Contamination of Water Resources by Industrial Effluents and Possible Effect of Chromium on Some Bacteria

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Abstract:

There are numerous industries in the world.But there searchers were only able to test the effect of some of these for the presence of heavy metals. It therefore cannot be generalized from this study that all of the industry available contains toxic heavy metals. Different samples were collected from different industrial area. The samples are used to test the contamination of water by industrial effluent. After the primary testing, the samples are sent for outsourcing for the study of chromium. On the basis of chromium contamination, different water sources selected for the study of possible effect of chromium on some bacteria. However, this study can be used as a referenceora foundation for future indepth studies. This research can also serve as an eye-opener to public, manufacturers and the professionals in the health care system. Because it may causesdirectorcumulativeeffects.Thestudy revealed significant concentrations of chromium. The data of this study indicates that the industrial effluents cause the contamination of water resources and the problems arise by different industry to the environment. Further studies will be undertaken to describe heavy metal resistance of microorganisms and its characterization.

Keywords:
Chromium resistance, Heavy Metals, Metal Pollution, Industrial Effluents, Water pollution.

Introduction:

The impact of Industrial effluent releases to water resources concerns with water quality. The criterion listed most frequently in the Water Quality Assessment as a contributor to non-supporting or partially-supportingstatus was heavy Metals. These heavy metals may include lead, arsenic, mercury, zinc, copper, cadmium andchromium. These metals may run off to lakes, rivers or different water bodies. Heavy Metal may cause resistance to the micro organisms due to effluents discharge by different industry. As the chromium is highly soluble due to its oxidizing nature, this study involves the contamination of water bodies by chromium and its possible effect on bacteria.

Material and methods:

Collection of Samples:

Three are as nearby different industries were selected randomly. From each of these areas, different samples were selected to complete a study of the chromium contamination. The top 3 resources samples were selected. These samples were then analyzed for contamination of chromium. Some analysis was done by outs ourcing. For the analysis, the samples were provided in unopened glass bottles subjected to analysis by the facility technician. The researchers as well as the facility technician were blinded as to what specific samples were analyzed. Because these samples were labeled as RA-1, RA-2, and RA-3 respectively. The facility technician then labeled these samples as a third party was present to observe the entire labeling process and may ensure no samples were tampered with.

Preparation of Effluent Samples for AAS:

A measured volume (50ml) of well-mixed, acid-preserved sample was transferred to a flask or beaker. 5ml conc. HNO_3 was added. A few boiling chips or glass beads was added. Sample brought to a slow boil and evaporated on a hot plate to the lowest volume possible (about 10 to 20ml).Heating was continued and conc. HNO_3 was added as necessary until digestion was completed as shown by a light-coloured, clear solution. Sample was not dried during digestion. Flask wall was washed with water and then filtered if necessary. Filtrate was transferred to a 10 ml volumetric flask. Two 5mL portions of water was addedrinsing to the volumetric flask. Cooled, diluted to mark and mixed thoroughly. Portions of this solution used for metal determinations.

Preparation of Standard of Selected Heavy Metals:

The selected heavy metalwas Chromium. For this selected metal, five standards were set for the calibration of the AAS. These are as follows: 0.5000ppm, 1.0000ppm, 1.5000 ppm, 2.0000 ppm and 2.5000 ppm. The calibration curve of well-prepared standards and an accurate Atomic Absorption Spectrophotometer should present as a line or curve.

Atomic Absorption Spectrophotometric Analysis:

Analysis of the heavy metal contents in the effluent samples were done with the use of the Atomic Absorption Spectrophotometer (AAS) following the 700B method of EPA (EnvironmentalProtection Agency) for flame absorption spectrophotometry. The AAS detects the presence of heavy metals. Also, it is designed to provide the concentrations in parts per million (ppm). Three trials were run on each effluent sample in every replicate of the heavy metal. The averages of the concentrations were then taken.

Isolation of bacteria from industrial effluents:

The samples were serially diluted 10 times. Then diluted sample plated in Luria Bertani (LB) agar plates supplemented with 100μg/ml of chromium concentration. All the plates incubated at 37°C for 24-96 hrs. A number of morphologically different colonies are selected and sub-cultured on the same medium for purification. The isolates are characterized on the basis of morphology and some biochemical characteristics using standard bacteriological techniques (Cheesborough, 2000; Holt *et al.*, 1994).

Result and discussion:

Calibration curve for this heavy metal was set to ensure the accuracy of the Atomic Absorption Spectrophotometer. Also it helps to establish the results of the determination were true and reliable. The data on the calibration for Chromium is as follows.

Concentration	Absorbance
0	0
0.5	0.0507
1.0	0.1023
1.5	0.1543
2.0	0.1957
2.5	0.2368

The proper calibration of the Atomic Absorption Spectrophotometer, as evidenced by the linear calibration curves, the water samples were tested and rerun twice for the heavy metal -Chromium. The data on these tests are presented in Table. All data is expressed as parts permillion (ppm).

The concentration of chromium determined in water samples showed variations during the Pre-monsoon and post-monsoon season. The results showed that the pre monsoon season was observed higher values than those of the post monsoon season, relatively. Butstatistical comparison indicates that no significant difference between these results. Chromium is essential for organisms as a micronutrient. But at higher concentrations it showed resistance. The organisms were isolated from chromium contaminated water samples. It indicates that the organisms tolerate the chromium concentration. Therefore, the isolates were grown on LB agar plates supplementing chromium concentration of100µg/ml. The organisms showed growth on this concentration.

Table.1-Pre-Monsoon results of Chromium concentration

Sample No.	Chromium concentration (ppm)			
	1	2	3	Avg
RA-1	0.0142	0.0152	0.0147	0.0147
RA-2	0.0038	0.0046	0.0044	0.0043
RA-3	0.0188	0.0189	0.0195	0.0191
RA-4	0.0256	0.0255	0.0255	0.0255
RA-5	0.0208	0.0214	0.0216	0.0213
RA-6	0.0081	0.0087	0.0087	0.0085
RA-7	0.029	0.028	0.031	0.0293
RA-8	0.0125	0.0125	0.0126	0.0125
RA-9	0.0147	0.0147	0.0147	0.0147

Tables.2-Post-Monsoon results of Chromium concentration

Sample No.	Chromium concentration (ppm)			
	1	2	3	Avg
RA-1	0.0145	0.0146	0.0144	0.0145
RA-2	0.0041	0.004	0.004	0.0040
RA-3	0.0188	0.0187	0.0186	0.0187
RA-4	0.0255	0.0251	0.0248	0.0251
RA-5	0.0209	0.0205	0.0204	0.0206
RA-6	0.0084	0.0084	0.008	0.0083
RA-7	0.0123	0.0122	0.0124	0.0123
RA-8	0.0121	0.0121	0.0122	0.0121
RA-9	0.0138	0.0137	0.0134	0.0136

Table.3-Average results of Chromium concentration

Sample No.	Chromium concentration (ppm)	
	1	2
RA-1	0.0147	0.0145
RA-2	0.0043	0.0040
RA-3	0.0191	0.0187
RA-4	0.0255	0.0251
RA-5	0.0213	0.0206
RA-6	0.0085	0.0083
RA-7	0.0293	0.0123
RA-8	0.0125	0.0121
RA-9	0.0147	0.0136

Table. 4-Biochemical characteristics of different isolates

Isolates	ID-1	ID-2
Gram staining	+	+
Motility	-	+
Oxidase	-	-
Catalase	+	+
Indole	-	-
Methylene blue	-	+
VogusPrauskaur	-	-
Citrate	-	-
Glucose	-	-
Lactose	+	-
Mannitol	+	+

Organism: *Staphylococcus* sp., *Bacillus sp.*

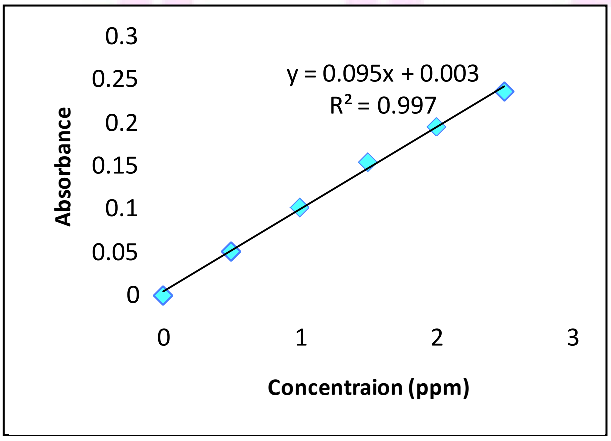

Figure. 1-Calibration graph of Chromium

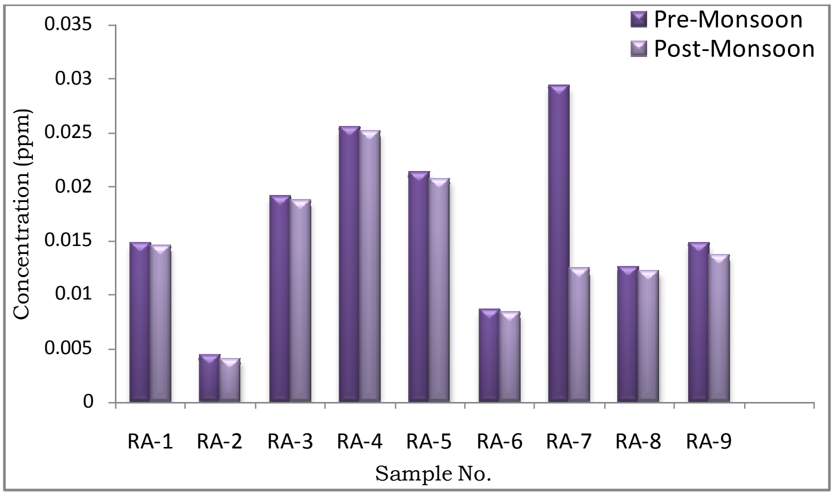

Figure. 2- Representation of Chromium concentration in ppm(Pre-Monsoon and Post-Monsoon)

Conclusion:

The presence of chromium in water bodies can be referred to the heavy metal concentrations in the effluent. Thus, use of industrial wastewater in for agriculture purpose is not suitable. Further discharging to the surface water or wells may have limitations. Therefore, before discharging to the environment it is needed to treat properly and it must meet the characteristic concentration limit. Industrial wastewater is an important source of water pollution and also the underground source of will be contaminated in long term period of time. Water has several limitations.

The chromium has been shown to be present in different concentrations. It has the carcinogenic effects. Thus, it may be toxic to different living animals, plants, human beings and organisms. The effluents also have considerable negative effects on the water quality of the receiving water bodies and as such, they are rendered not good for human use. It is therefore recommended that the careless disposal of industrial wastes without pretreatment should be discouraged. Imposition of direct charges on industrial effluents by the regulating agency, as well as continuous monitoring and surveillance is imperative in order to ensure the protection of water resources

As the some bacteria showed resistance to the chromium, these bacteria can help to remove chromium from contaminated environments. Understanding the regulation of resistance could be useful for biological waste treatment. Another implication is that these bacteria are pathogenic and cause infectious diseases. These diseases are becoming more difficult and more expensive to treat. Thus, we do not need to take care for drastic overuse for water treatment.

References:

1) **Batool R., Yrjala K., Hasnain S., (2012).** Hexavalent chromium reduction by bacteria form tannery effluent; 22(4):547-54.

2) **Cheesbrough M., (2000).** District Laboratory Practice in Tropical Countries. Cambridge University Press, Cambridge.

3) **Cheng S.,(2003).** Heavy metal pollution in China: origin, pattern and control. Environmental Sciences and Pollution Research; 10, 192-198.

4) **Holt J.G., Krieg R.N., Sneath A.H.P., Staley T.J., Williams T.S., (1994).**Bergey'sManual of Determinative Bacteriology 9th Edition. (International Edition).

5) **Malami D.I., Izakaria Z.I., Mohammed M.I. and Audu A.A., (2014)**. Comparison of levels of some metals in the water and sediment from challawa gorge dam, Kano, Nigeria. Bajopas vol. 7. No.1.

6) **Rahmani H.R., (2009).** Study the Most Important Source of Industrial Pollutant Soil, Water and Plant in Yazd Province, Journal of Environmental Studies,Vol. 35, No. 51.

7) **World Health Organization, (1993).** Guidelines for Drinking Water Quality Recommendations, Vol. 1, 2nd Ed., Geneva.

8) **World Health Organization, (2003).** Guidelines for Drinking Water Quality Recommendations, Vol. 1, 2nd Ed., Geneva