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IMPORTANCE OF SOIL WASTE INTERACTION

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ABSTRACT

Soil-Waste Interaction can affect almost all the properties of soil. Though the effects of pollutants on soil are complex, they may be better understood if the various factors are isolated and considered independently. The effects may be different for different types of soils. Therefore, soil testing is an integral part of analysis and design in soil engineering. A proper evaluation of soil sample and determination of engineering properties under simulated field conditions are an essential component in practice of geotechnical engineering. This paper reveals that accidental spillage or leakage of highly aggressive industrial effluents has detrimental effects on the properties of soil and hence prove that geotechnical engineering is backbone of civil engineering. The soil properties are influenced by presence of impurities such as toxic waste, hydrocarbons and interaction with them over a period of time.

Sub Area: Geotechnology
Broad Area: Civil Engineering
Keywords: 1.Impurities 2.Contamination 3.Toxic waste 4.Subsoil 5.Interaction 6. Soil 7.Geotechnical

INTRODUCTION

One of the legacies of the past in industrialized countries is that land has been contaminated due to mining, industry and society disposing off waste with little regard for future consequences. This paper reveals that accidental spillage or leakage of highly aggressive industrial effluents has detrimental effects on the properties of soil. The addition of these effluents into the sub-soil directly affects the use and stability of the supported structure. Recently, it was realized that a number of industrial buildings have undergone foundation failure due to the contamination of the subsoil by one or more contaminants.

IMPACT

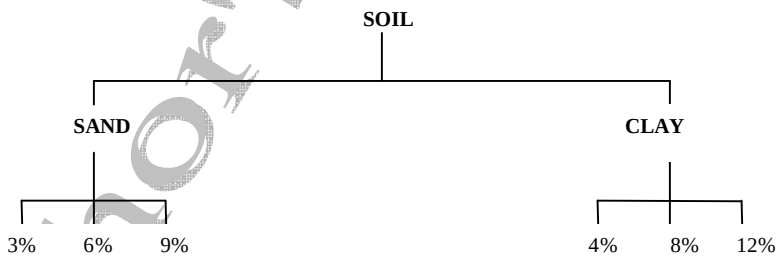
The detrimental effects of leakages of oil, toxic wastes on properties of soil have received attention but less than it deserves. Results of some studies indicate that the detrimental effect of

seepage of acids and bases into subsoil can cause foundation failures. For the purpose of this study, Petrol was selected as the pollutant and its effect on engineering properties of locally available sand and clay was studied. Petrol was primarily selected due to its multifaceted usage and its handling by various users. Petrol consumption of a country is often looked upon as the economic barometer of a country, higher the petrol consumption, greater is the economic prosperity. Crude petroleum is a complex mixture of hydrocarbons that are separated into fractions by different boiling ranges by the refining process. The various fractions either are used directly as such or are modified chemically to yield more energy efficient source. Petrol usage involves its transportation, storage and distribution through a network of pipelines. This leads to leakage of oil into subsoil and over a period of time resulting in modification of its engineering properties. Petrol is volatile and it is expected that petrol leaking from any kind of container viz storage tanks, pipeline transport tankers etc will partially seep into the soil and partially evaporate. Further, the two soils selected for the purpose were sand and clay because of their easy availability and their unique characteristics. Like in this case, the rate of permeation of petrol through sand will be faster than its passage through clay; which will be time consuming. Therefore, both these soils were selected for study along with petrol as a contaminant.

200kg of locally available Ghaggar river sand and clay from Morni Hills respectively were obtained and air dried. They were hand sorted to remove any pebbles and vegetative matter. The soil was then sieved through 4.75mm sieve to remove any gravel fraction. The soil was then oven dried for 24hours before mixing with the pollutant.
Petrol was obtained locally from petrol pumps.

CALCULATION

Literature study indicated that no fixed guidelines are available for deciding the quatity of pollutant to be mixed with the soil to enable study of effect on its engineering properties. Various research scholars have used different percentages of pollutant to conduct various tests. The quantity has been varied from 2%-12%. During conduct of tests on unpolluted soil sample, OMC was working out to 8%-12%. It was then decided to vary the quatity of pollutant from 3% to 12%. But during compaction of sand sample polluted with 12% petrol, a large amount of petrol was seen to be leaching out of the mould. Therefore, the maximum quantity of petrol to be added to the sand was restricted to 9%. The final addition of petrol to the soil samples was done as under:



By knowing the density of petrol, volume of petrol required was worked out on the basis of weight of soil sample.

The oven dried soil samples were hand-mixed with the known quantity of pollutant varying from 3%-12%. The soil-pollutant mixtures were mixed thoroughly into a soft, easily remouldable state and transferred to air-tight polythene bags to cure for 6-7 days before testing.

TESTS

The following tests were conducted on the uncontaminated soils:

- Moisture Content Determination
- Free Swell Test
- Grain Size Analysis-Sedimentation Analysis
- Atterberg's Limits
- Specific Gravity Test
- Permeability Test
- Compaction Test
- Unconfined Compression Strength Test(UCS)
- Direct Shear Test
- California Bearing Ratio Test(CBR)

Once the complete set of tests was conducted on the uncontaminated samples of soil, for comparison, the following tests were conducted on polluted soil samples:

- Free Swell Test
- Atterberg's Limits
- Specific Gravity Test
- Permeability Test
- Compaction Test
- Unconfined Compression Strength Test(UCS)
- Direct Shear Test
- California Bearing Ratio Test(CBR).

CONCLUSION

Accidental spillage or leakage of highly aggressive industrial effluents has detrimental effects on the properties of soil and hence prove that geotechnical engineering is backbone of civil engineering. The soil properties are influenced by presence of impurities such as toxic waste, hydrocarbons and interaction with them over a period of time. Also find During compaction of sand sample polluted with 12% petrol, a large amount of petrol was seen to be leaching out of the mould. Therefore, the maximum quantity of petrol to be added to the sand was restricted to 9%.

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