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Study and evaluation of physicochemical parameters of organic Mannur derived from different waste materials

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Abstract
Improper disposal of solid waste is one of the main causes of environmental pollution. Converting solid waste into compost and using it as an organic fertilizer in agriculture is an effective waste management method. The quality of such fertilizer may affect both human and environmental health. In this descriptive-analytical study, compost samples were prepared from different waste materials for chemical analysis. In the present study, parameters such as pH, organic matter, EC, carbon, nitrogen, phosphorus, potassium, ere studied. According to the results, the mean pH, EC, organic matter, carbon, nitrogen, phosphorus, sodium and potassium were good in all compost respectively but vermicompost found most rich compost.

Keywords: vermicompost, city compost, cow dung manure, chemical parameters

Introduction
Compost is the product of aerobic process during which microorganisms play an important role by decomposing the organic matter into a stable amendment for improving soil quality and fertility (Gebeyehu and Kibret, 2013) [4]. Composting is a technique which can be used to reduce the amount of organic waste through recycling and the production of soil fertilizers and conditioners (Khate, 2015) [7]. A number of biological wastes can be used for composting, which include municipal solid wastes, animal, human excreta Crop residues, unused bedding materials, silage, manures, and similar on-farm materials can be used as co-compost cover materials, along with many off-farm residues and wastes (Pan and Sen, 2013) [10]. Various methods have been proposed to decompose waste materials (Francau *et al*., 2005) [3]. In these systems, size and shape of piles, as well as the frequency and way of turning, are very important, since they have a direct influence on the material aeration, a key factor in composting (Manohara and Belagali, 2017) [9]. For the process to occur efficiently, some parameters need to be monitored. Temperature, which correlates with physicochemical and microbiological parameters from composting, is a simple and inexpensive means for this purpose (Cestonaro *et al*., 2014) [2]. The variation in nutrient concentration and structural changes during the composting process can be evaluated through the analysis of different physico-chemical parameters and spectroscopic characteristics. The aim of the present work is to determine the quality of the city compose, cow dung manure in comparison with vermicompost through the determination of physicochemical parameters.

Materials and Methods
Compost preparation and sampling
In the present study, different type of compost (cow dung manure, city-compost and vermicompost) was prepared. The fence was filled with different solid wastes. Soil was added above the waste material for 20 cm high. Again the dry leaves, stem of maize, paper, cattle manure and food wastes (leaves of avocado, onion, orange, banana and mango) were added to the composting fence above the fertile soil. The upper layer of compost was covered with dry leaves to protect the composted heap from wind and sunshine. The vermicopost fences were prepared with earthworms (Hussein *et al*., 2001).

Physico-chemical analysis of compost
The temperature of the compost piles was monitored every three days during the process using thermometer. The average reading was recorded. The ambient temperatures were also measured and recorded at the same time, according to Ryckeboer *et al*. (2003) [12]. Electrical conductivity and pH of compost was measured with a multimeter. Samples of each composting heap were taken to the laboratory for moisture content determination. Each sample is weighed using digital balance. The samples were then oven-dried at a temperature of 1100 C for 24 hours and reweighed. The amount of moisture was calculated from the difference in the weight of the compost before and after drying. Nitrogen content was determined by the Kjeldahl method. The carbon-nitrogen ratio was calculated using the results obtained from carbon and nitrogen contents. The carbon content of compost was determined by titration method as described in Sahilemedhin and Bekele (2000) [14].

Results and Discussion
Variation in pH values is presented in figure 1. The comparison of pH among different composts samples shadowed that the pH of vermicompost was low (5.98) compared to others. Then it continued to increase slowly. It could be explained that the vermicomposting pH value decreases due to production of organic acids derived from the intense fermentation of carbohydrates. Afterwards, the pH begins to rise which results from the release of ammonia due

to the start of proteolytic process (De Nobili and Petrussi, 1988). pH drop during thermophilic due to accumulation of organic acids reflects high rate of organic matter degradation and these acids are used later on as substrate by other microorganisms. During the cooling down and maturation stages the pH drops to a neutral value (Chefez *et al*., 1998). During the composting process, the pH dropped due to the ammonification and mineralization of organic matter by the activities of microorganisms as found by Wong *et al*. (2001). The pH value of compost is looked as an indicator of process of decomposition and stabilization. The change of pH value during composting is quite predictable (Miller, 1993; Benito, 2003; Page, 1982).

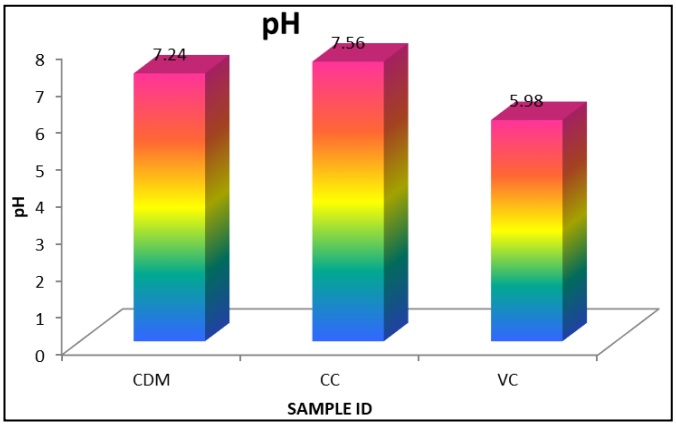

Fig 1: pH value of all compost

Figure 2 shows that Electrical Conductivity was maximum 2358 µS/cm for vermicompost. Cow dung manure represents low electrical conductivity. EC represents the concentration of dissolved salts in the compost. Application of compost with high levels of EC may cause some problems, including soil salinity and biological toxicity (Sadeghi *et al*., 2015) [13]. An average EC amount of 2358 µS/cm was found for the studied compost samples, which is in accordance with the standards.

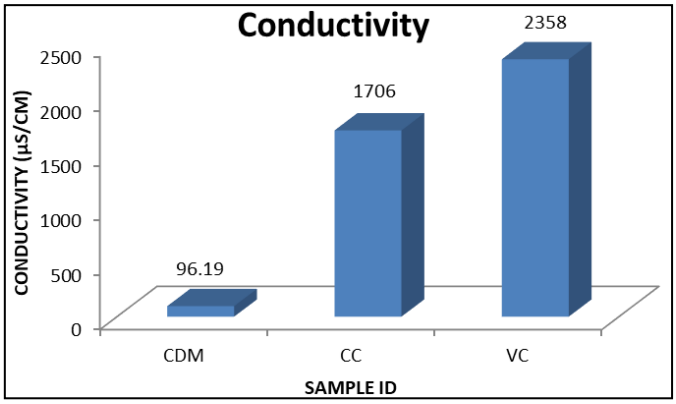

Fig 2: Electrical conductivity of all compost

Organic matter are among the parameters that affect the quality of the produced compost. The results of this study showed that 59% of the produced vermicompost are organic matter. This value is in accordance with the standard values. But, cow dung manure and city compose does not show a good quantity of organic matter. vermicomposting indicates net organic matter stabilization in the substrate due to joint action of earthworms and microorganisms (Kavita *et al*., 2010).

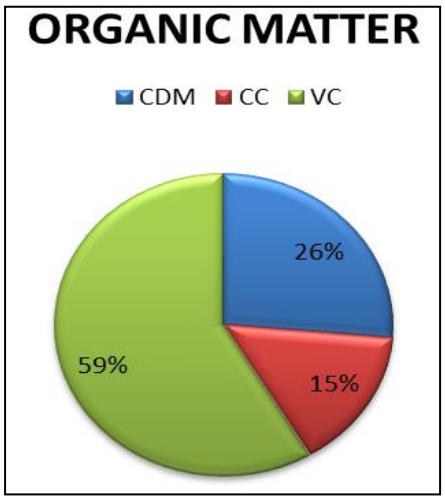

Fig 3: Organic matter of all compost

The nitrogen content present in all types of waste composted is represented in Figure. Increase in nitrogen content in the cow dung manure is due to the fact that bacteria enhanced the nitrogen cycle, which attributed to the increased levels of nitrogen in cow dung manure. The losses of organic carbon might be responsible for nitrogen addition in the form of mucus, nitrogenous excretory substances, growth stimulatory hormones and enzymes from the gut of earthworms (Achsah and Prabha, 2013) [1]. According to Suthar and Singh (2008) [15], the loss of carbon and addition of nitrogen during the composting process reduces the C:N ratio in the end product.

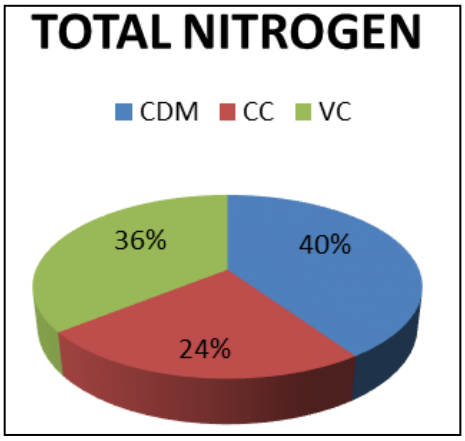

Fig 4: Total nitrogen of all compost

Figure 5 Illustrates the phosphorous content present in vermicompost, cow dung manure and city compost. Phosphorous content present in vermicompost is high compared to both. The enhanced phosphorous level in vermicompost is due to mineralization of phosphorous during vermicomposting. The release of phosphorous in the available form is performed partly by earthworm gut phosphatases and further release of phosphorous might be attributed to the

phosphorous-solubilizing microorganisms present in vermicompost. Some reports observed that vermicompost provided equivalent amounts of P to soil as mineral fertilizers (Pathaka *et al*., 2012) [11].

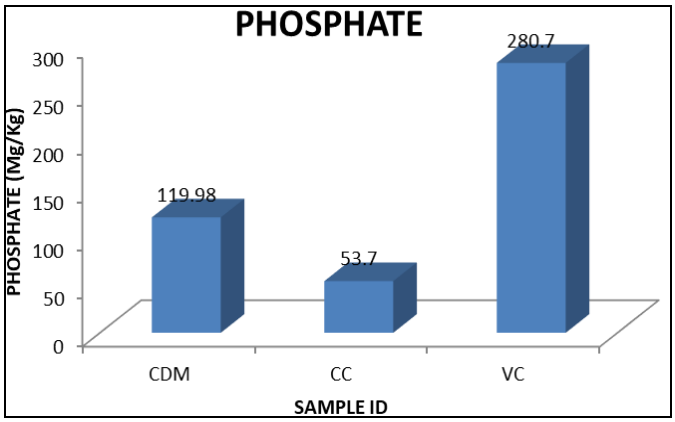

Fig 5: Total phosphate of all compost

Figure 6 depicts the potassium content present in vermicompost, cow dung manure and city compost. The total potassium present in vermicompost higher than others. The increase of potassium content in vermicompost might be due to changes in the distribution of potassium between non exchangeable and exchangeable forms. The earthworm processed waste material contains a high concentration of exchangeable potassium, due to enhanced microbial activity during the vermicomposting process, which consequently enhanced the rate of mineralization (Suthar, 2007) [16]. Nutrients in compost are analyzed considering the raw materials used in the compost pile, and also the application of the final compost. Nutrients are necessary in the compost pile because decomposer microorganisms need them to grow, and also they are important regarding the fertilizer value of the final product (Mahalingam and Maruthamalai, 2014) [8].

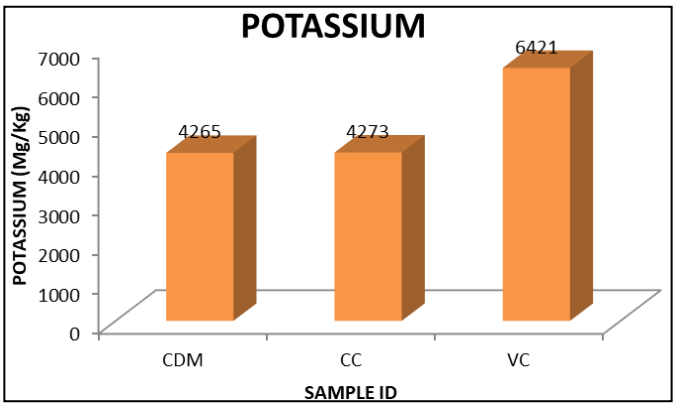

Fig 6: Total potassium of all compost Conclusion

The physicochemical parameter pH was tested and was found that the earthworms were sensitive to pH and that they can grow only in pH 6.9 to 7.2. The enzymes amylase, cellulose and invertase considerably increased in vermicompost than raw waste. The macronutrient test also confirmed the presence of high concentration of potassium, phosphorous and nitrogen in vermicompost. Thus it is concluded that vermicompost is more efficient compared to the other compost. Quality of the end product of any vermicomposting process has been always an important issue for commercial application of this technology. Use of sophisticated techniques/instruments will help to solve the use of end product as good manure for end user.

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