

ANALYSIS OF CONTAMINATED SOIL AND MEASURES IMPLEMENTED TO INCREASE ITS STRENGTH

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Abstract- Soil contamination or soil pollution is caused by the presence of xenobiotic chemicals or other alteration in the natural soil environment. It is typically caused by industrial activity, agricultural chemicals, or improper disposal of waste. Many industries dump their waste in their nearby surroundings. This action makes the soil sick by decreasing its fertility, and contaminates the ground water table of the region. Studies have revealed that contamination in soil leads to strength reduction and fertility. Due to this reason there is a high risk in taking up construction of buildings in and around the region. Bioremediation is emerging as a promising technology for the treatment of soil and groundwater contamination. This paper focuses on the treatment techniques of contaminated soil in Pondicherry region. The properties of the contaminated soil are determined and tested for the type of impurities present. Based on the behaviour of the soil the suitable remedial treatment is carried out in order to increase the fertility, strength and stability of the soil turning it out to be a suitable soil for either construction or cultivation. The Unconfined compression strength of un-contaminated clay was found to be 20 to 37 kPa. The paper also gives the

treatment efficiency factor by comparing the aspects of contaminated soil with the clay available in agricultural field, which is assumed to 100 % fertile.

Key Words: Contaminated soil, unconfined compressive strength, fertility.

INTRODUCTION

Waste disposal didn't always mean land pollution. Before the 20th century, most of the materials people used were completely natural so, when they were disposed of, the waste products they generated were natural and harmless too: mostly organic materials that would simply biodegrade there was really nothing we could put into the Earth that was more harmful than anything we'd taken from it in the first place. But during the 20th century, the development of plastics, composites, and other man made materials has produced a new generation of unnatural materials that the natural environment has no idea how to break down.

Feeding the world on a large scale is possible only because agriculture now works in an industrial way, with giant machines such as tractors and combine harvesters doing the work that hundreds of people would have done in the past, and chemicals such as fertilizers and

pesticides increasing the amount of food that can be grown on each piece of land. Unfortunately, most pesticides are by definition poisons, and many remain in the soil or accumulate there for years. This accumulation of the poison in the soil will lead to the strength reduction, fertility and stability decreases.

The surface and subsurface environment are adversely affected by industrial, municipal and day to day activities. The waste management techniques such as open dump is being adopted in outskirts and even in dwelling regions. These management practices are characterised by poor landfilling practices and open dumps in low lying areas. Also these dumps lack in the provision of production barrier and safety installations for waste dumping. This act of dumping contaminate the soil by infiltration of contaminated surface water, discharge of industrial waste into the soil and particularly seepage of leachate from the landfills or open dumps. The contamination adversely affects the engineering property of soil which lead to several problems like loss of strength, differential settlement and cracks in the existing structure. If expansive soil is present near these dump yards or landfill, the contamination increases the difficulty in construction. This paper deals with the contaminated soil collected below the open dump near \Kalapet region of Pondicherry state. The soil seem to be highly contaminated due to the dumping of medical and chemical waste

The biggest problem comes when contaminated land is returned to use, either as building or agricultural land. Houses might be built on brownfield (former industrial) sites that haven't been cleaned up properly, putting future owners and their families at risk. As bioremediation being

the emerging promising technology for the treatment of contaminated soil includes the land farming and bio stimulation. The one possible ways to overcome the contaminated soil is to treat them with suitable remedies and turn it out to be suitable soil for cultivation and construction of structures on it.

Around the world, Russia, china and India contain the most areas where toxic pollution and human habitation collide with devastating effects. Vapi, in India is a town in the western parts of Gujarat, houses are dumped remnant waste including petrochemicals, pesticides, pharmaceuticals and also other chemicals.

The remedial treatment should be carried out on the contaminated soil taken from the Pondicherry region. Determining the types of toxins and impurities present in the soil the necessary and suitable remedial action is done and it's compared with the agricultural soil and the measures are taken to improve the strengths of the contaminated soil.

2. MATERIALS USED:

2.1 LOCALLY AVAILABLE SOIL: The agricultural soil sample is taken from a nearby cultivable land of Madagadipet region. The physical and geotechnical properties of the soil is determined as per Indian Standards. The test results are shown in the table 2.1.

TABLE 2.1: Properties of agricultural soil

Sl.no	Soil properties	values
1.	Specific gravity	2.67
2.	Swell index	50%
3.	Liquid limit	61%
4.	Plastic limit	12.78

5.	Soil classification	CH
6.	Standard penetration number	12
7.	Total solids	935 mg/l
8.	pH value	8.1

2.2 CONTAMINATED SOIL SAMPLE:

This soil sample which is contaminated by dumping of medical waste is obtained from a kalapet region of Pondicherry state. The physical and geotechnical properties of the contaminated soil is determined as per Indian Standards. The test results are shown in the table 2.2.

TABLE 2.2: Properties of contaminated soil:

Sl.no	Soil properties	values
1.	Specific gravity	3.33
2.	Swell index	10%
3.	Liquid limit	42.15%
4.	Plastic limit	10.15%
5.	Total solids	786mg/l@27deg Celsius
6.	pH value	9.87

3. TEST PROCEDURE:

3.1 TESTING OF SAMPLES:

The soil collected from the agricultural land is subjected to various tests in order to determine the geotechnical properties of the soil. The test are conducted onto the contaminated soil as well which helps in determining the type and amount of impurities present in it. . On obtaining the results of the agricultural and contaminated soil, it would be

useful for comparison among the two samples to proceed with the necessary measures.

4. RESULTS AND DISCUSSION:

In order to study the effect of contamination on the strength UCS test was conducted on the locally available and contaminated soil. The figure 4.1 shows the stress strain curve of the locally available soil. It can be found that the stress value increases with the strain. The maximum stress of the soil was found to be 150 kpa.

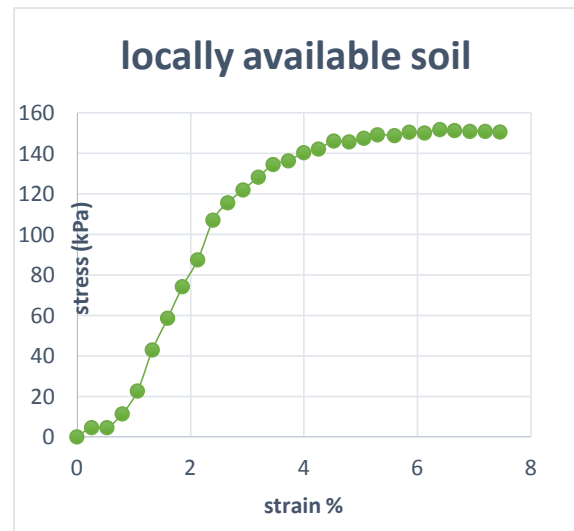


Fig 4.1 Stress strain curve of the locally available soil

The stress strain curve of the contaminated soil is shown in figure 4.2. The maximum stress at failure of the soil was found to be 25.68 kpa.

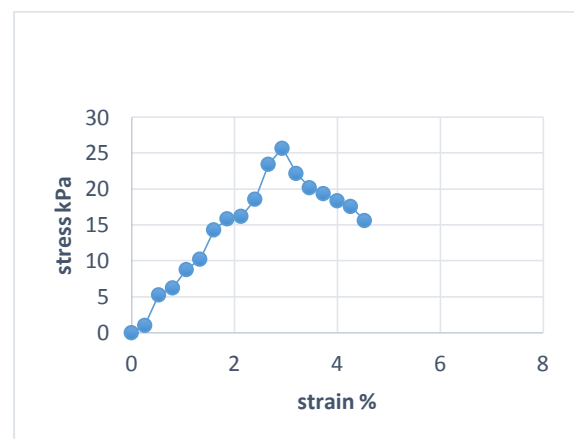
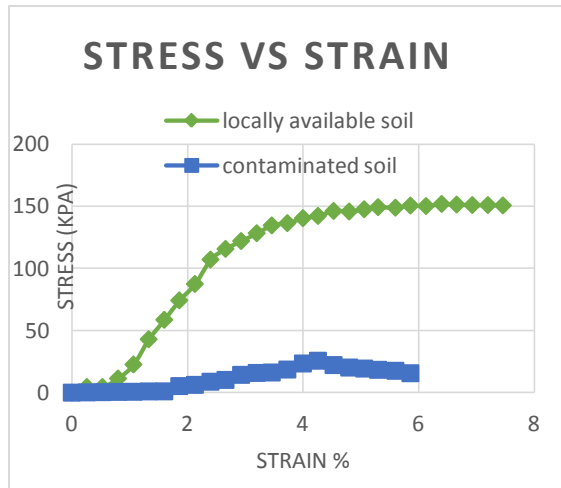


Fig 4.2 Stress strain curve of the contaminated soil

Thus it could be found that there is a strength decrease of 82.88 % for the contaminated soil. Also the strain value at failure of the contaminated soil is less compared to that of locally available soil. The figure 4.3 shows the comparison of the stress strain pattern of the two soils.



CONCLUSION:

The UCS of the contaminated soil is decreased by 82.88% compared to the locally available soil. The specific gravity of the contaminated soil is greater than the locally available soil due to the presence of heavy metals. The pH value of the contaminated soil is also greater than the locally available soil. Thus the contaminated soil shows invariable properties with respect to the properties of the locally available soil. Thus proper bioremediation techniques is necessary for this contaminated soil to be reused.

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