Pak. j. sci. ind. res. Ser. A: phys. sci. 2017 **60**(2) 114-116

Short Communication

Effect of pH During Composting of Municipal Solid Waste

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(received August 25, 2016; revised March 14, 2017; accepted March 16, 2017)

Abstract. This study was designed to monitor the pH during process of composting by using organic waste segregated from municipal solid waste. pH was measured by preparing sample in laboratory by mixing compost with distilled water (1:10). and monitored in laboratory for the authentic results. The main objective of this study was to monitor the effect of pH during aerobic composting process that do not release harmful gases. It concluded that the pH value end up with alkalinity in degradation process but initially it was acidic.

Keywords: pH, composting, C: N, moisture %

There are many issues related to waste management system in an under developed country like Pakistan. One of the main issue is the non-availability of proper landfill sites for waste. Managing this waste is the need of society now a days. There are two requirements that need to be fulfilled when deal with waste, (i) less waste and (ii) proper system to manage this waste. Several models that predict environmental burden caused by municipal solid waste (MSW) are developed. The production of biogas during incineration from incinerator emission could cause harmful effects. Anaerobic composting at industrial level could emit many harmful gases that can badly pollute environment. The life cycle model for MSW are still lacking these areas. The objectives of municipal solid waste degradation can be achieved by using this composting approach. It includes resource recovery, bulk and mass reduction (McDougall *et al.,* 2008)

There are many applications of biodegradable MSW. One important application is to sort MSW and degrade it with microbial activity to get compost. This compost has several benefits for plants. This compost can be combined with N, P, K to get better quality crops (Dees and Ghiorse, 2001). Compost improves organic matter status in soil. The grain, rice and wheat crops are grown with addition of compost with fertilizer as it increases the chemical properties of soil and result in better quality of crop (Sarwar *et al*., 2007)

The mature compost play unique role in specialized practices, including gardening which require self-heating organic matter and also it is used as substrate for edible mushroom cultivation. Compost is used as a soil conditioner for high value crops such as flowers and vegetable grown out of season.

LCL is operating an aerobic composting plant at Lahore that has been purchased from and installed by the Menart Composting Company, Belgium. The LCL is a part of Saif Group of Companies and is operating a composting plant by using organic waste, the municipal solid waste transported to Mahmood booti landfill place, Lahore. LCL utilizing 1,000 tonnes in a day. The LCL imports inoculum from Belgium. The main focus of this research was to produce an inoculum for decomposing organic waste that could give economic benefits to Pakistan.

Pakistan has good economic growth in agriculture sector. The efficient preparation of compost with addition of inoculum can be a better initiative to further increase the economic growth at agriculture side, because it can improve soil structure and help to grow healthy crops and plants.

pH is an important parameter need to be checked because it decide the level of maturity of end product. pH should be alkaline as the soil in Pakistan is also alkaline. The changes of the composition during the biodegradation process and the final waste composition were strictly dependent on the process conditions (Liwarska- Bizukojc and Ledakowicz, 2003)

There are many important parameters that need to be checked during the process of biodegradation of MSW to get the good quality of compost. These parameters

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include porosity, temperature, oxygen, C: N, moisture content, windrow weight, pH, EC and CEC (Wakchaure *et al.,* 2013)

The MSW was taken to landfill site and sorted by using machine at LCL to remove any inert material. The sorted waste was composed of screening matter from MSW, cow dung and saw dust. Cow dung and saw dust was added to manage C: N. The screening matter was the organic waste which include biodegradable kitchen waste, food waste and plant waste. LCL took only organic waste at landfill site. The windrow of 50 tonnes were prepared by mixing screening matter, cow dung and saw dust. It was divided in to 4 equal parts of 12 feet width and 5 feet height. The prepared windrow was evaluated for various parameters including C: N, moisture content, temperature and oxygen. The C: N was adjusted below the value of 30:1 as initial C: N was measured 34:1. The moisture content in all the four treatments were adjusted to about 50% for bacterial metabolic activity. Initially it was below 50% and the temperature was maintained at 65-700C by adding microbial inoculum because microbial activity increase temperature and rapid degradation. Proper turning of the windrow was provided to give aeration. The temperature of windrow was monitored by using OT meter. The four divided parts of windrow were treated differently

Treatment A: microbial inoculum combined with molasses

Treatment B: microbial inoculum

Treatment C: commercially available inoculum

Treatment D: without any microbial inoculum

The designed microbial inoculum used in treatment A and B contained two strains of *Bacillus* bacteria. Treatment A, B, C and D were compared weekly for pH value.

Determination of pH . The samples were taken from four divided differently treated parts of 50 tonne windrow. The compost solution was made by adding distilled water in 1:10 and the solution was left for 2 h so that the maximum salts were dissolved. The electrode of pH meter was dipped in the compost solution. Reading was noted on pH meter when it was stabilized. The electrode was washed with distilled water and dried with tissue paper (Sánchez Monedero *et al*., 2001)

pH profile of compost. There were varied pH values for samples obtained from each treatment windrow as summarized in Table 1-2 and displayed in Fig. 1 and 2 with the majority showing alkaline pH. The lowest pH obtained was 5.25 in treatment D and the highest 7.98 in treatment A at the first week of composting. The increase in the pH value was observed in each treatment with the interval of time.

The pH of all treatments was increased with the time interval. All the treatments at the end of degradation process showed alkaline pH. The pH of mature compost of all treatments was also alkaline. Low pH effects the rate of respiration in a compost pile (Sánchez-Monedera *et al.,* 2001). It reduces the rate of respiration and slow down the process of composting. Wang *et al*. (2015) recommended a range of pH from 6.9-8.3 at the end of

Table 1. pH profile of compost during 1st month

Treat-ments	pH			
	Week 1	Week 2	Week 3	Week 4
A	6.08±0.09	7.21±0.13	7.38±0.14	7.24±0.22
B	5.89±0.60	7.58±0.89	7.11±0.12	7.54±0.90
C	5.36±0.37	6.72±0.44	6.75±0.38	7.05±0.10
D	5.25±0.27	6.90±0.35	6.59±0.44	6.91±0.11

Table 2. pH profile of compost during 2nd month

Treatments	pH			
	Week 5	Week 6	Week 7	Week 8
A	7.68±0.85	7.15±0.78	7.45±0.21	7.98±0.31
B	6.34±0.33	7.56±0.47	7.67±0.11	7.62±0.11
C	6.42±0.38	6.45±0.26	6.89±0.39	6.86±0.56
D	6.74±0.10	6.58±0.17	6.88±0.10	7.58±0.11

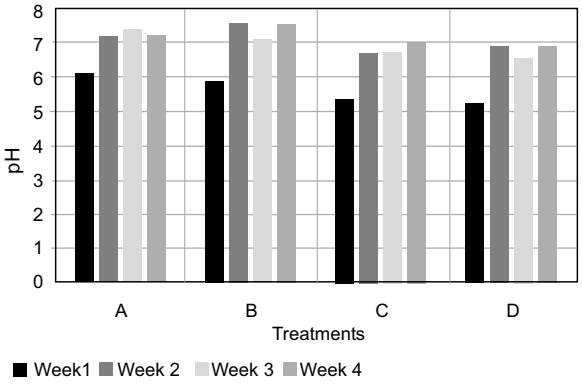

Fig. 1. pH variation of compost heap during 1st month of composting. (Treatment A, B, C and D were compared weekly for pH value.)

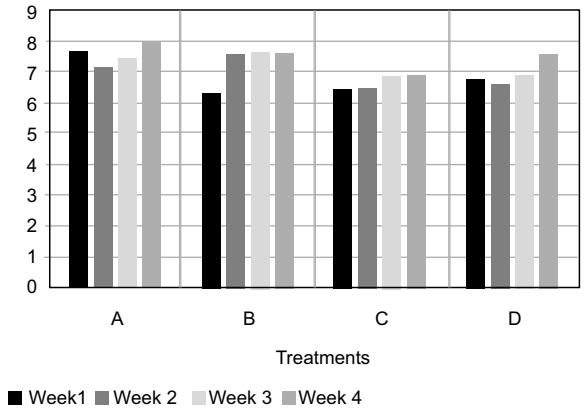

Fig. 2. pH variation of compost heap during 2nd month of composting. (Treatment A, B, C and D were compared for pH value weekly.)

composting and the results show this range of pH in all treatments. The pH of treated waste was alkaline at the end and these results are in line with the earlier findings of Sundberg *et al*. (2004) that the pH of the end product compost should be alkaline (Nakasaki *et al.,* 1993).

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