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FORMATION AND STUDY OF METAL PEROXY COMPLEX SPECTROPHOTOMETRICALLY

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ABSTRACT
There are different textile and dyeing industries in the Bhiwandi city, District Thane, Maharashtra.The Bhiwandi city is famous for fabrication, dyeing and bleaching, printing, finishing of cloths and fabrics due to which textile and dyeing industries are very famous in this city. Textile industries consume large quantity of water and in turn generate huge amount of waste water which are saturated with different types of pollutant and heavy metals. In present study the vanadium which is a heavy metal is analyzed spectrophotometrically by forming peroxy complex with hydrogen peroxide. The level of this metal obtained by present experimental work is more than the standard value. It was therefore concluded that textile effluents are not safe with regards to Vanadium metal pollution for discharge in to water reservoir without treatment.

Keywords: Vanadium, Industrial Waste Water, Spectrophotometer

INTRODUCTION
Waste water discharged from the textile industries in Nigeria contain many heavy metals, chlorine, toxic contaminants that leads to decrease in the level of micro organisms stabilizing the waste in the water and destroy the characteristics of these micro organisms which are responsible for cleanliness by some biological processes in water and thus decreasing the level of oxygen which is called as oxygen depletion .This result in destroy of aquatic ecosystem and self purifying tendency of water reservoirs. These all things are due to discharge of untreated textile waste effluent unconsciously in to water bodies causing dangerous environmental damages[1].

Large quantities of water and energy are consumed in the textile finishing and dyeing industry. Textile industries utilizes huge quantity of dyes around one lakh and produces seven lakh of product. But around 15% of the dyes goes as a waste every year through textile dyeing and finishing industries. Large amount of water is required for dyeing ,finishing and other different processes that takes place in textile industries , in turn huge amount of water are discharged as a waste which contain dyes which are left or not properly absorbed , adsorbed or reacted with the fabrics. This effluent water contain many organic and inorganic contaminants that are detrimental along with this heavy metals are also present in effluent water. This all contaminants are either non biodegradable or undergoing very slow biodegradation, they are persistant to light, temperature microbial attack and detergent. So they remain persistant in water and they damage whole ecosystem and environment. They have a tendency to get accumulated in living organisms called as bioaccumulation and causes long term damage that is chronic toxicity in human being , those who comes in contact with this contaminated water which are discharged in to big water reservoir. Cotton is the substrate that requires the most water in this process. The cotton dyeing industry mainly uses reactive dye reagents. These dyes represent approximately 20-30% of the total consumption of dyes [2,3]. Dye undergoes chemical reaction with the fiber, results in a covalent bond between involving oxygen, nitrogen, or sulfur atoms found in the fiber in the form of groups: amino, hydroxyl or thiol. Due to parallel hydrolysis reaction percent of non reactive dyes are not fixed to the fabrics in dyeing industries.This reaction involves a competitive process with the reaction between the dye and the fiber. Thus, once the dyeing process finishes, the resulting residual bath contains a given concentration of dye in its hydrolyzed form that is no longer able to react with the fiber and is removed with the washing process[4].

Vanadium (V) is one of the essential trace elements in human and animal, and participates in many important physiological activities, such as promoting hematopoietic function, reducing blood glucose concentration,

protecting the islet cell, lessening atherosclerosis, and performing anti-hyperlipidemic, anti-hypertension or anti-apoptosis. Excessive vanadium in the body, however, can produce toxic effects in respiratory, cardiovascular, urinary, blood and digestive systems. Over-exposure to vanadium has been shown to cause reproductive and developmental toxicities and even cancer. However, the effect of prolonged exposure to vanadium via the drinking water on the central nervous system remained unclear.Because of its special physical and chemical properties, vanadium is widely used in petrochemical industry, iron and steel smelting, welding, catalyst, pigment, storage battery, and preservatives. Vanadium compounds can be absorbed into the body through the respiratory, dermal and/or gastrointestinal pathways during mining and metal production. The discharge of waste gas, residue, and industrial waste water contributes to large amounts of vanadium in the water, soil and air. In our daily life, the combustion of gasoline, coal and other fuels also increases the environmental vanadium load, resulting in vanadium-associated environmental pollution and occupational hazard. More recent data suggest that vanadium exposure causes cognitive defects, altered neurobehavioral function, and impaired spatial learning ability. However, the mechanisms underlying these changes are unknown.Cumulative evidence has also established that the striatum, as a main component of the basal ganglia, not only participates in the regulation of voluntary movement, but also receives various sensory information and cognitive information, thereby modulating the learning and memory functions[5].

MATERIAL & METHOD

The effluent collected from three different industries of Bhiwandi city located in District Thane, State Maharashtra. Sampling done in the afternoon from 12.30 pm to 1.30 pm and effluents were collected in a plastic containers of one liter capacity after washing with 1% nitric acid, rinsing with double distilled water [6,7].

Vanadium metal form complexes with hydrogen peroxide in acidic medium having maximum absorption at 410 nm and 460 nm. Absorbance of series of standard solution of Vanadium metal is measured at both the wavelength along with absorbance measurement of effluent water.

STATISTICAL ANALYSIS

Data produced in present work were evaluated using Microsoft excel spreadsheet. Measured values of heavy metals were analyzed using MS excel software to create means, median, mode, maximum value, minimum value, error, average deviation, standard deviation and variance.

RESULT AND DISCUSSION

Table.1. Determination of Vanadium

Vanadium metal in ppm	Amount of sulphuric acid in (cm^3)	Amount of hydrogen peroxide in (cm^3)	Total dilution(cm^3)	Absorbance at	
				410 nm	410 nm
2.0	25.0	3.0	100.0	0.048	0.042
3.0	25.0	3.0	100.0	0.049	0.043
4.0	25.0	3.0	100.0	0.050	0.044

Table.2. Statistical Analysis:

Calculation of mode is NA in all effluent water samples.

Dyeing Effluent-I:

Dyeing Effluent-I						
Sr.No.	Amount of V in mg	Mean	Median	Mode	Max	Min
1	3.3328	3.321467	3.3275	NA	3.3328	3.3041
2	3.3275					
3	3.3041					

Dyeing Effluent -I					
Sr.No.	Amount of V in mg	Error	SD	Avg. Deviation	Variance
1	3.3328	5.35137 E-07	0.015272	0.011577778	0.000233
2	3.3275				
3	3.3041				

Dyeing Effluent-II:

Dyeing Effluent-II						
Sr.No.	Amount of V in mg	Mean	Median	Mode	Max	Min
1	3.4401	3.315333	3.3512	NA	3.4401	3.1547
2	3.1547					
3	3.3512					
Dyeing Effluent -II						
Sr.No.	Amount of V in mg	Error	SD	Avg. Deviation	Variance	
1	3.4401	6.99749E-06	0.146041	0.107088889	0.021328	
2	3.1547					
3	3.3512					

Dyeing Effluent-III:

Dyeing Effluent-III						
Sr.No.	Amount of V in mg	Mean	Median	Mode	Max	Min
1	3.3604	3.319867	3.2996	NA	3.3604	3.2996
2	3.2996					
3	3.2996					
Dyeing Effluent -III						
Sr.No.	Amount of V in mg	Error	SD	Avg. Deviation	Variance	
1	3.3604	1.05521E-06	0.035103	0.027022222	0.001232	
2	3.2996					
3	3.2996					

Table: Amount of Heavy Metals in Dyeing Textile Effluent Water

Sr.No.	Sample	Amount of Vanadium in mg
1	Effluent-I	3.321467± 0.015272
2	Effluent-II	3.315333 ± 0.146041
3	Effluent-III	3.319867± 0.035103

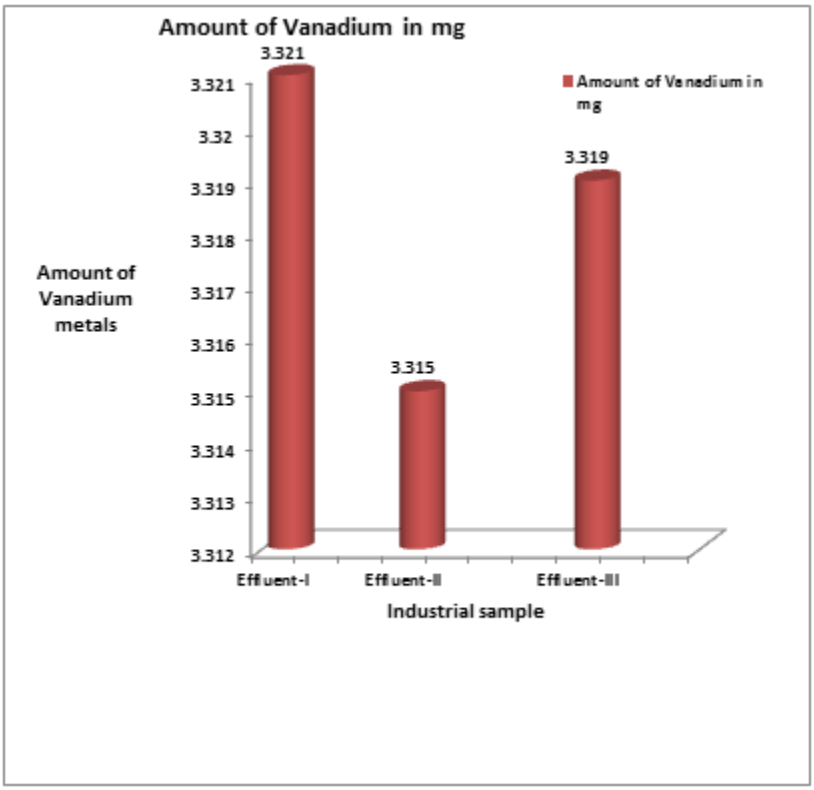

Figure: Amount of Vanadium Metals

Table: Adopted from World Health Organization (WHO) and Nigerian Standard for Drinking Water Quality (NSDQW) water quality guidelines[8]

	Acceptable limit for drinking water		Acceptable limit for discharge into stream		Obtained value
Standard body	NSDQW standard ppm	WHO standard ppm	NSDQW standard ppm	WHO standard ppm	
Vanadium	Not specified	Not specified	Not specified	Not specified	3.315mg to 3.321mg

Obtained value from present experiments are in the range of 3.315mg to 3.321mg but no any specific values are provided by the NSDQW and WHO and NSDQW standard for Vanadium metal concentration

Table: Standard value of Vanadium [6, 9]

Standard value of Vanadium					Obtained value
	Inland surface water	Public Sewers	Land for irrigation	Marine coastal areas	
Vanadium	0.2ppm	0.2ppm	----	0.2ppm	3.315mg to 3.321mg

Obtained value from present experimental work (3.315mg to 3.321mg) are greater than the standard values (permissible value) provided for discharge in to Inland surface water, Public Sewers and Marine coastal areas that is 0.2ppm

Table: FAO guidelines for metal [10]

FAO guidelines for trace metals in irrigation water: Recommended maximum concentration (mg/L)		
Parameter	Recommended maximum concentration (mg/L)	Remark
Vanadium	0.10ppm	Toxic to many plants at relatively low concentrations

Obtained value from present experimental work (3.315mg to 3.321mg) are greater than the Recommended maximum concentration (mg/L) as per FAO guidelines (0.10ppm)

Table: Jordanian Standard [10]

Jordanian Standard (JS: 893/2002) for discharge to streams, storage		
	Discharge to streams, Wadis and water storage areas	Ground water discharge
Vanadium	0.1ppm	0.1ppm

Obtained value from present experimental work (3.315mg to 3.321mg) are greater than the Jordanian Standard (JS: 893/2002) for discharge to streams, storage and Ground water discharge (0.1ppm)

Table: Jordanian Standard [10]

Jordanian Standard (JS: 893/2002) for effluent reuse for agricultural irrigation	
Parameter	(mg/L) Guideline values (maximum permissible)
Vanadium	0.1

Obtained value from present experimental work (3.315mg to 3.321mg) are greater than the maximum permissible set by Jordanian Standard (JS: 893/2002) for effluent reuse for agricultural irrigation (0.1ppm)

Table: Standard values of Vanadium[11].

	Daily intakes of vanadium from food	Average vanadium concentrations in tap water per 2 L of water a day	daily intake of vanadium from tap water for adults
Vanadium	0.01 to 0.02 mg	0.001 mg/L	0.002 mg

The amount of Vanadium obtained by present research work is very greater than the amount of vanadium required by human body

Table: Standard values of Vanadium [12]

	In freshwater	In seawater
vanadium	0.2 to more than 100 µg/litre	0.2 to 29 µg/litre

Amount of Vanadium obtained are further greater than the standard values for discharge in to fresh water and sea water.

CONCLUSION

The level of vanadium in water depends on the geographical position and ranges.In the global circulation, the main source of vanadium metal is ocean floor but due to discharge of these textile industrial effluent the concentration of Vanadium metal further get increased in ocean that get the water from different water bodies. The values of Vanadium obtained by present research work in effluent waste water which are going to be discharged in to water reservoir ,contaminating whole water bodies.The amount of Vanadium metal in textile effluent waste water is greater than permissible value set by various standard bodies for discharge in to inland water, surface water, ground water. The obtained values are also greater than the quantity of Vanadium which is requird for normal functioning of human physiology.Therefore these dyeing industries are not safe with respect to vanadium metal pollution and when such effluent water through drainage or by any other way find their way in to the lake,pond,river,sea or any other water reservoir then it contaminate the whole water bodies, if this water reservoirs are used for the drinking purpose or if it provides the source of edible fishes then the consumer of this contaminated water and fish get affected by this metal contaminants and it leads to various disease and disorder in human being or any other living organisms.Therefor it is recommended that before discharge of textile dyeing effluents in to water bodies it should be treated carefully so the there will be less chances of contamination and heavy metal pollution.Awareness should also be created among the people regarding the harmful effect of heavy metal pollution and the necessary precaution which are required to get rid of this pollutants.

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