

EFFECTS OF INDUSTRIAL EFFLUENTS ON BEHAVIOR OF SOIL

Submitted in partial fulfilment of the requirements for the award of
Bachelor of Engineering degree in Civil Engineering by

CH.PRUDHVI SURAJ (37200014)

S.DINAKAR TEJA (37200066)



**DEPARTMENT OF CIVIL ENGINEERING
SCHOOL OF BUILDING AND ENVIRONMENT**

**SATHYABAMA
INSTITUTE OF SCIENCE AND TECHNOLOGY
(DEEMED TO BE UNIVERSITY)**

**Accredited with Grade "A" by NAAC
JEPPIAAR NAGAR, RAJIV GANDHI SALAI, CHENNAI - 600119
APRIL 2021**



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Accredited with Grade “A” by NAAC
Jeppiaar Nagar, Rajiv Gandhi Salai, Chennai - 600 119

www.sathyabama.ac.in



DEPARTMENT OF CIVIL ENGINEERING

BONAFIDE CERTIFICATE

This is to certify that this Project Report is the bonafide work of **CH,PRUDHVI SURAJ**
(Reg.No.37200014) and S.DINAKAR TEJA (Reg.No.37200066) who
carried out the project entitled “**EFFECTS OF INDUSTRIAL EFFLUENTS ON**
BEHAVIOR OF SOIL” under my supervision from October 2020 to April 2021.

Internal Guide

(Dr.S.NANDHAKUMAR)

Head of the Department

Submitted for Viva voce Examination held on _____

Internal Examiner

External Examiner

DECLARATION

We, CH.PRUDHVI SURAJ (Reg.No.37200014) and S.DINAKAR TEJA (Reg.No.37200066) hereby declare that the Project Report entitled “EFFECTS OF INDUSTRIAL EFFLUENTS ON BEHAVIOR OF SOIL” done by us under the guidance of **Dr.S.Nandhakumar**, M.Sc., Ph.D., at Sathyabama Institute of Science And Technology, Chennai is submitted in partial fulfilment of the requirements for the award of Bachelor of Engineering degree in Civil Engineering.

1.

2.

DATE:

PLACE:

SIGNATURE OF THE CANDIDATE

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CHAPTER 1

INTRODUCTION

1.1 GENERAL

INDUSTRIAL WASTE WATER, Substances, especially from the chemical and pharmaceutical industries, are present in substances that must be processed before being discharged into biological treatment plants and subsequent water bodies. In selected wastewater sources, this is usually accomplished at the edge of the manufacturing site itself, before reaching a central facility. Every strategy has its own set of advantages and disadvantages. Furthermore, various waste water treatment methods exist, but it is always difficult to select the most straightforward, technologically and commercially viable choice.

Rising industrialization resulted in soil pollution as a result of economic units' effluent discharge. Every soil has its own distinct personality. Since the profile consists of a series of different layers among waste water percolation discharged into the soil, the pollutants are washed away to the horizons. Several hazardous chemical compounds, mineral acids, bases, and other effluents discharged from economic units on the shore collect on soil over time due to retention and adsorption.

Mineral constituents present in trace amounts in waste effluent promote the growth of algal, fungal, and bacterial colonies, which alter the soil's texture over time. The soil porosity is reduced by the micronutrients, resulting in low yields. Effluent discharge Plants/plants growing in such contaminated soils have the ability to damage a number of chemical deposits. With a high concentration of biodegradable organic matter discharged into the ground, organic effluent attracts saprophytic soil and air microflora, which may proliferate and contribute to low outputs or fungal diseases. As a result, we must manage soils used for irrigation and planting in which waste water is applied. As a result, the Board keeps track of a sample of soil from fields that have been contaminated by various pollutants.

Solid waste disposal arrangements for large and medium industries in developed (conforming) industrial areas are still in the works. Small businesses, on the other hand, continue to struggle with this problem. Small factories can easily create waste in many towns and cities, making it difficult, if not impossible, for local governments to collect this waste. In certain cities, industrial, residential, and business areas are merged, resulting in the mixing of all waste. As a result, it is critical to calculate the appropriate strategy for the proper collection and disposal of commercial solid waste in local governments in collaboration with the State Pollution Control Panel (SPCb). Waste, paper, glass bottles, polythene containers, and waste metals are examples. Commercial waste includes waste from supermarkets, markets, hotels, offices, and other

organizations. Paper, packing material, cans, bottles, polythene containers, and so on. Building waste is a term that refers to waste from the construction industry. For instance, wood, bet, debris, and so on. Biomedical waste includes the majority of organic waste.

Water is one of the world's most valuable commodities. Water is essential for life to exist. What, on the other hand, is the worth of water? Water is a versatile resource with a variety of characteristics. All of these water characteristics can be found in the table below.

Water can be a strong solvent – it's a dissolving power for many materials.

The boiling point and the water sludge make three states easy to use (solid, liquid, and gaseous).

The temperature of the water is very high. This helps water to absorb and slowly release heat, allowing the temperature to be changed.

The light will flourish in the modes of life that are immersed in them because of their transparency. This is also essential for the life of flowers in seas, lakes, and rivers.

Water is neither acidic nor basic in nature. It's a neutral substance with a pH of seven.

If it weren't for the high heat of water, the Earth's surface temperature would be much lower. It can make life difficult at any time. The heat from the sun is retained by the water in the world's oceans, which helps to keep the temperature stable at night. Water is essential for irrigating crops and is thus a part of farming. It is widely used in cooking since it boils at 100 degrees Celsius. Humans use water for some household activities such as washing and purifying. Water can also be used to carry cargo. Ships move many goods from continents around the world.

Our water supplies are literally drained because we are unusable leaks. Since water bodies make up the majority of the earth's surface, keep in mind that we dump waste into them. We pollute the water that we could use in fact. However, this does not reflect the full scope of wastewater's environmental impact.

Normally, wastewater is treated and recycled for irrigation. The water treatment processes aren't absolutely reliable, as though they weren't bad enough already. Chemicals that are toxic to crops may be damaged by the soil during proper waste water treatment. These chemicals would result in fewer and slower-growing crops in the soil. Consider how these crops will be consumed in the future, as this will have an effect on humans.

CHAPTER 2

LITERATURE SURVEY

2.1 LITERATURE REVIEW

Singh.K.K &Mishra L. C. Laboratory tests were conducted in 2000 to guide the impacts on the healthy physico-chemical properties of fertiliser's soil and germination effluent, growth, chemical effect pigments, and the dry count range of maize (*Zea mays* L.) and rice (*Oryza sativa* L.) output on various levels (2,5, 5, 10, 25 and 50 percent).

It had a rather high alkaline material, as well as a lot of suspended and dissolved solids like N^+ , Ca^{2+} , Na^+ , Cl , CO_3^{2-} , HCO_3^- , and others. It cost a lot of money because of its organic structure. The soil was significantly improved for effluent concentrations of 100 percent or more in water soluble salts, electrical conductivity, ion exchange efficiency, pH, N, Ca, Na, and Cl throughout the treatment of soil effluents. At lower levels of 2.5 and 5, the effluent has increased maize and rice growth and production. Higher effluent concentrations (10 percent and above) have stifled germination and caused negative effects on growth, yield, and chemical action pigments of dry matter (quantitative and qualitative), so each of them inspects the plants.

KiskuG. C. , BarmanS. C. & BhargavaS. K. has aforementioned that in the year 2004, For effluent contaminating agriculture, mobilization, and applied mathematics activities, the most likely hepatotoxic parts in soils and plants of fields irrigated with mixed industrial effluent have been examined. Cumulative Fe,Mn,Zn,Cu,Pb,nickel, and metal element levels were measured in polluted and non-polluted soil and plant species. The study includes 18 plant species and 18 root-adjacent samples from a contaminated Kalipur area, as well as 11 plant species and 11 root-adjacent Madhabpur soil specimens containing major crops, vegetables, and weeds. *Hibiscus esculentus*, tomato, and singkwa have been found to have a mobilizing magnitude ratio of 0.5 in effluent polluted areas and to have healthy broad morphology at the primary flora level. Coriander, *Raphanus sativus*, eggplant, *Spinaceaoleracea*, liliopsid genus *sativus*, *Brassica oleracea*, but they all retained the usual mobilization connection of >0.5 . Funded mobilization ratio Plants like *H. esculentus*, *L. acutangula*, and *L. esculentum*, as well as external morphologies, appear to be cultivated in industrial efflower irrigation lands. Cd and metal have been discovered to be the best and second-

largest enrichment problems (EFpp). Metal level in soil is not the most important metal uptake problem, according to Pearson's constant correlation. This research would make it easier to choose plant species to thrive in polluted areas.

Hadis Bibak, Jahangir Khazaei, and Hossein Moayedi claimed that the use of waste materials in industry to protect the environment and save the economy has always been important for humanity. We have a propensity and try to assess the possibility of replacing conventional additives in sentimental clay (lime) soil with waste from the water softening process in order to stabilize and reinforce soft clay soils in this study. Water glass was also looked at as a supporting agent for soil stabilization reactions. The performing arts obtained the optimal proportion of lime from the corresponding samples, and then entirely different waste- and water-glass shares were placed alongside this optimal lime percentage to understand its single result. Compacting, unconfined compression strength, and consolidation testing of the specimens have been completed, and it has been determined that the only safe soil preparation will be achieved once toxic waste and 1,5 percent water glass are available. The specimens were then scanned for maltreatment and diffraction, in order to find out what was causing the changes in the findings. Changes in hydrogen ion concentration have also been investigated.

Jasbir Saini, D. K. Soni & A. K. Mandal biological process Intelligence (2019) Previously, the primary technique of road construction was to stabilize the underlying soil. The primary aim of this research paper is to evaluate the cost of industrial or agricultural waste as a result of soil admixture with the goal of improving land properties. The behavior section of alkaline soils integrated on industrial waste materials such as solfa Syllable, TD, and agricultural waste RHA (PM) was clarified in this article, with the goal of growing the potential for bearing alkaline soils in particular. The study's aim is to identify and compare a number of specific combined soil properties, such as OMC, MDD, UCS, and CBR results, on each agricultural and industrial waste. The results show that after seven days of solidification, all stabilizers, including solfa syllables, TD, RHA, and PM, reach their peak strength.

Balaji Seshadri, Anitha Kunhikrishnan, Nanti Bolan, and Naidu, Environmental science and contaminant research, 2014, evaluated the impact of alkaline industrial by-products like flyash (FA) and redmud (RM) on phosphorous mobilization in rusty soils with irrigated waste products, incubation mistreatment, natural processes, and plant growth (napier grass [Pennisetu grass]). The soils outside the waste irrigated space were collected together and treated with inorganic (KH_2PO_4 [PP]) and organic (Pultry Manure (PM)) P

treatments, respectively, to determine the outcome of the solfa syllable and RM in P-mobilization plant growing experiment.

Among the amendments, the most important increase in Olsen P, acid content, and enzyme activity was seen. The very best increase in Olsen P for the non-irrigated soil treated with PM demonstrated greater solfa-silk and RM capability than inorganic P in mobilizing organic P. (PP). Plant growth soils had an increase in acid content of over 85 percent when compared to incubated soil, indicating the product of the acid-exuding mathematical grass. For the highest of the 5-week cycle, each amendment (FA and RM) saw increases in enzyme activity of more than ninety percent. The natural process experiment indicated a decrease in water-soluble P, supporting the solfa syllable's and RM's function in reducing P loss in water bodies. In both phases, the syllables of solfa and RM showed an improvement in plant biomass.

M. Parween, AL. Ramanathan & N. J. Raju ,International Journal of ecology and Technology (2017) This study also aims to determine the water quality of the Yamuna Stream in Delhi, one of the world's most polluted and densely populated megacities. Conduction, salinity, and atomic number 11 were among the contents contained in the permissible classes. The chloride concentration was above the safe drinking limit. Water quality was poor in the least polluted areas, especially in the lower part of town, due to significant metal contamination. High metal levels were several times above the allowable limits of drinkable at a step up from BIS pointers for metals number 13, copper, chromium, cadmium, iron, lead, metallic element, and nickel, reaching 29, 4.9, 10, 31, 27, 83, 7.3, and twenty-seven times higher.

The Shahdara district, as well as Najafgarh, drains major destinations. High organic masses and eutrophication traces, as well as significant nitrate and total phosphate amounts, all contributed to the potential for low oxidation-reduction. It's possible that high-metal-concentration discharges from agriculture, waste, and power plants would be needed. To prevent metal contamination in the stream, major measures must be taken, in addition to the implementation of laws on the safety of Brobdingnagian populations in megacities such as towns. The city is working hard to make significant changes in terms of waste water collection from specific sources. Treatment of all waste generated up to a tertiary level is needed to minimize dissolved solids, especially toxic metals, and to make effective use of farming. Treatment plants need to be well maintained, have constant fuel, and be monitored on a regular basis. To establish the constructive and safe use of waste, there should be a variety of live projects and services.

N. Mahjouri p.H.D. & A. Moridi ,International Journal of ecology & Technology (2006) Similarly, rapid industrial growth in the Khuzestan province of western Asia resulted in the daily disposal of about 1750 tons of waste. Although acknowledging environmental concerns, the majority of these industrial solid wastes and hazardous waste sites have been decommissioned. This has had a huge effect on emission levels in the atmosphere. This paper serves as a foundation for forming an opinion on the management of industrial solid waste.

The estimation of the prevailing emission mass of solid waste and the efficient approach used by the area management systems unit often have very different requirements. A multi-criterion decisioning technique, in particular, the Analytical Hierarchy Process (AHP), and the share of each unit in a total solid wastes load, is used to rank economic units in order to promote their share of solid waste-related environmental emissions. In the Islamic Republic of Iran, for industrial solid waste management in the province of Khuzestan, a complete set of area units designed to manage solid waste pollution are introduced, directly, indirectly, and funded, and a data base and primarily based GIS maps for studies are further developed. According to the findings, factories located near Ahwaz, the province's capital, generate 30% of the province's total solid waste pollution load. The technique has also shown that square measurement is widely used to produce and manage solid economic waste.

HeidarzadehN. & Gitipour.S. ,International Journal of ecology and Technology (2019) He calculated the contamination potential of waste from oil treatment plants using squares, and geotechnical characteristics were investigated during this analysis. A customary sampling arrangement was in place to collect 11 samples. A waste sample had to be prepared in six samples, according to applied mathematical research. As a result, a mixed sample was ready to determine its wet content, pH, Atterberg limit, and waste density. In the analysis of organic compounds and essential metals, total fossil fuel hydrocarbons (TFH) and metallic elements as a result of the most pollutant have been discovered. The results also revealed that waste, like fine-grained soil, is highly contaminated with fossil oil hydrocarbons.

The mean TPH concentration for diesel variables, organic oil varieties, and TPH was 216 g/kg, which was 832, 108, and 433 times the required cleanup number. Significant metal levels are calculated squarely for industrial space, but clean-up levels are predicted. The pH, liquid limits, plastic limit, plastic index, and density were among the twelve wet contents of the mixed sample. 9.6, 25.91, 15.83, 10.08, and 1.22 g/cm³ make up the 26 percent. Following that, multiple rectification methods were evaluated in order to identify the only one that endorsed the physical and chemical properties of waste, as well as the value of the action plan and implementation costs. Finally, we suggested that the situation be cleaned up by consolidating/stabilizing the technique of

organophilic clay victims using stabilizers, combustion, and bioremediation techniques.

Karkush M. O. & Abdulkareem M. S. ,International Journal of ecology and Technology (2019) In this study, he predicted the effects of residual oil on the geotechnical properties of the measurements on the clay's terrestrial square. The investigation also includes victimization piles of soil contaminated samples for rectification and analyses of soil samples' geotechnical properties. The lime piles square technique entails thinking of the techniques that are used to thoroughly rectify and improve the soil. Residual oil is also a by-product of the fuel used in the thermal power plant. The soil square clay samples are unnaturally contaminated with two types of pollutants: one contains 49 residue oil, 20 first residue oil, and half-hour water, and thus 70th residue oil and half-hour fuel; the other contains 49 residue oil, 20 first residue oil, and half-hour water, and thus 70th residue oil and half-hour fuel. This is achieved by using square soil samples.

The soil sample square is saturated with thirty-day contamination to ensure that the contaminant has penetrated deep into the soil samples and that the chemical response to clear soil samples is nearly complete. Lime Piles are square measurements prepared by mixing lime and dry-solar mass on August 15, 1945, and dumped in 20 mm diameter and 500 mm long holes wherever the rectification process takes 30 days. The results of the tests showed that lime stack technology has a major impact on the chemistry and engineering properties of polluted soil samples, with recovery in untrained shear strength ranging from 26 to 34 percent and dynamic reaction modules from 25 to 34 percent, but effects on soil softness ranging from 3 to 5 percent.

According to Wenjun dynasty & Xiaoliang Guo, Environmental science and pollution analysis (2020), it is possible to use a totally unique solidifying agent, which is created by mixing cement with fly ash and desulfurizing minerals, to stabilize and consolidate Nickel-Copper contaminated soil (CFG). In accordance with unconfined compressive strength (UCS) inspection, porosity, and scanning electronmicroscope (SEM), sample characteristics, covering UCS, deformation, and porosity, square measurement was investigated under a completely different solidification time, particle concentration, and solidification agent content in line with unconfined compressive strength (UCS) examination, porosity, and scanning electronmicroscope (SEM), sample characteristics, covering UCS, deformation, and porosity. It is possible to quantify the relationship between UCS and sample porosity. The findings show that increasing age of solidification induces a gradual increase in UCS and impermeability of the sample square measurement; however, the failure strain weakens steadily, however the trend is

reversed with increasing significant concentrations of metals. Larger CFG volumes are also used in mechanical and impermeability characteristics.

The relationship between the UCS and the porosity constant indicates that the UCS of contaminating soil is significantly inversely related to the constant porosity, and thus to the extreme estimate of formulas for porosity age and CFG material. Furthermore, microscopic analysis reveals that the association product Ca salte hydrate (C-S-H) and etringite (AFt) of the Solid Factory Square are the primary reason for increasing UCS and impermeability of contaminated soil .The increased concentration of nickel and copper, on the other hand, causes a decrease in combination product and, as a result, coagulated soil compactness, which weakens the contaminated soil's compressive strength and impermeability.

CHAPTER 3

AIM AND SCOPE

3.1 AIM

AND

SCOPE:

The main aim of the project is to check whether the strength of the region where an industry has disposed the waste effluents, has been effected or not

3.2 OBJECTIVE

*To carry out some tests-

water tests-*water pH test

*water turbidity test

*total solids

Soil test-*soil pH test

*specific gravity of the soil

* atterberg limits-plastic limit
liquid limit

*compaction test on soil

*free

swell

index.

CHAPTER 4

MATERIALS AND METHODS

4.1 STUDY AREA

"Kakinada (formerly known as Coringa, Cocanada) concerning this soundlisten is that the sixth largest town of the Indian state of province and is that the district headquarters of the East Godavari district."

Kakinada Port is situated on the Bengal Bay coast". it's one among the intermediate ports within the state." The four National Waterway links Kakinada to Puducherry and was proclaimed in 2008 by the Asian National Authority for Lading Transport and Tourism as a National Waterway.

NFCL(NAGARJUNA FERTILIZERS COMPANY LIMITED) One of India's largest urea complexes is spread over 1130 acres. It is strategically located in Kakinada, an eastern Indian seaport in the province of Andhra Pradesh. The business is close to raw materials and has a ready market for them. The gas-fired plants have one of the lowest rock energy rates in the world. After de-bottlenecking, the plan's operational capacity grew once a year from 1,4 million tons to about 1,5 million tons, enabling the project to be upgraded to a more ambitious future. Additional gas from the massive gas supplies is planned to be used in the expansion of the gas supply in the nearby Krishna-Godavari basin.



FIG4.1.0:NFCL
KAKINADA

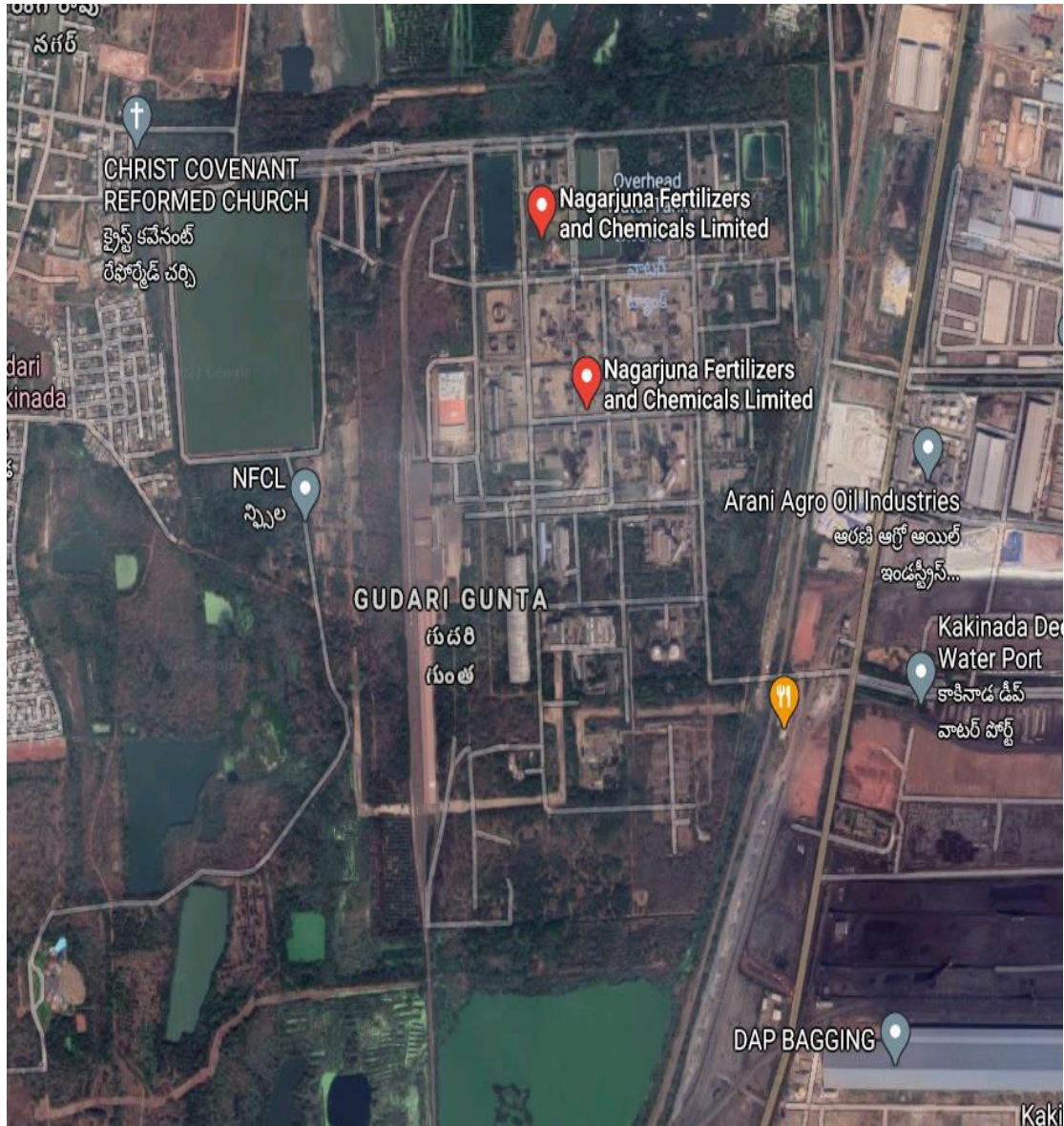
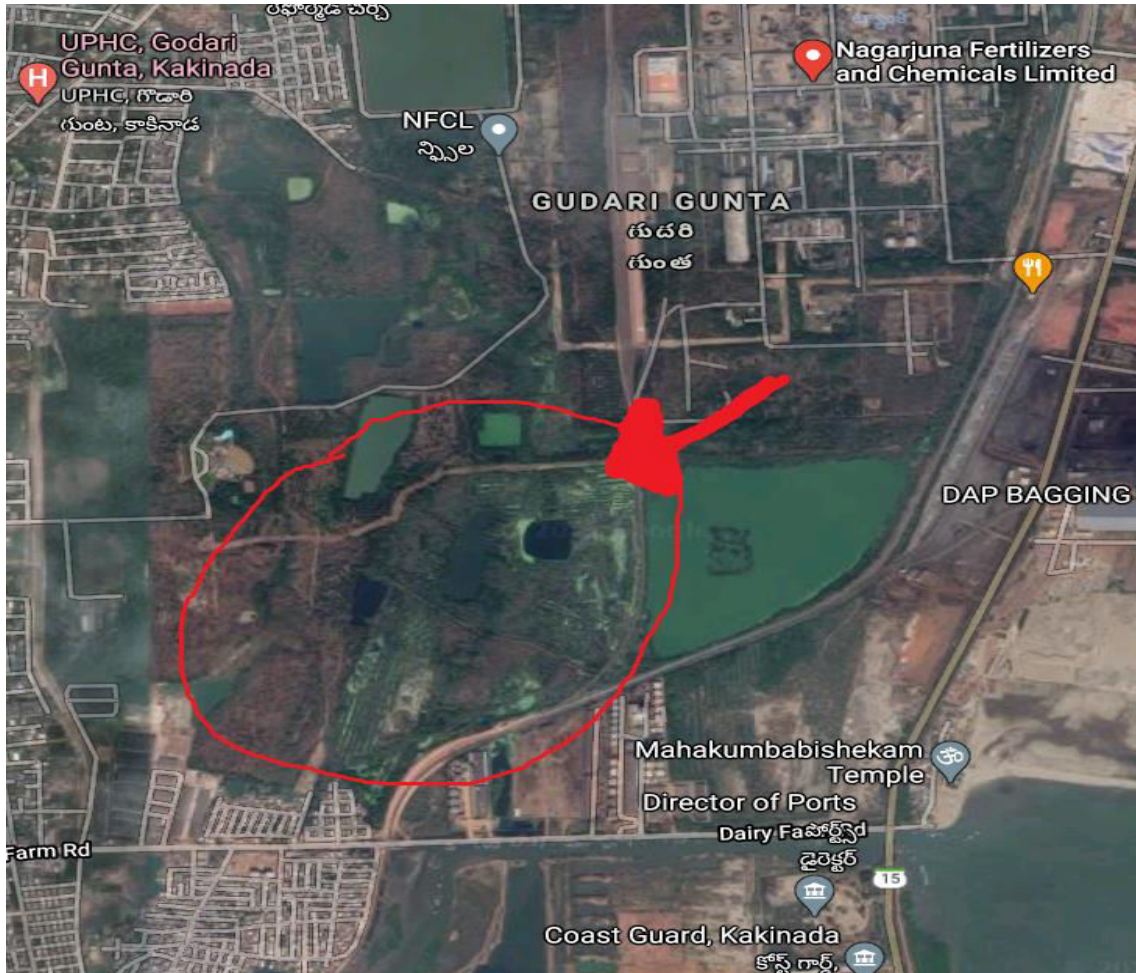


FIG4.1.2:SATELLITE VIEW
OF THE FACTORY

FIG4.1.3:THE RED MARKED AREA IS BEING USED BY GOVT FOR BUILDING RESIDENTIAL FLATS FOR THE POOR



4.2ME
THODO
LOGY

FIG4.1.4 METHODOLOGY

4.3.1 WATER pH TEST

This test method is used to determine the pH of soil or water samples using a pH meter

To properly mix and swirl the water sample, a glass rod is used.

Using a glass of watching water that is suitable for 40ml, a beaker is inserted (about 5ml). The temperature of the water will be stabilized for 1 hour after the sample is placed. Between these points, stirring is also done.

"The temperature of the water is determined after 1 hour, and this temperature is adjusted inside the pH metre.". As a result, the pH meter shows the same temperature as the sample. Prior to the test, these machine adjustments must be made and glued. Temperature controls on certain pH meters are automatically changed. The manufacturer's directions must be followed at all times.

The pH meter is often standardized. As with the previous process, the temperature is adjusted here.

The electrodes are inserted into the water sample. The electrodes are calibrated and turned in the beaker so that they have good contact with the water.

Until reading, the electrodes must be submerged in the solution for 30 seconds. This time must be read correctly in order for the meter to be properly stabilized. The pH meter will display a sign with an automatic reading system to indicate that the meter has stabilized.

When the reading is seen, the reader must be read to the tenth of the whole amount. It must be completed if the value is 100th. The tenth is left when the number 100 is less than 5. After the decimal, values greater than 5 are rounded to one unit. If the 100th position corresponds to 5, the rounded value is the nearest even number.

After each use, the device should be maintained. The used electrodes are fully washed with water. It is cleared when there is some kind of film around the electrodes. Electrode washing should be avoided as this could lead to polarization that could result in a slow response to the experiment.

TABLE 1.1 RESULT OF WATER pH TEST:

ON NORMAL WATER	ON WASTE WATER
6.61	7.68



FIG4.1.5 WATER Ph TEST

4.3.2 WATER TURBIDITY TEST

Turbidity is the amount of cloudiness in the water. This will vary from a river overflowing with silt and mud to spring water where the water cannot be measured (due to high turbidity) (low turbidity). Turbidity is caused by the following factors:

- silt, sand and dirt ;
- microorganism and different germs
- chemical precipitates.

As an optical property of water, turbidity is one of the most difficult parameters to live with. The amount of turbulent or opaque water is also a subjective assessment. To standardize turbidity levels and allow comparisons, different units are defined, which is supported by the measuring process. "Today, 3 fashionable methodology for live muddiness of the sample and 2 fashionable ways for measurement total suspended solids also are there." "These techniques have enlarged the vary and precision" of opacity measurements from simple object visible tests and historical visual extinction techniques.. However, each methodology has its advantages and limitations."

The presence of particles and colored water causes confusion. It can also be measured using a turbidity tool, such as a turbidity monitor, or by comparing the clarity of the water. Turbidity sensors can also be represented as submersible turbidimeters. A disk or a tube are examples of water clarity methods. They're always quick and cheap, but they're also very precise because they're used by people."Turbidity metres use nephelometry (90 degree scattering) or alternative optical scatter-detection techniques for quick, correct murkiness measure on water samples."

TABLE 1.2 RESULT OF TURBIDITY TEST:

ON NORMAL WATER	ON WATE WATER
0.072NTU	2.024NTU

FIG4.1.6:



4.3.3 TOTAL SOLIDS

The entire solid, TS, can be alive in a single drop of water, including both suspended, colloidal, and dissolved solids. This category includes dissolved salts

like binary substances and NaCl, as well as solid particles like silt and species. In rivers and streams, AN is much more common than total solids. The most common waste material sampled from rivers and rivers by the Environmental Protection Agency's National Water Quality Inventory¹ is sedation, which is one of the first players to contribute to total solids. Complete water solids can be caused by a variety of factors. You may play a significant role in wearing. Increasing waterflow or reducing vegetation along the riverbank would hasten the wear process and increase the amount of suspended particles including clay and silt. CaCO₃ can dissolve in water when mixed with solids in rocks or minerals in soil, such as sodium chloride (NaCl) or stone.

Over time, some suspended solids settle to the bottom of a water body at a constant low level. Gravel and sand, for example, typically settle as they enter a low- and no-water district. Although this subsidence increases water clarity, hyperbolic silt smooths out benthonic organisms and larvae. The remaining particles do not combine to form a mixture or solids that do not settle. For all times, the suspended solids area is too small or too small to settle down.

Although chaos tends to be the same as the syndrome, the latter is much more valuable because it provides associates with the actual weight of the particulate matter sample. To create a site-specific link in water quality observation, a series of laborious syndrome measurements are combined with comparatively fast and simple muddy steps. Many frequently produced chaos measurements will not estimate syndrome until the relation has been satisfactorily established, saving energy and time. Because of the turbulent readings, this approach necessitates a correlation equation for each position, which must be schemed with zeal for particle size, shape, and color. Furthermore, objects and situations that tend to hang large particles by water movements (e.g., increasing stream current or wave action) not primarily in the middle of the resulting rise in chaos produce higher syndrome values.

TABLE 1.3 RESULT OF TOTAL SOLIDS:

EMPTY WEIGHT	ON WASTE WATER
50.16	55.6



FIG4.1.7 DETERMINATION OF TOTAL SOLIDS

4.3.4 SOIL Ph TEST

The pH of the soil is a measure of the acidity or basicity of the living soil. Soil pH may be a key attribute that contributes to informative qualitative and quantitative studies of soil characteristics. Since the negative logarithm (basis 10) (H^+ or, more precisely, H_3O^+) is present in a solution, the pH of the hydronium ion activity is established. It is usually measured in soils with soil suspension mixed with water (or a salt solution, such as 0.01 M CaCl₂), and ranges from three to ten, with seven neutral soils. Soils with an acid pH of less than seven and an alkali pH of less than seven. Ultra-acidic (pH 3.5) and highly basic (pH > 9) soils are unusual measurements.

Since it affects so many chemical processes in soils, pH is a master variable. It has a significant impact on plant nutrient availability by controlling the

chemical types of nutrients and altering their chemical reactions. For most plants, the ideal pH ranges from 5.5 to 7.5, although others are tailor-made for pH levels outside of this range.

The mineral content of the parent soil, and therefore the weathering effects of the parent soil, determine the pH of the natural soil. Natural land processes occur over time in hot, wet environments because weathering square commodities quantify the amount of water being leached into the soil either sideways or downstream. In dry climes and squares of natural processes, however, less intensive and less soil pH is usually acidic or alkaline.

TABLE 1.4:RESULT OF SOIL pH:

NORMAL SOIL	AFFECTED SOIL
8.61	7.68



FIG4.1.8 SOIL SAMPLES:

4.3.5 SPECIFIC GRAVITY TEST

Soil is a three-phase material made up of solid particles and vacuums that is filled with water and air. The magnitude relationship between the weight of the solid particles and the unit weight of the water is referred to as accurate soil gravity (GS). GS is not to be confused with soil density; it is a dimensionless unit that expresses the magnitude relationship between two different densities.

Since it is related to the composition and weathering of minerals in the soil, GS may be a significant soil mechanics parameter. Many soil parameters, such as porousness, dry and saturated density, and, as a result, the saturation degree, will be measured.

Specific severity is the quantitative comparison of the mass of soil volume at an explicit temperature to the mass of the same gas-free water volume at an explicit temperature

Specify and record the clean and dry empty pycnometer load, WP. Place 125 g of dry ground sample in the pycnometer. Confirm and record the dry soil pycnometer's load. Fill 3/4 of the pycnometer with water by inserting [*fr1]. Soak a sample for ten minutes. Apply a partial vacuum to the contents for another 10 minutes to release the trapped air. Stop the vacuum and disconnect the pycnometer from the vacuum line fully. "Please fill the distilled pycnometer (water on the mark) and wipe the skin of the pycnometer with a clean, dry cloth." Confirm the pycnometer's load and contents. The pycnometer should be clear and clean. After that, simply fill it with water (to the mark). Clean the pycnometer's external surface with a clean, dry cloth. The water and pycnometer load have been checked.

TABLE 1.5:SPECIFIC GRAVITY OF NORMAL SOIL

S.NO	PARTICULARS	TRAILS(KG)
1.	WEIGHT OF PYCNOMETER(W1)	0.640
2.	WEIGHT OF PYCNOMETER+DRY SOIL(W2)	1.610
3.	WEIGHT OF PYCNOMETER+DRY SOIL+WATER(W3)	2.050
4.	WEIGHT OF WATER(W3)PYCNOMETER+DISTILLE D(W4)	1.460

The specific gravity of normal soil is 2.51.

TABLE 1.6:SPECIFIC GRAVITY OF AFFECTED SOIL

S.NO	PARTICULARS	TRAILS(KG)
1.	WEIGHT OF PYCNOMETER(W1)	0.630
2.	WEIGHT OF PYCNOMETER+DRY SOIL(W2)	1.580
3.	WEIGHT OF PYCNOMETER+DRY SOIL+WATER(W3)	1.990
4.	WEIGHT OF WATER(W3)PYCNOMETER+DISTILLED(W4)	1.460

The specific gravity of affected soil is 2.15.

4.3.6 ATTERBERG LIMITS

The Atterberg limits calculate the simple live quality of the essential water content of a fine seed soil: its reduction limit, its plastic limit and its limit on liquids.

A soil will appear in one of four states depending on its water content: solid, half-solid, plastic, or liquid in all four states. As a result, in any state, the consistency and operation of an entirely different entity unify its technological characteristics. As a result, an improvement in the soil's conduct could be made public at intervals between each state. It can also be used to distinguish silt and clay from Atterberg's boundaries, as well as different forms of silts. The amount of water in the soil varies from country to country, or Atterberg's cap. The sum of water in the soils

4.3.7 PLASTIC LIMIT: The plastic limit is when the water content of a solar-water paste ranges from solid to plastic as a result of rolling into 3,175-mm (1/8 inch) thread in the conventional way. The second measured parameter of Atterberg limits take a glance at is that the liquid limit. The Atterberg limits take a glance at put together includes the property index, that's calculated as a result of Excellence between fluid boundary and plastic boundary additional. All Atterberg units are determined on soil samples passing #40

4.3.8 LIQUID LIMIT: The water content of the soil as a fluid is the fluid limit. A clay sample is placed in a regular cup and a spatula is used to determine the liquid cap. Before it vanishes, the cup is born. The water content of the soil is determined by this sample. You analyze it once more by increasing the water content. Soil with a high water content would produce a lot of blows, while soil with a low water content would produce less blows.

TABLE 1.7:PLASTIC LIMIT OF NORMAL SOIL:

S.NO	WEIGHT OF CONTAINER(M1)	WEIGHT OF CONTAINER+WEIGHT OF WET SOIL(M2)	WEIGHT OF CONTAINER+WEIGHT OF DRY SOIL(M3)
1.	38.32	41.88	41.29
2.	38.08	42.77	42.02

the plastic index value is 21.92.

TABLE1.8:PLASTIC LIMIT OF AFFECTED SOIL:

S.NO	WEIGHT OF CONTAINER(M1)	WEIGHT OF CONTAINER+WEIGHT OF WET SOIL(M2)	WEIGHT OF CONTAINER+WEIGHT OF DRY SOIL(M3)
1.	40.16	42.69	42.27
2.	41.41	43.69	43.28

the plastic index value is 17.03

TABLE1.9:LIQUID LIMIT OF NORMAL SOIL:

S.N O	WEIGHT OF THE CONATINER(M1)	NO OF BLOWS(N)	WEIGHT OF THE CONATIENR+WEIG HT OF WET SOIL(M2)	WEIGHT OF THE CONATIENR+WEIG HT OF DRY SOIL(M3)
1.	39.65	45	67.78	61.65
2.	41.87	40	79.95	71.22
3.	38.40	35	54.91	51.24
4.	37.40	30	77.56	68.41

exact 25blows the liquid limit is at 34.5.

TABLE2.0:LIQUID LIMIT OF AFFECTED SOIL:

S.N O	WEIGHT OF THE CONATINER(M1)	NO OF BLOWS(N)	WEIGHT OF THE CONATIENR+WEIG HT OF WET SOIL(M2)	WEIGHT OF THE CONATIENR+WEIG HT OF DRY SOIL(M3)
1.	39.90	46	79.90	70.87
2.	44.16	34	78.23	69.98
3.	3873	21	64.89	58.20
4.	38.20	18	74.97	65.94

Exact 25blows the liquid limit is at 32.5.



FIG4.1.9:LIQUID LIMIT

plasticity index of normal soil
= $WL-WP$
= $34.5-21.92$
= 12.58

plasticity index of affected
soil= $WL-WP$
= $32.5-17.03$
= 11.47

FIG4.1.9:PLASTICITY INDEX CALCULATION

4.3.9 COMPACTION TEST

Soil compaction is a process in which mechanical tension is used to keep the soil in place and densify it. Strong particles and air-stricken voids make up soil. Soil as a three-phase method allows for a great deal of systematic rationalization of soil nature. Soil particles decentralize between soil masses until they become a source of concern, at which point the amount of vacuum in the system decreases, resulting in concretion. Kneading, as well as dynamic and static methods, may be used to create mechanical tension. The soil cubic unit weight shift d is used to determine the degree of compaction.

Compaction is particularly helpful in engineering applications, as it leads to:

- An increase in strength of soils
- A decrease in compressibility of soils
- A decrease in permeability of soils

In structures and engineering applications such as earth dams, embankments, floor support, or supporting pillars, this is a key factor.

The degree of compaction is determined by the soil's characteristics, the energy type and quantity of the compaction process, and thus the soil's water content. In Nursing, there is an optimum amount of moisture for each soil that will experience the most compression. In other words, at the optimum level of water content, a soil achieves its maximum unit weight (d_{max}) for a given compact effort (w_{opt}).

The softness of a relatively dry soil can be increased when water is added to it. To put it another way, water acts as a material, allowing soil particles to slip relative to each other at different water content (w_{opt}), resulting in a denser configuration. Excess water on the far side causes an increase in pore water pressure, which causes the soil particles to separate, resulting in a degree of precise water content ($w > w_{opt}$).

TABLE 2.1: COMPACTION TEST OF NORMAL SOIL:

DESCRIPTION	1	2	3	4
MASS OF MOULD+COMPACTED SOIL	13.410kgs	13.450	13.520	13.550
MASS OF COMPACTED SOIL(WT)	3.160	3.200	3.270	3.300
BULK DENSITY $T_t = W_t/V$	1.26	1.28	1.308	1.32

AVG WATER CONTENT w	8.65	10.06	12.08	14.34
%OF WATER CONTENT	8	10	12	14
DRY DENSITY $T_d = T_t / (1 + w)$	1.16	1.163	1.167	1.154

Maximum dry density:1.247

Optimum moisture content:10.06%

TABLE2.1:COMPACTION TEST OF AFFECTED SOIL:

DESCRIPTION	1	2	3	4
MASS OF MOULD+COMPACTED SOIL	13.340kgs	13.440	13.460	13.450
MASS OF COMPACTED SOIL(WT)	3.040	3.090	3.194	3.200
BULK DENSITY $T_t = W_t / V$	1.216	1.236	1.277	1.280
AVG WATER CONTENT w	9.26	8.93	3.55	31.2
%OF WATER CONTENT	8	10	12	14
DRY DENSITY $T_d = T_t / (1 + w)$	1.13	1.23	1.21	1.19

Maximum dry density:1.167

Optimum moisture content:8.93

4.3.10 SWELL INDEX

Free Swell Index means that the volume of a field is increasing, with no external restrictions, as the water sinks

Passing 425 micrometer of the IS Sieve, take 2 10 g of dry soil kitchen equipment.

In each two-glass graduated cylinders of a capacity of 100 ml each soil specimen shall be poured.

Then, up to a mark of 100 millilitres, one cylinder is filled with kerosene oil and thus with water. After the soils in the cylinders have been drained, they can be settled (by stirring or stirring with a glass rod). The soil sample must be given enough time (not just twenty-four hours) to reach the balancing volume status with no further adjustments in the soil volume.

The final volume of soils in every of the cylinders shall be browse out.

$$\text{Free swell index} = \frac{V_d - V_k}{V_k} \times 100 \%$$

V_d = The volume of soil specimen read from the graduated cylinder containing distilled water.

V_k = The volume of soil specimen read from the graduated cylinder containing kerosene

FREE SWELL INDEX OF NORMAL SOIL

$$\begin{aligned}\text{Free swell index} &= (\text{final} - \text{initial}) / (\text{initial}) \\ &= (13 - 10) / (10) \\ &= 30\%\end{aligned}$$

$$\begin{aligned}\text{Differential free index(DFS)} &= (\text{water} - \text{kerosene}) / (\text{kerosene}) * 100 \\ &= (13 - 10) / (10) * 100 \\ &= 30\%\end{aligned}$$

RESULT:

Free swell index = 30%

Differential free index = 30%

FREE SWELL INDEX OF AFFECTED SOIL

$$\begin{aligned}\text{Free swell index} &= (\text{final} - \text{initial}) / (\text{initial}) \\ &= (11 - 10) / (10) \\ &= 10\%\end{aligned}$$

$$\begin{aligned}\text{Differential free index(DFS)} &= (\text{water} - \text{kerosene}) / (\text{kerosene}) * 100 \\ &= (11 - 10) / (10) * 100 \\ &= 10\%\end{aligned}$$

RESULT:

Free swell index = 10%

Differential free index=10%

5 CONCLUSION

5.1 COMPARING RESULTS:

TABLE:2.2COMPARING THE PROPERTIES:

PROPERTY	LATERITE SOIL	AFFECTED SOIL
SOIL pH	8.61	7.68
2.ATTERBERG LIMITS		
A.PLASTIC LIMIT	34.5	32.5
B.LIQUID LIMIT	12.58	11.47
3.SPECIFIC GRAVITY	2.51	2.15
4.DIFFERENTIAL SWELL INDEX	30%	10%
5.COMPACTION CHARACTERISTICS		
A. MAXIMUM DRY DENSITY	1.297	1.167
OPTIMUM MOISTURE CONTENT	10.06%	8.93%

5.2 DISCUSSION:

By comparing all the properties of the samples collected we have found the following changes:

1. The water pH collected from industrial effluents is acidic whereas the normal water is neutral
2. The water turbidity for normal water is 0.072NTU , which is less than 1 it means water is safe whereas, the affected soil is more , it is health risk.
3. The total solids present in affected soil are more than in normal soil.
- 4.The soil pH for normal soil is basic in nature, whereas , the affected soil is acidic in nature.

5. The Atterberg limits results obtained for normal soil are more compared to the affected soil.

6. The specific gravity obtained for normal soil is more than the value of affected soil.

7. The swell index obtained for normal soil is less than affected soil.

8. The comparison of compaction results for normal and affected soil are 1.247 and 1.167.

FINALLY AFTER DOING THE RESPECTIVE TESTS WE HAVE COME TO A CONCLUSION THAT THE STRENGTH OF THE SOIL IN THE PARTICULAR REGION HAVE DECREASED.

AS WE MENTIONED ABOVE THE GOVERNMENT IS PLANNING TO CONSTRUCT RESIDENTIAL HOMES FOR THE POOR, THE SITE NEED TO CHECKED AND THE CHECK WHETHER THE SOIL IS SUITABLE FOR CONSTRUCTION OR NOT.

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