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Effective utilization of textile effluent in the concrete of Solapur textile industrial water

Amit B. Patil
amitpatil001415@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Amarjit B. Mohite
amarjitbmohite@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Shubham N. Sirsat
shubhamsirsat7575@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Digvijay C. Mudkanna
ppprasadpatil143@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Gundesha R. Phundipalle
gundushaphundipalle@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Vijay A. Pujari
vpujari177@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

Pravin V. Kulkarni
pvkulkarni1978@gmail.com
Vidya Vikas Pratishthan Institute of Engineering and Technology, Solapur, Maharashtra

ABSTRACT

In future world population is going to be under high water scarcity according to World Water Development (UN) report. Countries of Africa and Asia like Cambodia, Bangladesh, China, and India are still developing are likely to face water scarcity more. It was expected that till 2055, 70 to 75 % of population will leave in city of India. With shrinking of water, low rainfall, etc. it is difficult to provide water to such high population. Water is one of the most highly consumed materials over the world. Scarcity of fresh drinking standard water is becoming evident due to increasing population, improvement of lifestyle, climate change and lack of appropriate water resource management. Therefore, conservation of freshwater is becoming an important issue. Study reported 825 billion liters of fresh water was required to satisfy world concrete requirement in 2010. This research aimed to use treated industrial wastewater as substitute of freshwater in mixing and curing of concrete. Water samples were obtained from central waste water treatment plant of Chittagong Export Processing Zone (CEPZ), Chittagong, Bangladesh which generally is disposed to the Bay of Bengal after treatment. Firstly, treated waste water quality is examined and compared this with the relevant standard of pure drinking water. Cement setting time and mortar flow were evaluated using both freshwater and treated wastewater. Both types of water were used to produce and cure concrete. Workability, compressive strength and Ultrasonic Pulse Velocity (UPV) tests were conducted on the concrete samples. It is concluded that, treated waste water could be as a replacement of freshwater in the production and curing of concrete and can help saving a large amount of valuable freshwater and thereby achieving sustainability in concrete industry. This study tries to provide problems arising due to water scarcity in India.

Keywords— *Chittagong Export Processing Zone (CEPZ), Ultrasonic Pulse Velocity (UPV)*

1. INTRODUCTION

Concrete is a composite material consisting of fine aggregate, coarse aggregate and a binding material, usually cement, and water, with or without admixtures. It is a universal construction material that plays a key role in modern construction as a structural material. In India the population is rapidly developing simultaneously the construction industry is also developing. In construction industry there is no substitute of concrete. It is very important part of structure. Concrete need potable water but now a days specially in summer season the scarcity of water is a major global problem at that time we need to study other types of water that is a wastewater and it is collected from the industry. Now days we are losing million liters of waste water and there is no provision to use this water rather than farming. after testing waste water in a lab if it is giving similar result than the potable water then we need to use this waste water for construction purpose. In waste water there is a lot of bacteria. There is possibility of killing these bacteria in heat of hydration so we can easily use concrete for residential purpose. The benefit of this project is we save millions litter of waste water which we can use in industry.

Freshwater is the highest consumed natural entity of the planet earth. It is a renewable source abundantly available in nature; however, its quantity amenable to human extraction is limited Water shortage is one of the most significant problems in human societies in recent decades. The most important reasons for water crisis are increasing population, improvement of lifestyle; climate change and lack of appropriate water resource manage. In this situation, the treatment and reuse of wastewater could be one of the most important solutions in the development of water resource management. Concrete on the other hand, owing to its extensive use in construction, has emerged as the most widely consumed man-made entity of present era. With its worldwide consumption standing next only to of water, the necessity of rendering concrete production sustainable has been well appreciated. Concrete industry consumes water in its production, curing and washing aggregates as well. Indeed, with minimum 250 kg of cement per 1m3 of concrete and 0.5w/c ratio, approximately 825 billion liters of water used in production of concrete during the year 2010 (Tony and Jenn, 2008) Quality of mixing water plays an important role in concrete properties. The impurities in the mixing water may affect the setting time, contraction and durability of concrete. Researches indicated that water may affect unsuitable drinking water can still be used in concrete mix (TayandYip,1987: Cebeci and Saatci, Al-Ghushain and Terro,2003). Neville (2000) reviewed extensively the research literature on the use of wastewater in concrete, and concluded that much work needs to be done on water use in concrete and there is a need to review the existing standards on water quantity in light of various types of cementitious materials and water reducing admixtures in use currently.

2. LITERATUREREVIEW

V. Karthik, K. Saravanan and et al (2014): have Studied "An overview of treatments for the removal of textile dyes". Waste water discharged from industries contains contaminants including dyes. Removal of dyes from industrial wastes using different methods has been reviewed. Biological treatment requires large area and also less tractability in operation. Chemical treatment is not cost effective. Adsorption process is simple and effective manner. Activated carbon is found to be more effective because of high specific surface area, high adsorption capacity. Activated carbon costs more and efforts have been made for producing it using several waste products. Various biological, chemical and physical methods are adopted for the treatment of dyes whichisdischargedaseffluentfromindustries.Differentmethodsarereviewedfortheremoval of dyes. Adsorption is found to be most economical among all methods. Adsorption by activated carbon is most widely used method. Several attempts have been made using waste products as adsorbents for the removal of dyes.

N.P. Mohabansi, P.V. Tekade and et al (2011): have studied the "Physico-chemical Parameters of Textile Mill Effluent, Hinganghat, Dist. Wardha (M.S.)". In this paper Sample of textile industry effluent was collected from Hinganghat, District Wardha (M.S.) India and analyzed for their physico-chemical characteristics. The results of this analysis were compared with the water quality standards of BIS (Bureau of Indian Standard). In this analysis the various physic-chemical parameters such as color, odour, temperature, density, surface tension, viscosity, alkalinity, acidity, chloride, hardness, Total Dissolved Solids (TDS), total suspended solid, pH, conductance, sulphate, COD, BOD, were determined using standard procedures. Elements like Sodium and potassium were determined flame photometrically. Thequalityofwatersampleswasdiscussedwithrespecttotheseparametersandthusan attempt was made to ascertain the quality of water used for drinking and domestic purposes in the studied area. The water quality parameters of the areas situated around Hinganghat nearer to the textile industries are studied. From this analysis it may be concluded that proper environment management plan may be adopted to control the release of effluent. Hence, it is suggested to exercise all the necessary precaution before the water is used for drinking and irrigation. Otherwise, it may lead to much adverse health effect.

Y. F. Fan, Y. S. Chen and et al (2006): Presented a paper on "Experimental Study on Compressive Strength of Corroded Concrete". In order to study the compressive property of corroded concrete, accelerated corrosion test are performed on concreteC30. 6 corrosive solutions, including hydraulic acid solution (PH=2), hydraulic acid solution (PH=3), 10%NaClsolution, 20%NaCl solution, 10%Na2SO4 solution, 20%Na2SO4 solution, are applied as the corrosive medium.6 series of corrosion tests, including108specimens, were carried out. Then mechanical property of all the corroded specimens is tested respectively. Compressive properties of the corroded specimens (e.g., compressive strength, stress-strain relation, elastic modulus etc.) are achieved. Effects of the corrosion solution on the compressive property of corroded concrete are discussed in detail. The following conclusions can be derived, A. Specimens exposed to hydraulic acid solution: it is discovered the changing trends in compressive strain-stress relation for concrete corroded by hydrochloric acid solution with different PH value are similar; with the specimen being corroded more severely, the stress-strain curve become more gently; the compressive strength and elastic modulus of the specimens will decrease with exposure days.

K. Nirmalkumar (2008): presented a paper on "corrosion studies on concrete using treated and untreated textile effluent and impact of corrosion inhibitor". An attempt was made to use the waste water from textile industry for construction purpose, so that the shortage in water can be greatly reduced and the waste water can be suitably disposed for safe guarding the environment. The basic properties of the treated and untreated water from the textile industry were tested and the results were found to be satisfactory such that itcan be used for construction purposes. By using the waste water from the textile industry cubes, cylinders and beams were casted and tested for its mechanical properties (compressive strength, tensile strength, flexural strength etc.) and the result was found to be satisfactory. Hence the experiment was continued on for durability studies where the corrosion attack was also studied. The results of other durability studies were found to be satisfactory. In this experimental study the results of specimen's casted using treated and untreated textile water were compared with the specimens casted with potable water. Since there was some corrosion, admixtures were added to counter act the same and the results were found to be satisfactory from thediscussionitisclearthatthetreatedanduntreatedtextilewatercanbeusedforconstruction purpose after adding concare and calcium nitrate admixture. It will be a boon for the environment if the industrial water is used for construction purpose. The problem of disposal of the waste water will be greatly reduced.

M.Kanitha1, P. Ramya2 and et al (2014): have presented a paper on "potential utilization of untreated/treated textile effluent in concrete". This paper reports the experimental findings to predict the practicability of using treated textile effluents as alternative to fresh water in mixing concrete. Potable water was replaced with four stages of effluents in the textile effluent treatment process (ETP) namely, Collection Tank Water (CTW), Anaerobic Outlet Water (AOW), Tertiary Clarifier Water (TCW), Reverse Osmosis Feed Water (ROFW). The chemical compositions of the treated effluents were investigated. Concrete specimens were assessed withhold to setting time, workability, compressive strength and split tensile strength. The specimens made with AOW attained higher strength than the specimens made with potable water. It was noticed that the compressive strength was increased by 26.15% for AOW in comparison with PW at the age of 28 days. It can be concluded that AOW can be used as an alternate to fresh water for mixing concrete. linearly, while the maximum strain will increase with exposure days exponentially; the failure mode of the severely corroded specimen is different from that of uncorroded specimen. B. Specimens exposed to sodium chloride and sodium sulfate solution: at the initiation of corrosion state, the compressive strength will have a slight increase, and the increase amount of the compressive strength is relative to the solution and the solution concentration; with the severe corrosion of the concrete, the strength will decrease; it can also be discovered that the corrosion damage of specimens exposed to NaCl solution are slight, and little difference exists between the failure process of the corroded specimen and the ordinary concrete; for the specimens corroded by Na2SO4solution, the corrosion damage is obvious, the failure mode of the corroded specimen is different from that of uncorroded specimen.

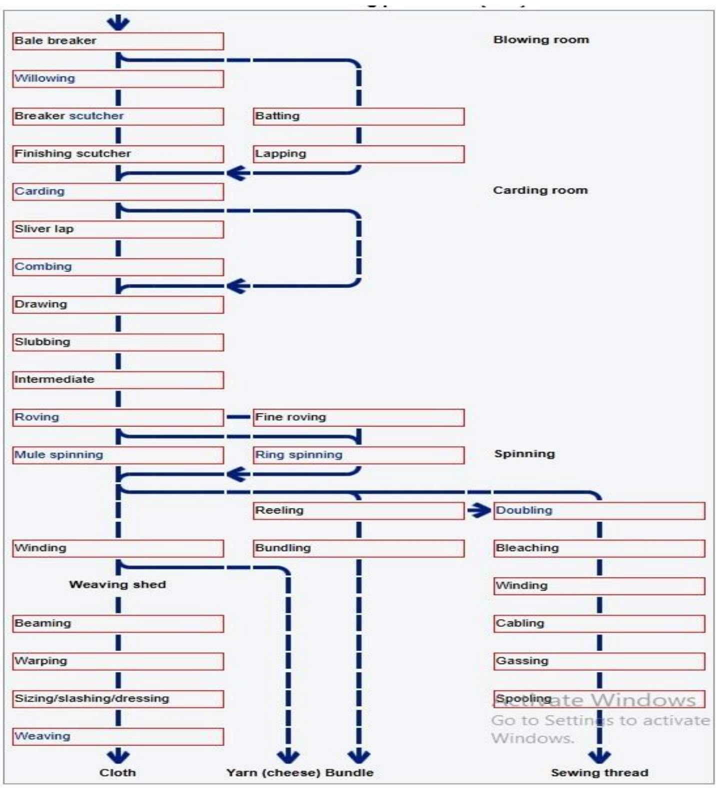
Mr. K. J. Kucche, Dr. S. S. Jamkar and et al (2015): presented a paper on "Quality of Water for Making Concrete: A Review of Literature". This paper reviews the literature related to quality of water for making concrete. The allowable limits of physical and chemical impurities and the test methods of their evolution are compiled. The limits of impurities as per Indian, Australian, American and British standards represented. From the literature it is seen that, the reaction between water and cement affect the setting time, compressive strength and also lead to softening of concrete. All the impurities may not have adverse effect on the properties of concrete. The use of impure water for concrete mixing is seen to favorable for strength development at early ages and reduction in long term strength.

SUMMARY OF LITERATURE

Water is used in a large quantity for Construction purposes as well as in Cotton industries, also due to draught, the shortage of water will be there. So, to reuse Cotton industry wastewater for construction purposes it will minimize the water scarcity after treating it or without treatment as both gives satisfactory results in comparison with the reference specimens. Lots of literature is available to reuse textile waste water for construction purpose and safeguarding the environment. However, use of cotton industry wastewater for Reinforced cement concrete works after necessary treatment will give good results.

3. COMPARATIVESTATEMENT

3.1 Manufacturing Process



EFFECTOFORGANICIMPURITIESONCONCRETE

IMPURITIES	REMARK
$NaNO_3$ and KNO_3	Sodiumandpotassiumnitratesgivestrengthlittle inferiortothoseobtained withsodiumchloride.
$CaSO_4$	Watersaturatedwithcalciumsulfateissatisfactoryfortheliquid phase incementpaste which is normally saturated or even super-saturated withthiscompound.
$Ca(NO_3)_2$	Calcium nitrate added 1.7% weight of cementacceleratessettingtime andstrengthreduction.
Na_2SO_4,$MgCl_2$,$MgSO_4$	1%concentrationofthesecommonions,exclusiveofcarbonate and bicarbonate, could be present withoutmucheffectonstrength.
$FeSO_4$	Inmixwater,if 0.5,1,2and 4%weightbywatershows 28daysand3 yearstensile strengthswhichisexceeding10and15%ofcontrolspecimens.
Zincoxide	Nosignificant effectbut0.1%stronglyretardedsettingtime and lowered strength.
Ammonium-ion	Ammonium chloride increased strength 0.4, 0.8 andhigher percentage by weight of water of ammoniumnitrategivesamestrengthaswithsimilarpercentageofNaClin waterformakingconcrete.
Tannicacid	Noeffectonstrengthbutmayhavea considerable effectonsettingtime ofconcrete.

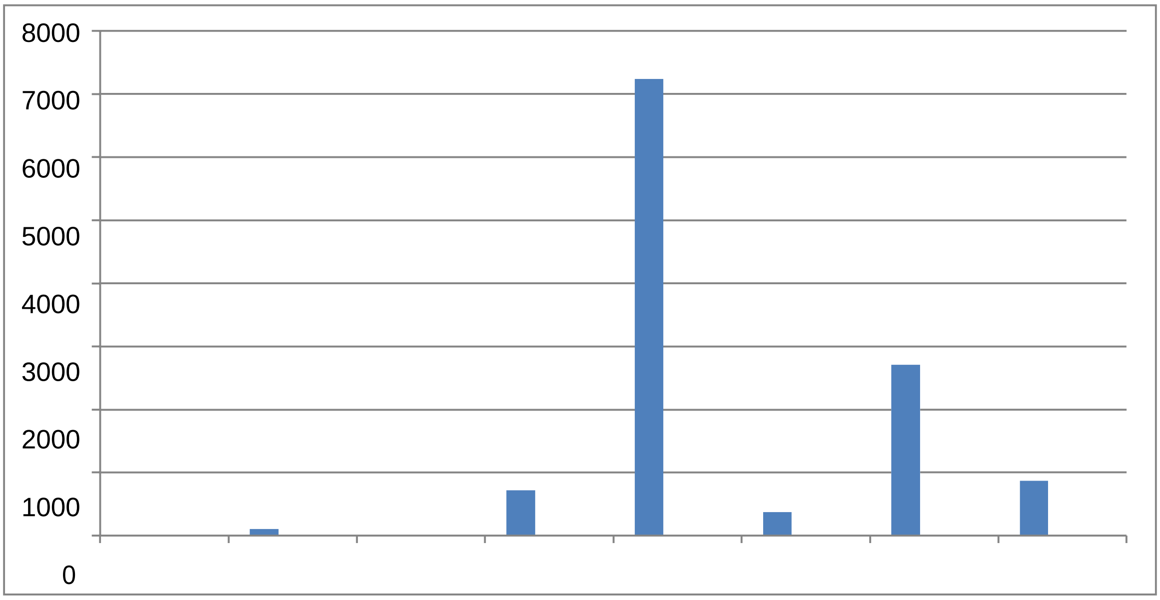
RESULT

1) SampleID:BleachingWastewaterResultofAnalysis

Sr. No.	Parameters	Results		LimitsasperIS-456For Construction
1.	Appearance	Turbid	*	Clear
2.	Neutralization TestusingPhenolphthalein indicator	0		Not more than 5 ml of0.02NNaOH
3.	NeutralizationtestusingMixed indicator	105	*	Notmorethan25mlof0.02NH_2SO_4
4.	pH	7.75		Notlessthan6
5.	Organic	723	*	Max 200mg/l
6.	Inorganic	7244	*	Max 3000mg/l
7.	Sulphates	376		Max 400mg/l
8.	Chlorides	2710	*	1) Max.2000mg/lforconcretenot containing embeddedsteel) Max. 500 mg/l forreinforcedconcretework
9.	SuspendedMatter	870		Max.2000mg/l

Remarks:Thegivenwatersampledoesnot confirmtothestandards.

*-ITINDICATESTHATTHEPARAMETERISNOT ASPERLIMITSASPERIS-456FORCONSTRUCTION



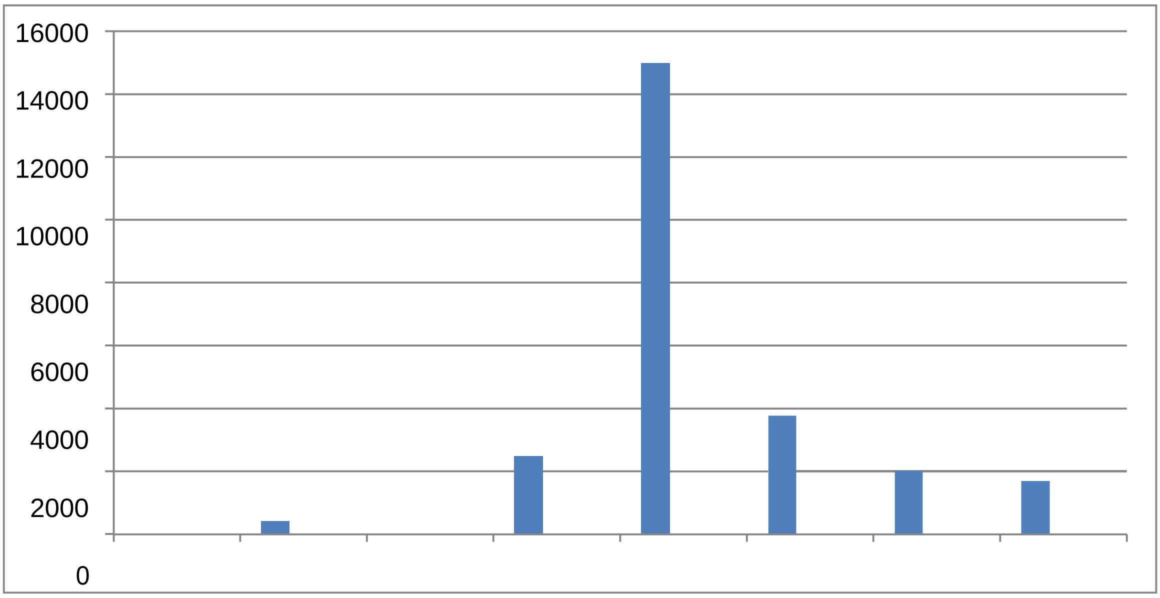
Barchart1: OnX-axisparameters&onY-axisparametersrange

2) Sample:-DyingWasteWaterResultofAnalysis

Sr. No.	Parameters	Results	LimitsasperIS-456For Construction
1.	Appearance	DarkblueTurbid *	Clear
2.	Neutralization TestusingPhenolphthalein indicator	0	Notmorethan5mlof0.02NNaOH
3.	Neutralizationtestusing Mixedindicator	417 *	Notmorethan25mlof 0.02NH2SO4
4.	pH	9.29 *	Notlessthan6
5.	Organic	2500 *	Max 200mg/l
6.	Inorganic	14976 *	Max 3000mg/l
7.	Sulphates	3780 *	Max 400mg/l
8.	Chlorides	2020 *	Max.2000mg/lforconcretenot containing embeddedsteel Max. 500 mg/l forreinforcedconcretework
9.	SuspendedMatter	1691	Max.2000mg/l

Remarks:Thegivenwatersampledoesnot confirmtothestandards.

*-ITINDICATESTHATTHEPARAMETERISNOTASPERLIMITSASPERIS-456FORCONSTRUCTION



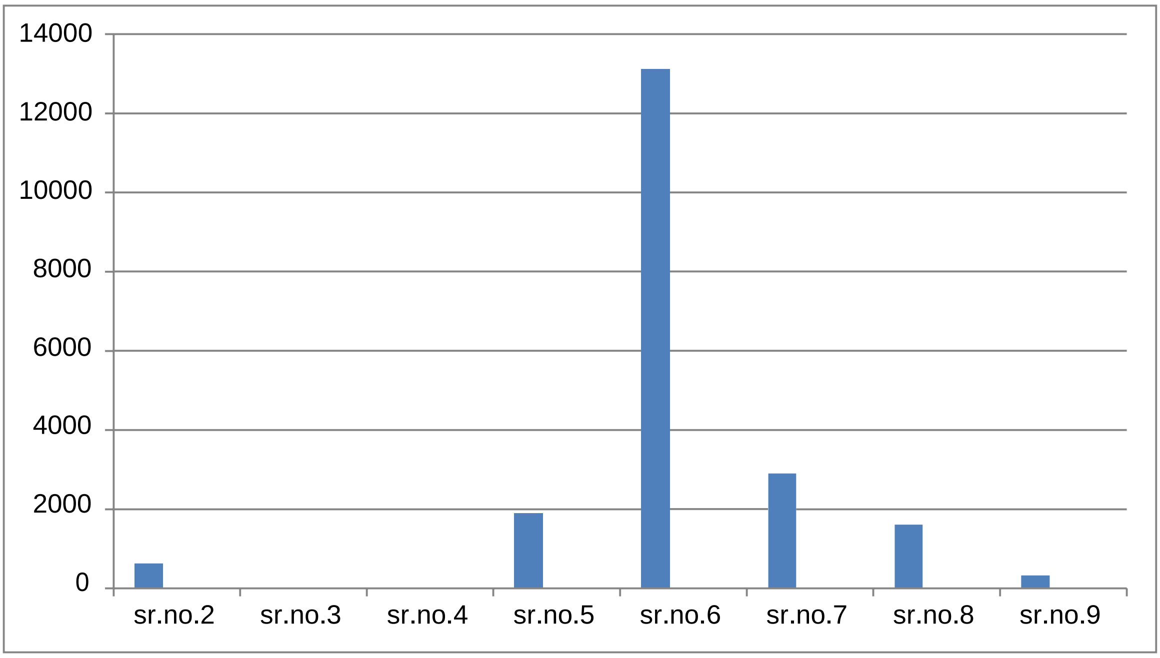
Bar chart2: On X-axis parameters & on Y-axis parametersrange

3) Sample: Outlet of wastewaterindustry(Mix)ResultofAnalysis

Sr. No.	Parameters	Results	LimitsasperIS-456For Construction
1.	Appearance	Orange,Turbid*	Clear
2.	Neutralization Test using Phenolphthalein indicator	630*	Notmorethan5mlof0.02NNaOH
3.	Neutralizationtestus ing Mixed indicator		Notmorethan25mlof0.02NH2SO4
4.	pH	2.78*	Notlessthan6
5.	Organic	1896*	Max 200mg/l
6.	Inorganic	13110*	Max 3000mg/l
7.	Sulphates	2900*	Max 400mg/l
8.	Chlorides	1605*	Max.2000mg/lforconcretenot containing embeddedsteel Max. 500 mg/l forreinforcedconcretework
9.	SuspendedMatter	324	Max.2000mg/l

Remarks: The given water sample does not confirm to the standards.

*-ITINDICATESTHATTHEPARAMETERISNOTASPERLIMITSASPERIS-456FORCONSTRUCTION



Bar chart 3: On X-axis parameters & on Y-axis parameters range

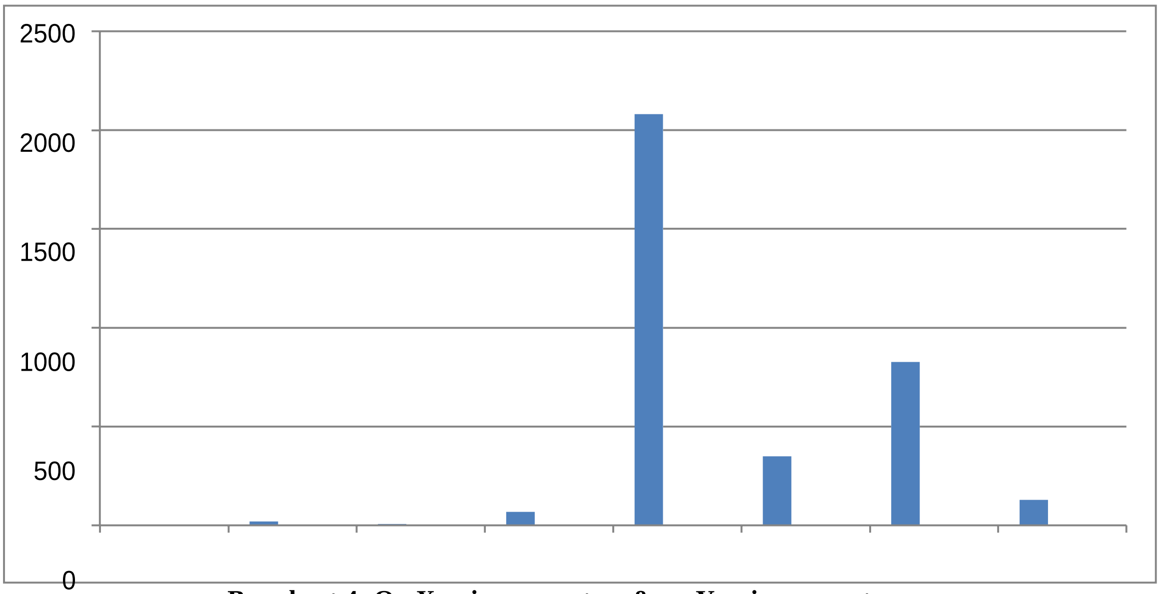
Sample: Treated waste water

RESULT OF ANALYSIS

Sr. No.	Parameters	Results	LimitsasperIS-456For Construction
1.	Appearance	Grayish Turbid*	Clear
2.	Neutralization Test using Phenolphthalein indicator	3.20	Not more than 5ml of 0.02N NaOH
3.	Neutralization test using Mixed indicator	19.5	Not more than 25ml of 0.02N H_2SO_4
4.	pH	5.95*	Not less than6
5.	Organic	67	Max 200mg/l
6.	Inorganic	2081	Max 3000mg/l
7.	Sulphates	350	Max 400mg/l
8.	Chlorides	827*	Max.2000mg/l for concrete not containing embedded steel Max. 500 mg/l for reinforced concrete work
9.	SuspendedMatter	130	Max.2000mg/l

Remarks: The given water sample does not confirm to the standards.

*-ITINDICATESTHATTHEPARAMETERISNOTASPERLIMITSASPERIS-456FORCONSTRUCTION



Bar chart 4: On X-axis parameters & on Y-axis parameters range

4. CONCLUSION

- The result of the dying water shows that about 5 parameters are confirmed with standard as compare to other untreated water sample.
- The result of treated industry water also confirms with 5 parameters with standard.
- Treated waste water the results are positive as compared to potable water but it is not economical.

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