kind of fertilizer is very difficult to cause poisoning excess in the soil and subsoil.The result obtained by the technique has been favorable for recycling organic waste from home and these are serious health problems and pollution, the treatment for these wastes have excellent results using the prior art, since this fertilizer contains acceptable levels of macro and micro nutrients in the soil and subsoil with a favorable range.The quality of compost depends on the type of waste generated which may contain high nutritional value, improving the quality of compost[22-23].

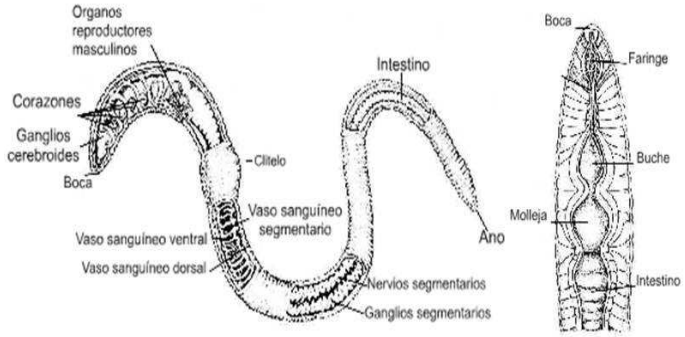

Fig. 1 Cross section of the worm

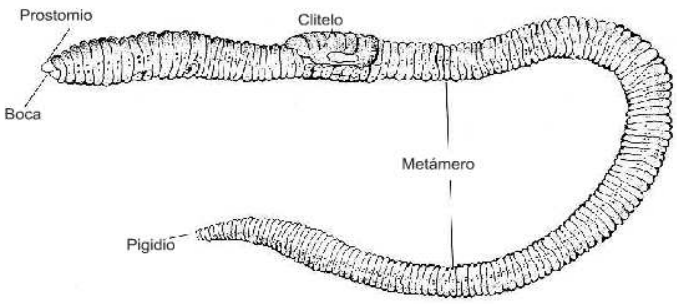

Fig. 2 External morphology of the worm

Fig.3 Organic waste pretreatment

Fig.4 Suitability of organic waste

Fig.5 Precomposta

Fig.6 Ditch the elaborate Precomposta

Fig.7 Conditioning of organic waste treatment in the study area

Fig.8 Substrate mixed with California Red worm

Fig. 9 Production of organic fertilizer, uniformly screened separately, spongy texture, soft high moisture content and pleasant smell

Parameter	Organic Household Waste	NMX-FF-109-SCFI-2008	Manual analysis techniques physical and chemical humus Institute of Soil earthworm (CUBA)
P^H	8.4	5.5 a 8.3	6.0 a 8.5
Nitrogen %	1.9	1 a 4	0.5
Phosphorus %	0.95	-	0.26
Potassium %	1.2	-	0.53
Calcium %	4.1	-	-
Magnesium %	0.7	-	-
Mn (ppm)	201	-	-
Zn (ppm)	140	-	-
Fe (ppm)	813	-	-
Cu (ppm)	30	-	-
% Organic Matter	11.7	20 a 50	13.75
Relationship C/N	14	≤ 20	16
Ashes %	88.23	-	-
Moisture %	2.783	-	-

Table 1.Results of the fourteen parameters analyzed and values to be compared, and determination of the compost

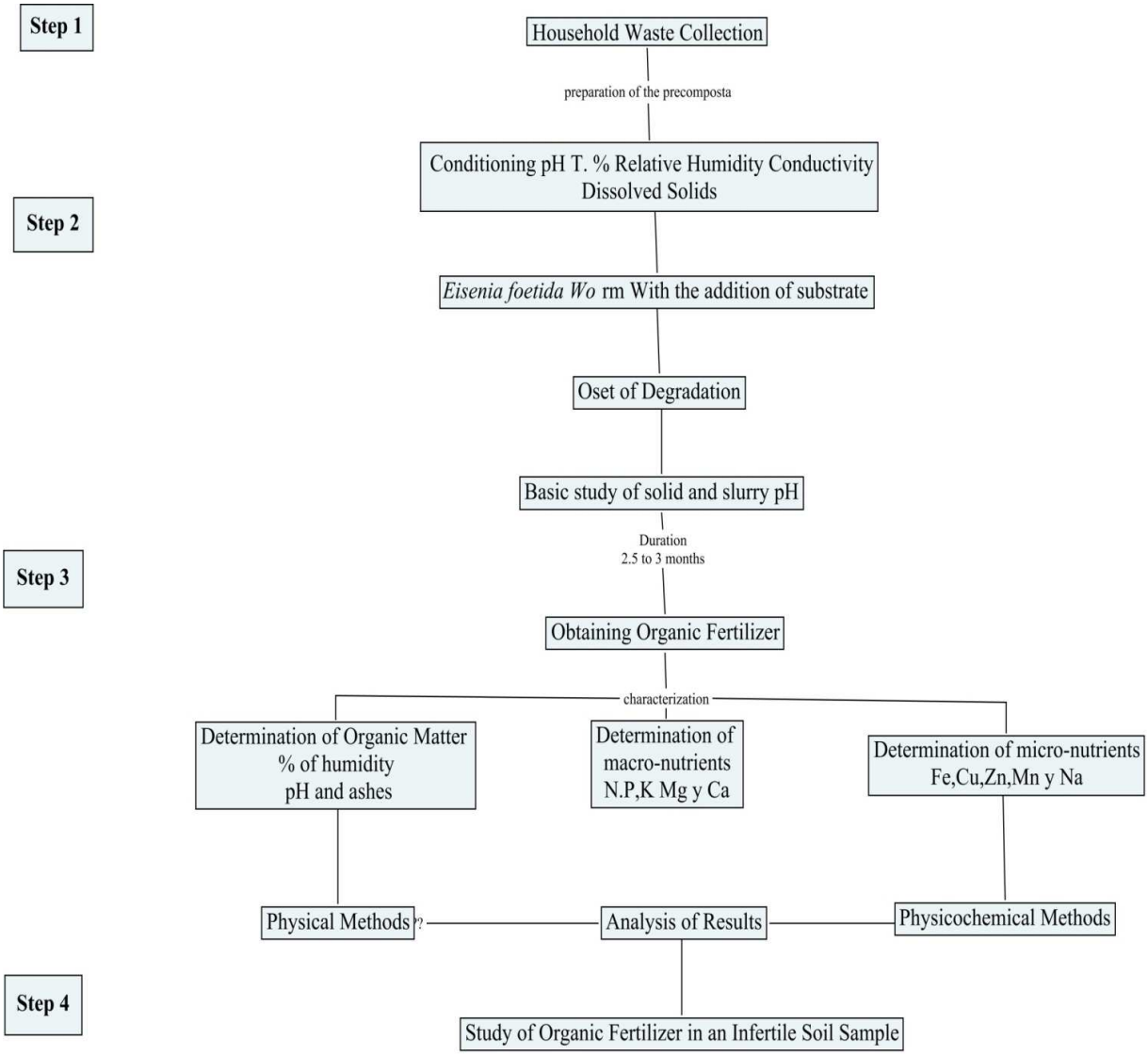

Fig.10 Experimental stages for obtaining compost from organic household waste

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