InternationalJournalofResearchinEngineering and Science(IJRES)
ISSN (Online):2320-9364,ISSN (Print):2320-9356
www.ijres.org Volume9 Issue8‖2021‖ PP.17-22

AReview ontheStudy ofSoil-IndustrialEffluentInteractionandTheirEnvironmentalBehavior

KomalSharma
AryaInstituteof EngineeringTechnology&Management,Jaipur,Rajasthan,India

MonikaBasetiya
AryaInstituteof EngineeringTechnology&Management,Jaipur,Rajasthan,India

Mr.ArunBihani
Professor, Civil Engineering Arya Institute of EngineeringTechnology& ManagementJaipur, Rajasthan, India

Abstract: *Urbanization and industrialization is increasedaybydayinourcountry.Itplaysakey role inwealth and economy of a country. Alarge amount of effluent generated from the industrial activities aredischarged either treatedor untreated over the soil leading to change in soil properties causing improvement ordegradation of engineering behavior of soil. Whether an improvement is in engineeringbehavior of soil, thenthereisavalueadditiontotheindustrialwastesservingthethreebenefitsofsafedisposalofeffluent,usingasa stabilizer and return of income on it. If there is degradation of engineering behavior of soil then solution fordecontamination is to be obtained.Hence,in this study to investigatethe effect ofvarious industrial effluentsuchastextile effluent, tannery effluent andbattery effluentonthe California bearing ratio of an expensivesoil.*

Keyword:-*Expensivesoil,TextileEffluent,TanneryEffluent,BatteryEffluent,CBRvalue.*

DateofSubmission:06-08-2021 Date ofacceptance:19-08-2021

I. INTRODUCTION

Soil is the one of the most important resources which is obtained by weathering of rocks. The nature ofsoil in a place is largely influenced by such factor as climate, natural vegetation and rocks. Various types of soilfound in India include alluvial soil, laterite soil, red soil, black cotton soil,desert soil, and mountain soil.Determination of soil condition is the most important work for every type of civil engineering construction. Outof these soils the black cotton soilis theexpensivesoil because of their colour and cotton growing potential.Black cotton soils undergo swelling when they come into contact with water and shrink water is squeezed out.The typicalbehavioris due the basic mineral compositionof the montmorillonite. The nature ofsoilis causeslot of damage in civil engineering structures which are constructed over them. Expensive soils create seriousproblems to civil engineers in general and to geotechnicalengineers in particular. One of the best remedialmeasure is stabilization of soil with the help of external agent.Soil stabilization is the treatment of soils toenable their strength and durability to be improvedsuch that they become totally suitable for constructionbeyond their original classification. Cropping and leaching of soil nutrients is adversely affects physicochemicalpropertiesofthesoil.

Some industries release their effluents on to the ground which leads to the changes in the physical andchemical properties of the soil. There are various types of industries such as tannery, battery, textile, dyeing,pharmaceutical, foodproduction,somekindofmineralandmanyotherchemicalindustries.

The index and engineering properties of the ground gets modified in the vicinity of the industrial plantsmainly asaresultof contaminationby theindustrialwastedisposed.Themajorsourcesofsurfaceandsubsurface contamination are the disposalof industrial wastes and accidental spillage of chemicals during thecourse of industrial operations.The leakage of industrial effluent into soil & subsoil is directly affects the useandstabilityofthesupportedstructure.Resultsofsomestudiesareshowthatthedetrimentaleffectofseepageofacidsandbasesinto subsoilcancause severefoundationfailures.

II. LITERATUREREVIEW

Sridharan (1981): Extensive cracking damage to the floors, pavement and foundations of light industrialbuildinginafertilizer plant.

Joshi(1994):Severdamage occurred to interconnecting pipe of aphosphoricacidstorage tank in particularand also to the adjacent buildings due to differential movement between pump and acid tank foundations offertilizerplant.

Shrisavkar (2010): It has been made experimental investigation to study the suitability of molasses to improvesomeproperties ofsoil.HeobservedthatthevalueofCBRis foundtoincreasebytheadditionofmolasses.

Kamon Masashi (2001): reported that the durability of pavement is improved when stabilized with ferrumlime-aluminumsludge.

EkremKalkan (2006): investigated and concluded that cement-red mud waste can be successfully used forstabilizationofclaylinersingeotechnicalapplications.Inpracticefoundationlayers,subgradelayerofpavementandalsomostofthelaboratoryexperimentsareconductedatoptimummoisturecontentandmaximum dryunitweightofsoil.

III. METHODOLOGY

A. Materialused

1. Soil

2. Industrial EffluentI)-Textile effluentII)-TanneryeffluentIII)-Batteryeffluent

Table:1 Propertiesofuntreatedsoil

SI.NO	Property	Value
1.	Grainsizedistribution	
	(a)Gravel(%)	3
	(b)Sand(%)	65
	(c)Silt+Clay(%)	32
2.	AtterbergLimits	
	(a)LiquidLimit(%)	77
	(b)Plastic Limit(%)	29
	(c)PlasticityIndex(%)	48
	Differential freeswellindex(%)	255
4.	Swelling pressure(KN/m^2)	210
5.	Specificgravity	2.71
6.	PHvalue	9.20
7.	Compactioncharacteristics	
	(a)Maximumdryunit weight (KN/m^2)	18.3
	(b)Optimum moisturecontent (%)	12.4
8.	California bearingratiovalue(%)	
	(a)2.5mm penetration	9.98
	(b)5.0mm penetration	9.39
9.	Unconfinedcompressive strength (KN/m^2)	173.2

Table.2: ChemicalCompositionoftextileeffluent

S. NO.	Parameter	Value
1.	Colour	Yellow
2.	PH	9.83
3.	Chlorides	380mg/l
4.	Alkalinity	2400mg/l
5.	Suspended	1500gm
6.	Totalsolids	13.50
7.	BOD	150mg/l
8.	COD	6200mg/l

Table.3: ChemicalCompositionofTanneryEffluent

S.NO.	Parameter	Value
1.	Colour	Black
2.	PH	3.15
3.	Chromium	250mg/l
4.	Chlorides	200mg/l
5.	Sulphates	52.8mg/l
6.	Totalhardness	520mg/l
7.	BOD	120mg/lit
8.	COD	450mg/lit
9.	Suspendedsolids	1200mg/lit

Table.4: ChemicalCompositionofBatteryEffluent

S.NO.	Parameter	Value
1.	Colour	White
2.	PH	8.45
3.	Sulphates	250mg/l
4.	Chloride	30mg/l
5.	Leadsulfate	63.08%
6.	Freelead	7.44%
7.	Totallead	75.42%
8.	BOD	110mg/l
9.	COD	320mg/l

B. ProcedureforMixing

The soil from the site is dried and hand sorted to remove the pebbles and vegetative matter if anypresent. It is further dried and pulverized and sieved through a sieve of 4.75mm to eliminategravel fraction ifany.Thedriedandsievedsoilisstoredinair tightcontainersandreadytouseformixingwitheffluents.

The soil sample is prepared then mixedwith solutions of different concentration of textile, tannery andbattery effluent. The percentage varied from 20 to 100% in increment of 20%. The soil-industrial effluentmixturesaremixedthoroughlybeforetesting

C. TestsConductedonTreatedSoil

1. StandardProctorTest

The compaction parameters optimum pore fluid content and maximum dry unit weight play a vital rolein changing the strength characteristics of an expensive soil. But these twoparametersare strongly influencedby pore fluid chemistry.Hence in this investigation standard proctor's compactiontest are carried out onexpensive soil treated with textile effluent, tannery effluent, battery effluent at various percentage of 0%, 20%,40%,60%,80%and100%bydryweightofsoil

D. ResultsandDiscussions

I. CompactionParameter-TextileEffluent

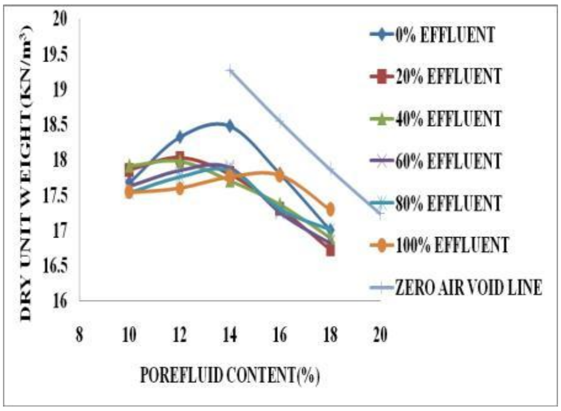

Fig 1:variationofdry unitweightwithpercentporefluidcontent

The standard proctors compaction tests results, conducted at different percentage of textile effluent are shown infig1. From these curves, it is observed that the peak points are shifted towards right with percentage increase ofeffluent.

II. CompactionParameter-TanneryEffluent

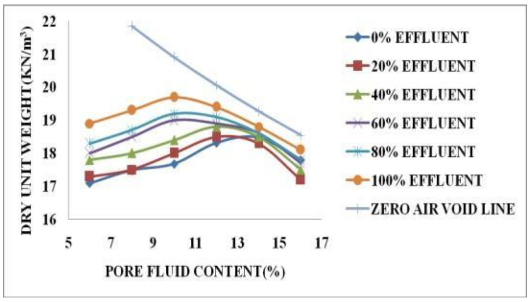

Fig.2.variationof dryunit weightwithpercentporefluidcontent

The standard proctors compaction tests results, conducted at different percentage of tanneryeffluentare shown infig.2. From these curves,itis observed that the peak points are shiftedtowards leftwithpercent increase oftanneryeffluent.

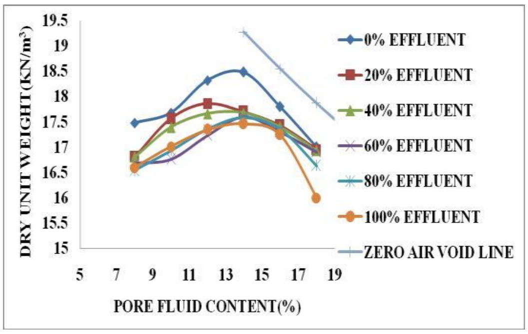

Fig.3.variation of dryunitweightwithpercentporefluidcontent

The results of the standard proctor’s compaction tests, conducted at different percentage of batteryeffluent are shown in fig.3. the top most curve correspond to 0% of battery effluent followed by 20%,40%,60%, 80%,and100%respectively.

2. Optimumporefluidcontent(OPC)

The variation of the optimum pore fluid content at different percentage of textile, tannery and batteryeffluentareshownintable.5.

Table.5:Optimumporefluid(OPC)contentatdifferent percentageofeffluents

Effluent(%): Water(%)	OPC(%)		
	Textile	Tannery	Battery
0:100	12.4	12.4	12.4
20:80	12.6	12.1	13.5
40:60	12.9	11.9	13.6
60:40	13.4	11.6	13.7
80:20	14.4	11.3	13.9
0:100	15.4	11.1	14.1

So it is observed that the maximum percentage increase in optimum pore fluid content for 100% textileeffluent is about 24%, 100% battery effluent is about 14% and that themaximumpercentage decrease inoptimumporefluidcontent for100%tanneryeffluentisabout11%.

2. MaximumDryUnitWeight(M.D.U)

The variation of the maximum dry unit weight at different percentage of textile, tannery and batteryeffluentsareshowninfig.6.

Table.6:variationofmaximumdryunitweight(M.D.U)atdifferentpercentageofeffluents

Effluent(%): water(%)	M.D.U(%)		
	Textile	Tannery	Battery
0:100	18.30	18.3	18.30
20:80	18.27	18.6	17.71
40:60	18.22	18.8	17.51
60:40	18.14	19.1	17.41
80:20	18.09	19.5	17.37
0:100	18.03	19.8	17.2

So it is observed that the maximum percentage decrease in maximumdry unitweight for 100% textile effluentis about 1.5% and for 100% battery effluent it is about 6.0% and that the maximum percentage increase inmaximumdryunit weightfor100%tanneryeffluentisabout8%.

IV. CONCLUSION

Industrial activity is necessary for socio- economic progress of a country but at the sametime generateslarge amount of solid and liquidwastes. Disposal of solid or liquid effluent in open area or in a land. If soil wasteinteraction causes improvement in soil properties then the industrial waste can be used as soil stabilizers. And itisalsocausedegradationofsoilpropertiesthenthesolutionfordecontaminationofsoilistobeobtained.

- Black cotton soil has an expensive nature. Dueto expensive nature it reduces the stability and expendoverthesurface.
- Mixtheindustrialeffluentinblack cottonsoiltoreducetheexpensivenature
- Textile, Tannery and Battery effluent aremix in the soil to reduce the expensive nature and for soilstabilization.
- Expensiveclayconsideredin thisinvestigationissensitivewhen itistreatedwithindustrialeffluents.
- When soil is treated with textile and battery effluents separately an increase in optimum moisturecontent and decrease in maximum dry density is observed. But when it is treated with tannery effluent oppositetrendisobserved.

REFERENCE

[1]. EkremKalkan“UtilizationofredmudasaStabilizationmaterialforthepreparationofClayliners”*Engineering,Geology*,87,(3-4),220-229.(2006)

[2]. I.S.1498-1970(FirstRevision), ClassificationofsoilsforGeneralEngineeringpurposes.

[3]. Joshi,R.C.,Pan,X.,andLohita,P.“VolumeChangeinCalcareousSoilsduetoPhosphoriacid,Contamination”,Proc.OftheXIIIICSMFE,NewDelhi,1569-1574.(1994)

[4]. Kumapley,N.K.,andIshola,A.,“TheEffectofChemicalContaminationonSoilStrength”Proc.oftheXIICSMFE,Sanfrancisco,Vol.3,1199

[5]. KamonMasashiGUHuanda,Masahiro“Improvementof mechanicalproperties offerrumlimestabilizedsoilwiththeadditionofaluminumSludge”MaterialsscienceresearchinternationalISSN1341-1683,vol.7,47-53(20016).

[6]. Sridharan,A,Nagraj, T.S., andSivapullaiah,P.V.“HeavingofsoilDuetoAcidContamination”Proc.oftheXICSMFE,Stockholm,Vol.2,383-386.(1981)

[7]. S.S.Shirsavkar,Prof.S.S.Koranne“InnovationinRoad ConstructionUsingNaturalPolymer”,EIJJE,Joural,Vol.15,Bund.O,1614-1624.(2010)

[8]. Sridharan,AsuriandEl-Shafei,AhmedandMiura,Norihiko“Mechanisms controllingtheundrainedstrengthbehaviorof remoldedAriakemarineclays”.In:MarineGeoresources&Geotechnology,20 (1).21-50.(2002)