# Survey of E.Foetida Population on pH, C/N Ratio and Process's Rate in Vermicompost Production Process from Food Wastes

**Rostami, R.**[*1]**, Nabaei, A.**[2]**, Eslami, A.**[3]**, Najafi Saleh, H.**[4]

1-Ms.C., Department of Environmental Health Engineering, Iran University of Medical Sciences, Ilam-Iran

2-Instructor of Zanjan waste water treatment palnt., Zanjan-Iran nabei2005@yahoo.com

3- Assist. Prof., Department of Environmental Health Engineering, Zanjan University of Medical Sciences, Zanjan-Iran eslami_akbar@yahoo.com

4-Ms.C., Department of Environmental Health Engineering, Shahid Beheshti University of Medical Sciences, Tehran, Iran h_n_saleh@yahoo.com

Received: Oct., 2008 Accepted: Sep., 2009

## Extended Abstract

Million tons of organic wastes are land filled or incinerated annually. Each of these methods for disposal of wastes can make various damages to environment. Also, gathering, landfill or incineration of these materials imposes high costs. In landfill of wastes in addition to problems related to costs and occupying of ground by wastes, there is infiltration threat of nitrate and other contaminants to groundwater. One of the useful methods for processing the organic wastes is recycling to organic fertilizer. As a result of this process, in addition to health and environmental problems' reduction, considerable amount of organic fertilizer produced. Nowadays, applying earth worms for production of organic fertilizer from wastes, which is called vermin-compost, has found special popularity.

In process of compost production by worms, worms are fed by organic wastes and the worms change it to fertilizer. In this process, by feeding the worms with organic materials, some useful bacteria for organic wastes decomposition are added which expedited the process. Also these bacteria have positive effects on stabilization and making minerals that are applicable for plants. Positive effect of adding vermi-compost to soil in tomato field had shown by Federico. In another research, the increasing of rice stalks and soil fertility obtained by adding vermi-compost. Iran has a production potential of 4 million tons compost from municipal solid wastes, annually. So attention to this matter can be useful in solid waste management for improving the produced compost's quality.

## Methods

### Preparation of media

Preparation of wastes are done for 18 days in aerobic condition, then the prepared wastes added to worms' bed, in lower part of pots placed 350gr vermin-compost as bed which made proper height in pot for lair of worms. We set 5 pots containing 350gr bed, including blank, with no worm, and 4 pots with 6, 12, 18 and 24 worms. The worms scaled to maintain weight arrangement of worms among the pots, then 70gr of prepared wastes added to each pots and 100gr vermin-compost placed on the wastes for conversion. The pots marked B0 (blank pot), B1, B2, B3, and B4 respectively and monitored for a month.

### Chemical analysis

For measurement of pH, samples after drying in 105 ºC for 24hr, suspended in distilled water and mixed for one minute, after 10 minute stabilization it filtered through Whatman no. 1 filter paper and their pH measured. Measurement of carbon content was done in 550 ºC for 2 hr And Carbon content was calculated with determination of VS. Measurement of Nitrogen content was accomplished by micro Kjeldahl Titrimetric method on 0.1gr samples.

### Sampling

Homogenized samples of each pot's waste was taken in 10 days during a month. For sampling first the cover layer removed and then after taking the sample the covering layer was returned again.

### Statistical analyses

We applied multivariate and linear regression tests for statistic analysis of data.



Corresponding author: +98 241 4155020 E-mail:ro.rostamy@gmail.com

**Results**

The results of examinations to determination the influence of worms population on process rate, pH and C:N ratio in 5 pots come in Figure 1.

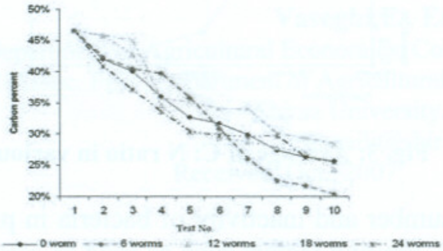



Fig. 1.b

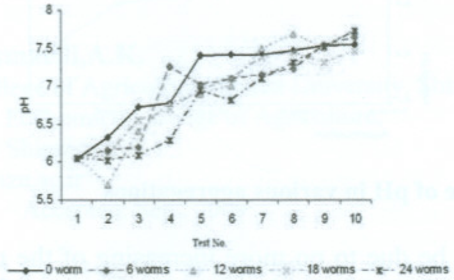



Fig. 1.a

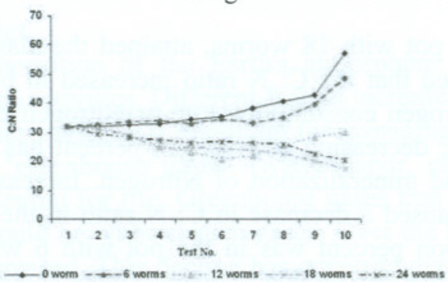



Fig. 1.d

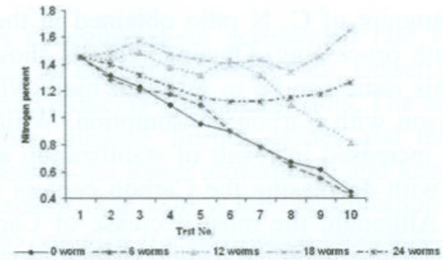



Fig. 1.c

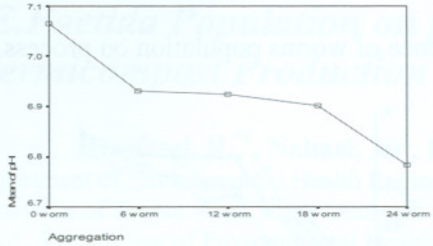
**Fig. 1: a, b, c and d: The monitored parameters during a month, 10 times samples had taken during a month**

Obtained results show a growing trend in C: N ratio at the blank pot. This trend in C:N ratio for other pots is lowered and in B3 and B4 it has a decreasing trend. The comparison of obtained results shows that the amount of pH has a growing trend in all of the pots. Percent of Nitrogen and Carbon has a decreasing trend in most pots but, it showed a growing trend of Nitrogen percentage in B3 and B4, or decreasing trend of Nitrogen percentage has been lowered in these pots. The percent of Nitrogen has increased to 0.196 percent in B3. The most increase of pH was in B4 and the most decrease of Carbon percent was seen in B1. The most decreasing in C:N ratio observed in B3 and the most decrease for Nitrogen percent was observed in B1.

**Discussion & Conclusion**

The results of Multivariate test didn't show significant difference for pH value at various pots. The aforesaid analysis shows that, increasing of the worm population from 0 to 24 does not affect the pH changes. But, comparison of pH averages, according to Fig 2, shows decreasing in pH with increasing in worm population. The difference in pH value was considerable between blank pot and the other pots. Also, between 18 and 24 worms it showed considerable difference in PH value. Accordingly, it can be concluded that increasing in number of worms can be effective in maintaining the pH in the standard range of a class's range, 6.5-8.4, (Brinton, 2000). Since, studies showed that vermin-compost is effective in increasing the conversion rate of Ammonia-Nitrogen to Nitrate (Bansal and Kapoor, 2000; Federico et al., 2007), we are supposed this matter has been effective in controlling of pH and it can prevent from excessive increasing of pH by decreasing of the Ammonia. Multivariate analysis and Scheffe test didn't show significant difference for influence of worms population between 0 worm and 6 worms on C:N ratio but, there was a significant difference (P-value< 0.05) in C:N ratio between 0 worm and other pots with more number of worms. Also, this analysis didn't show a significant difference in C:N ratio among the pots with 12, 18 and 24 worms. Therefore, we can state that excessive increasing of worm's population is not effective on decreasing of C: N ratio.

The comparison of C: N ratio averages has shown in Fig 2. According Fig 3, by increasing in the number of worms, the C: N ratio has decreased but, it has come near by each others at population of 12, 18 and 24 worms.



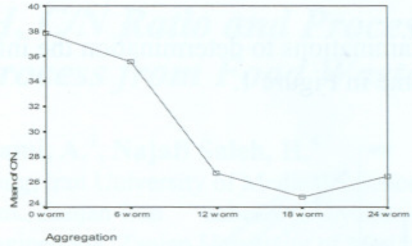




**Fig. 2: Average of pH in various aggregations**

**Fig. 3: Average of C: N ratio in various aggregations**

This result may be due to no more increasing of the number and inactivity of bacteria in presence of more worms or decreasing of worms' activity. In this regards, limiting factors such as food or other factors can be the main cause.

The minimum amount of C: N ratio obtained in the pot with 18 worms, attained the class B of compost during one month processing. Obtained results showed that the C: N ratio increased in blank and with 6 worms' pots. This issue can be in result of more Nitrogen consumption rate or Nitrogen escapes from the pots in comparison with Carbon consumption. While, decreasing of Nitrogen percent has been smaller in other pots or it increased in result of stabilization and mineralization of Nitrogen. Increasing of Nitrogen simultaneously with decreasing the Carbon content caused a decrease in C: N ratio in the pots with more than 6 worms. Although, the most decrease of Carbon percent was in the pot with 6 worms but, much decrease in Nitrogen content and its non stabilization, that can be due to inappropriate condition for bacteria activity or insufficient number of worms for turn over and feeding of materials and consequently take place anaerobic condition and Nitrogen escape from the pot, caused an increase of C: N ratio in this pot. If we consider that the rate of process is the rate of reaching lower C: N ratio, which the C: N ratio is one of compost maturation indexes, so with linear regression analysis of this ratio in various population of the worms and with having slope of line we can state that, what population of worms has more effect on decrease rate of C: N ratio. This analysis shows that by increasing the number of worms, slope of regression line for C: N ratio has been increased in retrograde direction. It means that, decreasing rate of C: N ratio has been increased. The amounts of gradient for B0, B1, B2, B3 and B4 are -0.93, -1.4, -0.18, 1.3 and 2.5, respectively. This results show that, the most negative gradient is in the pot with 18 worms, see Fig 4. So, this pot will be attained to maturation in less time. This case is not far from more proportion at the consuming of Carbon and Nitrogen in the process according to C: N ratio. It shows that, maturation of compost is faster in the pot with 18 worms in 70gr of wastes. Although, statistic analysis shown no significant difference between this pot and other pots with 12 and 24 worms but, this few difference in slopes can be resulted from existence of more worms in competition for food and decrease of their activity that cause again this trend to be waned in the pot with 24 worms.

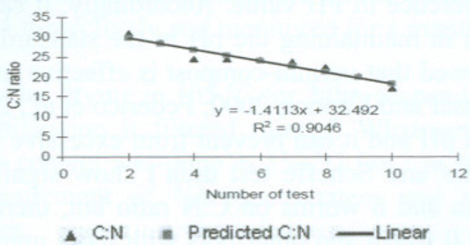



**Fig. 4: Regression line for C: N ratio in 18 numbers of worms**

**Key words**
Aggregation, Vermicompost, Rate of process, E.Foetida, Food waste