Microbial Biodiversity of Municipal Solid Waste (MSW) dumpsites of Cochin, Kerala, India.

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Abstract

Cochin, the commercial and industrial centre of Kerala, lies on the south-west coast of Arabian sea. It covers an area of 94.88 Km^2. There are two major dumpsites in the city, one at Brahmapuram and other at Kalamassery. The proper management of the waste has been a challenging task for the concerned authorities. One of the cost-effective combating ways is the use of microbes. A preliminary attempt was performed to quantify both the physicochemical and microbial characteristics of the dumpsite soils and evaluated by using standard techniques. The soil samples from the study sites showed higher values for bacterial and fungal counts than the control soils. Some of the isolated species belonged to the genera *Bacillus*, *Pseudomonas* and *Klebsiella*. As the findings reveal that the dumping site soils have wide microbial diversity which can be exploited for sustainable and eco-friendly bioremediation approach.

Keywords: Municipal solid waste dumpsite soils, Microbial biodiversity, Cochin.

1. Introduction

Municipal solid waste (urban solid waste) constitute predominantly domestic waste that are disposed of into the assigned dumpsite. Such dumpsites articulate diversified nature at both biological as well as physicochemical perspectives (Atalia *et al.*,2015).

Microbial diversity in terms of quantity and quality is important to understand the microbial ecology of the ecosystem and to identify the bacterial strains with potent valuable application capacity in various sectors. This research work attempts to quantify the culturable bacterial and fungal diversity of MSW dumpsite soils along with the physicochemical characteristics (Chetan *et al.*,2017).

2. Materials and Methods

2.1. Description of the study area

The study area was **Brahmapuram** and **Kalamassery** in Cochin city (commercial and industrial capital of Kerala). The city produces around 180-250 metric tons of waste per day which gets dumped at Kalamassery and subsequently ends up at the waste management plant situated at Brahmapuram, which is in dilapidated condition. It covers an area of 106 acres. The sampling stations at the site were represented as B1, B2, B3, BC (Brahmapuram site), K1, K2, K3 and KC (Kalamassery site).

Table 1. Latitude and Longitude of the Sites

Sites	Location
B1	N 09º 59'512" E 76º27'920"
B2	N 09º 59'517" E 76º21'922"
B3	N 09º 59'501" E 76º21'916"
BC	N 09º 59'777" E 76º22'194"
K1	N 10º 03'903" E 76º19'659"
K2	N 10º 03'906" E 76º19'666"
K3	N 10º 03'903" E 76º19'676"
KC	N 10º 03'818" E 76º19'579"

2.2. Soil sampling and Analysis

The top 15 cm soils were collected from four points at each site aseptically. The sample pH, conductivity, moisture content, nutrient levels, soil texture and organic matter were analyzed by using conventional techniques.

2.3. Enumeration, isolation and characterization of Bacteria in the MSW dumpsite

1 g of each sample was serially diluted in phosphate buffered saline and spread on nutrient agar plates in duplicate. The plates were incubated at 37 ℃ for 24 h in inverted positions and the average counts were recorded. Purity of cultures ensured by sub-culturing followed by staining and biochemical tests to identify the cultures (Cruickshank *et al.*, 1975).

2.4. Enumeration, isolation and characterization of Fungi in the MSW dumpsite

Similar procedure as that for bacterial enumeration were followed and the spread plate was done on potato

dextrose agar in duplicate. The plates were incubated in the room temperature for 5-7 days and average counts taken. Needle mount method was conducted to identify the fungal cultures (Haley and Callaway, 1978).

3. Results and Discussion

In the present study, the pH ranged between 7.4 – 8.52 with control 6.53- 7.4; temperature 28-31°Cwith control also in the same range. Electrical conductivity of the dumpsite was observed in the range 136.2 - 843µS cm^{-1} and that of control at 44.7 – 178.7µS cm^{-1}. The moisture capacity was recorded lower for the control soils as compared to the dumpsite soil. This could be attributed to the higher organic matter of the soils.

The culturable total bacterial count at waste dumpsites ranged between 350 x 10^4 to 295 x 10^6 and in the control samples it was recorded between 14 x 10^4 to 27 x 10^6.

Figure 1. Culture plates with control and bacterial colonies

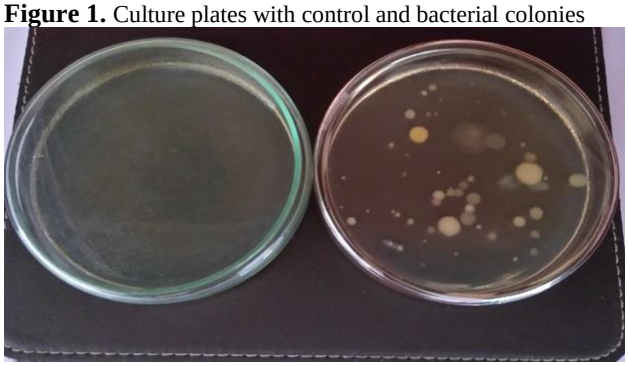
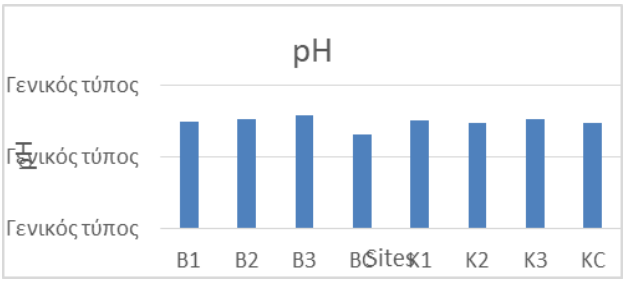
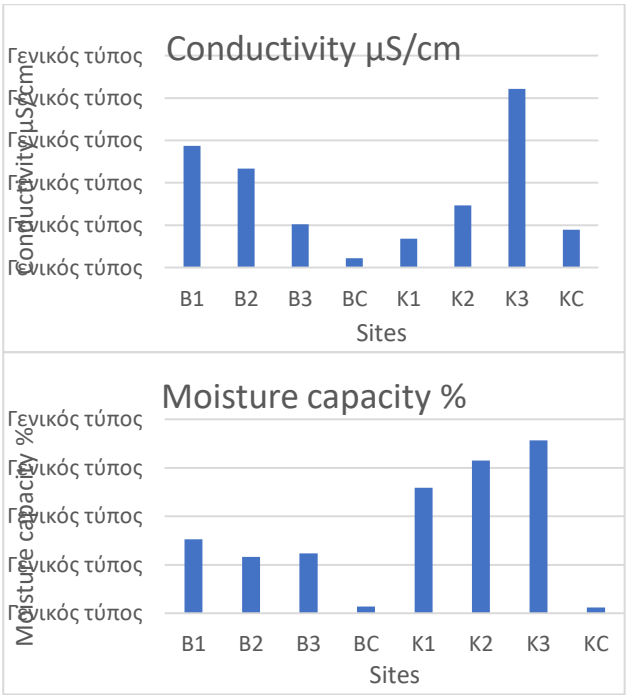


Figure 2. Graphs showing pH, conductivity and moisture level of soil samples**.**





4. Conclusion

The preliminary findings of the present work suggest that the dumpsite soils of Brahmapuram and Kalamassery have wide microbial load than the control soil samples analyzed. This includes the preliminary observations and a small fraction of the actual load present at the site. The detailed in-depth investigations are being carried out in the current analytical research work and to explore nonculturable microbial diversity.

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