CONSEQUENCES OF OPEN DUMPING OF MUNICIPAL SOLID WASTE ON SOIL BULK DENSITY, PARTICLE DENSITY AND POROSITY IN BALASORE DISTRICT OF ODISHA, INDIA

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Abstract: A major aspect of environmental pollution is soil pollution due to open dumping of municipal solid wastes. In this work, the consequence of MSW open dumping on soil physical characteristics like Bulk Density (BD), Particle Density (PD) Porosity (PO) has been studied. In all the four MSW dumping sites such as Balasore Sadar, Soro NACs, Nilagiri NACs, and Jaleswar NACs in Balasore district of Odisha state in India the bulk density has been decreased. The particle density has been increased in all dumping sites than their respective controls. The porosity in dumping site soils of all the cases has been increased than their respective controls. Increase in porosity exhibited the same trend with the particle density. Addition of organic materials in MSW and the presence of degradable and non-degradable materials which are the important constituents of MSW have altered the soil physical property.

Keywords: Bulk Density, Particle Density, Porosity, Municipal Solid Waste

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I. INTRODUCTION:

Consequent upon scientific inventions, discoveries, and technological development consumption of natural resources increased to its maximum. This resulted in the production of various kinds and huge amount of waste materials. When the solid waste materials come through the municipal councils they are designated as municipal solid waste (MSW). Increased population growth and modern lifestyle also added waste materials to MSW. In most of the countries, the MSW disposal has become a challenge for not only for environmentalists but also for planners and policymakers. Very often the MSW materials are open dumped in nearby areas of production which causes pollution in the soil. The pollutants present in the MSW not only disturbed the soil food chain and quality but also disturb the physicochemical features of the soil. In a long run, they damage the soil health and most of them percolate into groundwater (Palanivel and Sulaiman, 2014). Soon the dumping of waste management will be a serious challenge for human beings and also for the future generation. The main cause behind the problem associated with waste was the applied method which has been adopted by most of the countries i.e., open dumping of the waste for its handling. Various researchers worked on the effect on the physical properties of soil because of the dumping of MSW (Tripathi and Misra, 2012; Zhao et al., 2012; Krishna et al., 2016). Few works have been done on soil health importantly bulk density particle density and porosity of MSW dumping site soil in Odisha. The present work had done to study the effect of open dumping on soil physical properties in the MSW dumping site of Balasore district of Odisha state in India.

II. MATERIALS AND METHODS:

The soil samples were collected from the four MSW dumping sites in the district of Balasore of Odisha state in India. The control sites were selected about 1km away from each MSW dumping site. The selected study sites include MSW dumping sites of Balasore Sadar, Soro NACs, Nilagiri NACs, and Jaleswar NACs. From each study site, four random soil samples were collected from different points. The soil samples were collected up to the depth of 10cm and were brought to the laboratory for analysis of bulk density, particle density, and porosity following Brady and Well (2005).

III. RESULTS AND DISCUSSION:

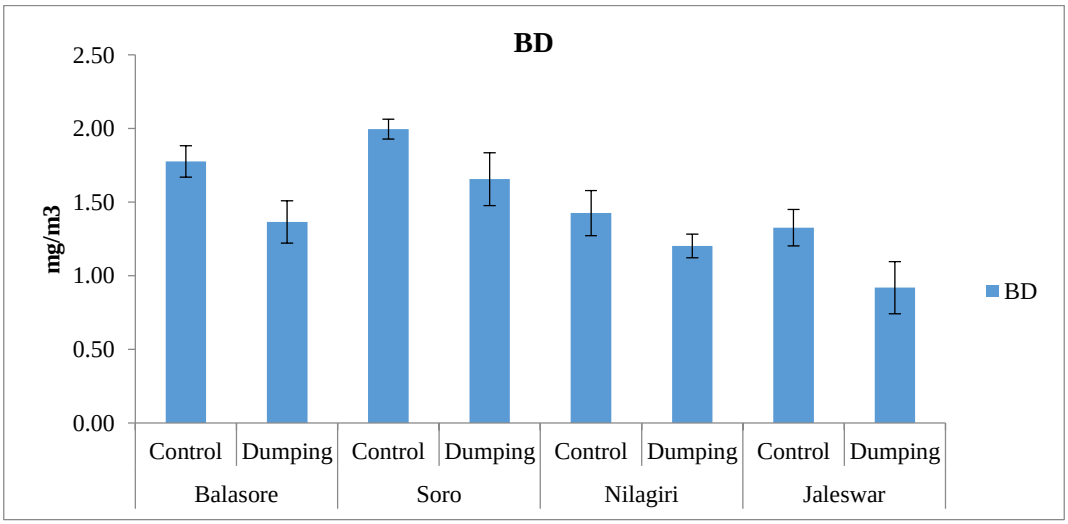

Figure:- 1: Bulk Density of the soil of Control and MSW Dumping sites soil of Balasore District

Figure-1 shows the Bulk Density (BD) of the soil of Control and MSW Dumping sites in the district of Balasore. The BD of control site of Soro NAC was highest; which was 2.00±0.07 mg/m^3; but in Jaleswar NACs control site it was the lowest i.e., 1.33±0.12 mg/m^3. In all dumping sites, the BD was less than their respective controls. In the dumping site of Soro NACs, the BD was highest (1.66±0.18 mg/m^3) in comparison to all the sites and it was lowest (0.92±0.18 mg/m^3) in Jaleswar NACs.

Pradhan and Behera (2011) reported decreased BD of soil with increase in concentration of paper mill effluent. Shiralipour et al., (1992) also reported decrease in BD of soil-applied with MSW compost with sewage sludge. Saritha et al., (2014) worked on soil characteristics administrated by the MSW. In their findings, a similar type of observation was found. The dumping site soil showed lower BD as compared to the garden soil and remained with the depth of soil. He et al., (1992) experimented on the beneficial aspect of MSW composting on soil i.e., in agricultural lands. In their findings, the BD was decreased when compost of MSW was applied in the soil. The decreased BD in the dumping site soil of the present study might be due to presence of more organic matter and increased porosity of the soil.

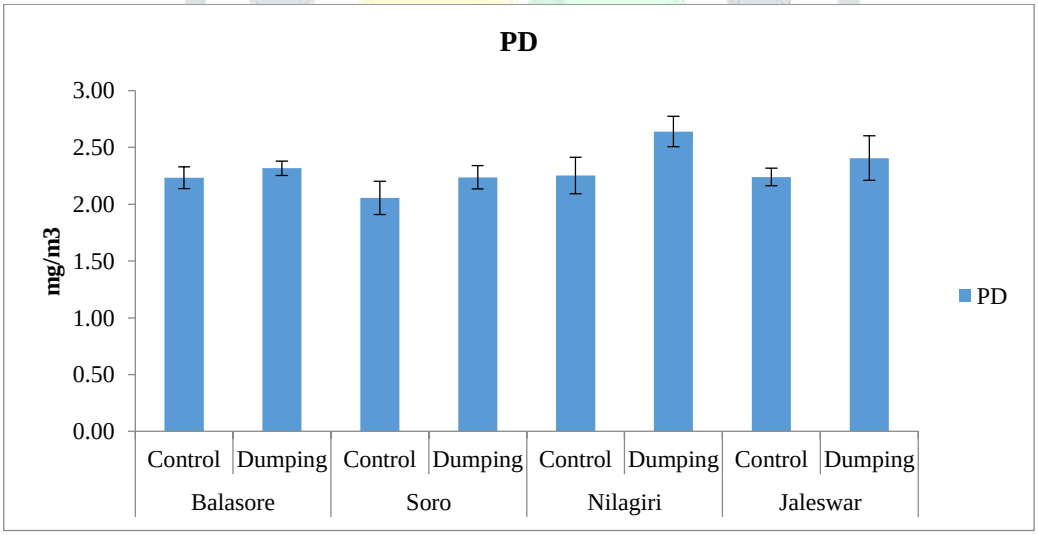

Figure:- 2: Particle Density of the soil of Control and MSW Dumping sites soil of Balasore District

Figure-2 shows the particle density (PD) of the soil of MSW dumping sites and their respective control site. In all study sites, the dumping site soil exhibited more PD than their respective control. In Nilagiri NACs the PD was highest in comparison to all dumping sites which was 2.64±0.13 mg/m^3 and in Soro NACs MSW dumping site the PD was lowest i.e., 2.24±0.10 mg/m^3. Highest PD in the MSW dumping site soil in all the cases than their respective control might be due to the addition of particles from the waste materials to the soil. Mondal et al., (2015) worked on the soil physicochemical and enzymatic test of soil contaminated by arsenic. In their findings, they found that the soil PD was decreased after the monsoon season as compared to the pre-monsoon season.

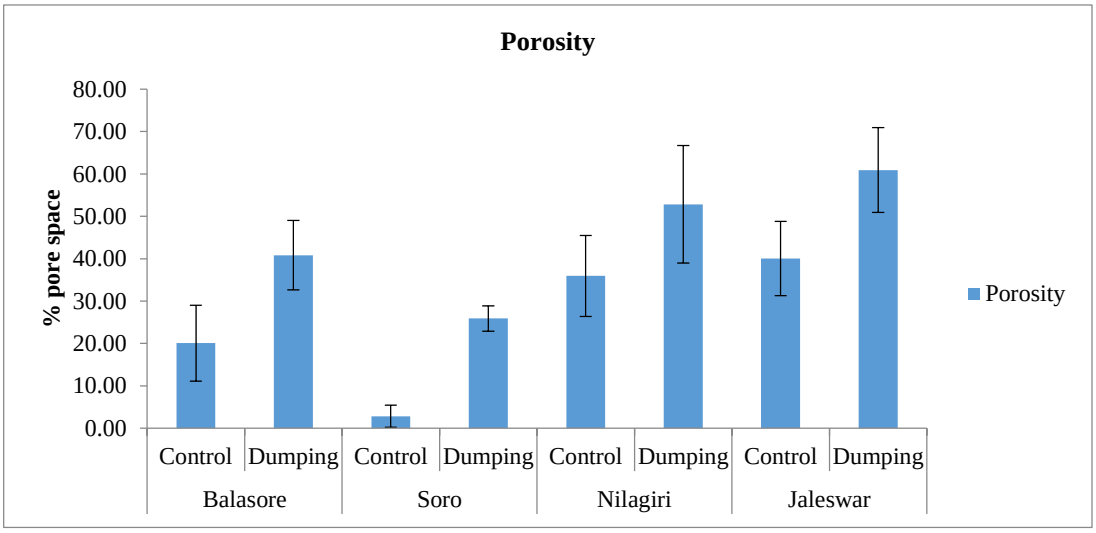

Figure:- 3: Porosity of the soil of Control and MSW Dumping sites soil of Balasore District

Figure-3 shows the porosity of the soil of MSW dumping site soils with their respective controls. Highest porosity was observed in the soil of MSW dumping site of Jaleswer NACs. It was found to be 60.92±10.0 % pore space. It was lowest in dumping site of Soro NACs i.e., 25.92±2.98 % pore space. Pradhan and Behera (2011) reported that the porosity of the soil increased with the concentration of applied paper mill effluent. The increase in porosity of MSW dumping site might be due to addition of non-decomposable waste materials to the dumping site soil whose presence might have been increased the pore space.

IV. CONCLUSION:

MSW dumping has become a challenge for present-day society. From scientific viewpoint, the soil physical structure has been altered due to dumping of municipal solid waste. Decrease in bulk density of MSW dumping sites showed the effect of MSW dumping on the soil. Presence of organic matter in the MSW has caused reduction in bulk density. Particle density has been increased in the dumping site soil which is attributed to the presence of non-degradable materials in the MSW. Increased presence of degradable and nondegradable particles in MSW has increased the porosity of the soil.

V. ACKNOWLEDGMENT:

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