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# Changes in Properties of Soil Due to Disposal of Waste

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***Abstract:-*** **Due to increase in population and industrialization, there is increase in construction activities in the cities and industrial area leaving very little locations of good soils for new projects. There are some open plots of land which are filled by liquid and solid wastes coming from municipal and industrial areas. The fill material, decayed organic soils and soils having continuous contact with sanitary fill environment loose their desired geotechnical properties. The specific gravity of polluted soil is decreased due to decay of lighter weight particles present in the soil. Organic matters have broken down to the smaller size particles of the soil and thus increasing clay size particles. This has resulted in increased plasticity of polluted soil. Liquid limit of polluted soil increases due to more number of smaller size particles present in the soil. Dry density of polluted soil is decreased due to decay of lighter weight organic matters present in the soil. Shear strength parameters of polluted soil also decreased. Angle of internal friction depends on void ratio and shape of particles, decay of organic matters and other pollutants to make the soil particles more granular. It reduces the angle of internal friction but increases the cohesion of the soil. Waste water affects the agricultural properties of the soil. Proper land filling increases the space for extra land filling. Using dynamic compaction light weight construction can be done on filled area. Taking into consideration all these factors, before starting a new civil engineering construction projects on polluted soil, study of changes in properties of soil due to disposal of waste is very essential.**

***Key words:- Maximum Dry Density, Optimum Moisture Content, Safe Bearing Capacity of Soil, C.B.R. , Plasticity Index.***

## INTRODUCTION

Due to massive increase in population and industrialization there is increased construction activities in the cities and in industrial area, leaving very little locations of good soils to construct on. Lands in the periphery of town which are open to environment are filled by liquid and solid wastes coming from municipal and industrial areas. This is happening due to limited dumping space for the pollutants or lack of proper environmental planning. Various decomposed organic materials and most of the time industrial pollutants also come into contact of surrounding soil mass due to unlined drainage systems. These wastes may find their way to shallow depth of soil and react with the same. The fill material, decayed organic soils and soils having continuous contact with sanitary fill environment loose their desired geotechnical properties. Soil in contact with pollutants becomes plastic, compressible and show comparatively lower shear strength and hence have low bearing capacity values. Organic soils due to decay of organic materials show unpredictable settlement.

## SIGNIFICANCE AND TESTING

| Sr. No. | Properties | Original soil | Polluted soil |
|---|---|---|---|
| 1 | Specific gravity | 2.57 | 2.48 |
| 2 | Liquid limit (%) | 37 | 41 |
| 3 | Plastic limit (%) | 21 | 24 |
| 4 | Plasticity index | 16 | 17 |
| 5 | Dry density (g/cm$^3$) | 1.61 | 1.55 |
| 6 | Optimum moisture content (%) | 20.7 | 22.3 |
| 7 | Dry density (g/cm3) | 0.21 | 0.24 |
| 8 | friction (degrees) | 21 | 17 |
| 9 | Soaked C.B.R. value | 3.89 | 3.19 |

To utilise effectively even the poorest type of soil for supporting the structures to be constructed over it, efforts of geotechnical engineers are directed to develop technically viable and economically feasible solutions. As already discussed in the present study soil samples for each industry were collected from two locations one from polluted area and another in the vicinity but unpolluted area. When the soil is to be used for supporting the foundation standard Proctor test and shear strength parameters are important. Similarly for classification of fine grained soil Atterberg's limit are important. When soil is to be used for supporting the road soaked C.B.R. value of soil is important. Hence, with these considerations the different geotechnical tests such as specific gravity, liquid limit, plastic limit, maximum dry density, optimum moisture content, shear strength parameters *i.e.* cohesion and angle of internal friction were determined for all six cases. For two cases *i.e.* sugar factory and Alwin chemicals in addition to this soaked C.B.R. values were determined.

The experimental results of geotechnical properties carried on affected and unaffected soil samples from sugar factory are as shown in Table 4.1

From the table 4.1, it is found that sugar factory effluent environment affect the geotechnical properties of soil. The result shows that the specific gravity of non polluted soil is found to be 2.57. The values of liquid limit and plastic limit are found to be 37% and 21% respectively. The plasticity index of this soil is 16. The values of dry density and optimum moisture content are found to be 1.61

g/cm$^3$ and 20.7% respectively. The shear strength parameters *i.e.* cohesion and angle of internal friction of non polluted soil are found to be 0.21 kg/cm$^2$ and 21$^0$ respectively.

The effect of sugar factory effluent on geotechnical properties showed the changes in properties of soil. Specific gravity of soil is slightly decreased from 2.57 to 2.48. The specific gravity is an index test and which is an indication of durability of the material. In general, materials with low specific gravity are likely to break down and change their properties with time. The heavier material composing soil, the greater is the specific gravity of the soil. Thus, it is found that due to disposal of sugar factory effluent specific gravity of soil is reduced making the soil less durable. This has taken place due to increase in lighter weight matter in the polluted soil and due to continuation of decaying procedure. Liquid limit and plasticity index increased from 37% to 41% and 16% to 24% respectively. Plastic limit and dry density of polluted soil is found to be 24% and 1.55 g/cm$^3$. Optimum moisture content is slightly increased from 20.7% to 22.3%. Cohesion of polluted soil is slightly increased from 0.21 kg/cm$^2$ to 0.24 kg/cm$^2$ and angle of internal friction is reduced from 21$^0$ to 17$^0$. The percentage increase in cohesion is found to be 12.5 whereas the angle of internal friction reduces by 19.05%. It is due to decay of organic matters in the soil. The organic matter has broken down and is converted into smaller size particles leading to more number of smaller size particles. From table 4.1, it is found that the soaked C.B.R. value of unpolluted soil sample and polluted soil sample are found to be 3.89% and 3.19% respectively Thus due to disposal of sugar factory waste, the reduction in soaked C.B.R. value is found to be 17.99%. The soaked C.B.R. value of the soil governs the design of pavement. Thus, if C.B.R. value of soil is reduced, crust thickness of pavement increases, making the pavement construction costlier than unpolluted soil samples. Thus due to disposal of sugar factory effluent, the reduction in soaked C.B.R. value of the soil governs the design of pavement. Thus, if C.B.R. value of soil is reduced, crust thickness of pavement increases, making the pavement construction costlier than unpolluted soil samples.

## CONCLUSIONS

On the basis of analysis carried out in the present work, following conclusions are drawn. The study indicates that there is decrease in specific gravity of the soils at all the polluted sites due to decay of lighter weight particles present in the soil. The presence of organic matter makes the soil less durable. Liquid limit of all the polluted soils at different sites have increased due to significance of organic matters present in the soil. The changes in liquid limit and plastic limit has lead to increase in plasticity index of soils at different polluted sites due to break down of organic matters present in the soil from slit size particles to smaller sizes which makes soil more cohesive and plastic. Plasticity index of the polluted sites are increased due to increase in liquid limit and plastic limits of the soi1. Distillery and animal waste polluted soils have more range of plasticity index than other soils.

## FUTURE SCOPE

In the present study laboratory investigations have been carried out to see the changes in geotechnical and agricultural properties of soil due to disposal of wastes. Based on this bearing capacity is determined and in all cases it is reduced as soil becomes more plastic and angle of internal friction reduced. The future scope of work may be considered as field testing of soil by standard penetration test and plate load test. The field tests conducted will focus on settlement of the proposed footings and which also governs the design.

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