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Relative Analysis of Physio-Chemical Characteristics of Secondary Metallurgical Industry Effluent of Vkia And Bagru Industrial Area Phase- II

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ABSTRACT
The study of physiochemical characteristics of effluent discharged from industrial area helps in analyzing the potential threat industrial area posses on quality of ground water and what measures we can initiate to impede the detrimental outcome of effluent discharge. In this investigation we have compared and correlated the physiological characteristics of effluent discharged from the two different industrial area viz Bagru Industrial Area Phase II Extn and Vishwakarma Industrial Area. It was found that the both industrial area posses threat of contaminating and degrading the ground water quality, if the effluent will be discharged without proper treatment. Some positive correlation within the two parameter are suggesting that they released from same industrial process or are treated by the same treatment process
Keywords: *Physio chemical characteristics, Effluent, Metallurgy industries, effluent treatment systems*

INTRODUCTION

Water is a primary driving force for major physical, chemical and biological changes all over the world [1,2].Life cannot be sustained more than few days without water, even inadequate supply of water change the pattern of distribution of organisms as well as human being [1].

Freshwater is a limited resource, which is essential not only for survival of living organisms but also for human activities such as agriculture, industry and domestic needs [1]. The history of freshwater resource utilization is as old as human civilizations [2].

Any significant human activity in the catchment area can produce huge volume of pollutants such as heavy metals, organic pollutants, nutrients, salts and other synthetic compounds [2], which alter the water quality and consequently disintegrate the ecological integrity [3, 4]. The rapid economic growth achieved by most of the developing countries after globalization has adversely affected the quality of the environment, imposed considerable social costs and livelihood impacts, and has become a major threat to sustainable development. Since the citizens of poor countries may not demand a high level of environmental quality, these countries take up export oriented manufacturing which is sometimes pollution intensive.

It is extremely important for developing countries to achieve a critical level of economic growth to mitigate their unemployment and poverty. But the major challenge is to ensure development in an environmentally sustainable manner, so far to achieve a proper trade-off between environment and development.

Almost in all parts of Jaipur city and adjacent areas, a large number of industries have come up during last two decades. Such areas include Vishwakarma, Bagru Industrial Area (Phase I), Bagru Industrial Area (Phase II), Sudershanpura, Bais Godown, Jhotwara, Malviya, Sanganer, Sitapura industrial areas, etc., which play a major role in polluting different water resources..

The study of physiochemical characteristics of effluent discharged from industrial area will help in analyzing the potential threat these industrial area posses on quality of ground water and what measures we can initiate to impede the detrimental outcome of effluent discharge.

STUDY AREA

The study areas are Bagru Industrial Area Phase II extension and Vishwakarma Industrial Area. Bagru is a small village, located at a distance of 30 km from Jaipur, on Jaipur-Ajmer Road. This town is located between north latitude $26^0 48'$ 07" to $26\ ^0 50'18$" and east longitude $27^0 32'07$" to $75^0 34'06$". Bagru Industrial Area Phase II extension is situating nearby the Phase-I Bagru Industrial Area. Vishwakarma Industrial Area is situated in Jaipur district set up by RIICO in 1970. Bagru (Phase II extension) and VKIA Industrial area are dominated by metal finishing industries. Location of VKIA and Bagru is marked in google map below.
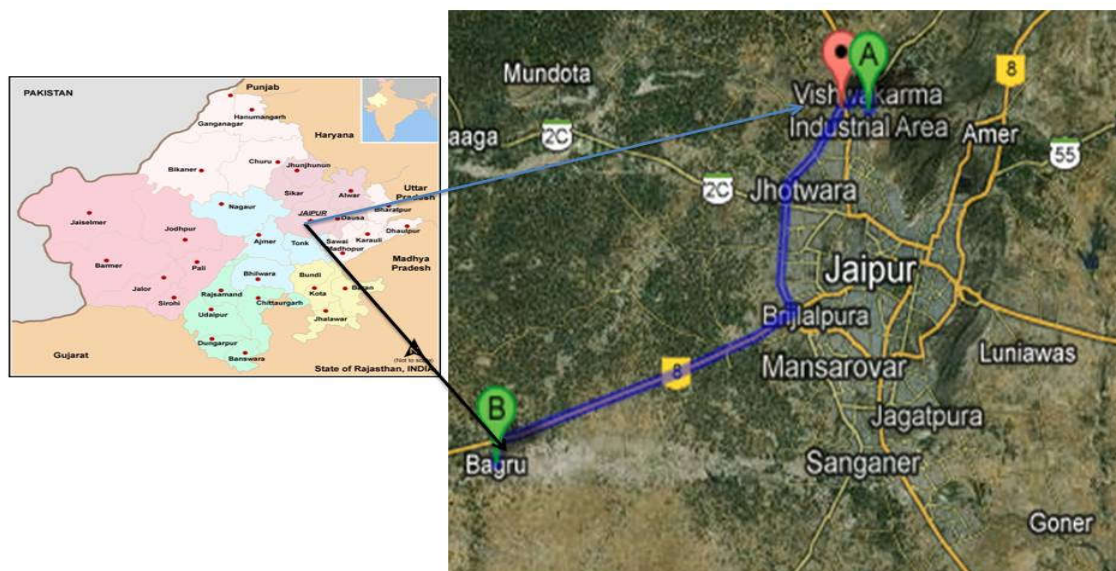

Figure 1: Study Area of Proposed Study

In the metal finishing industries of VKIA and Bagru, Ingots are manufactured by the freezing of a molten liquid (known as the melt) in a mold. Further, these ingots are reheated to manufacture TMT Iron Rods, Billets and etc. Wastewater from metal finishing industries contains contaminants such as heavy metals, organic substances, cyanides, and suspended solids, at levels which are hazardous to the environment and pose potential health risks to the public. Heavy metals, in particular, are of great concern because of their toxicity to human and other biological life. Heavy metals typically present in metal finishing wastewater are cadmium, chromium, copper, lead, nickel, silver, tin, and zinc. The effluent discharged by this industry leads to serious pollution of groundwater and soils and ultimately affects the livelihood of the poor.

EXPERIMENTAL
Collection of samples
The samples were collected from the effluent streams of existing industries of both the industrial areas. The water sample tends to modify itself to the new environment. The essential objectives of water quality assessment are to:

- Define the status and trends in water quality.
- Analyse the causes for the observed conditions and trends.
- Identify the area specific problems of water quality and provide assessments in the form of management to evaluate alternatives that help in decision-making

Collected samples were analyzed for parameters like BOD, COD, pH, F, TSS and metals viz, Ni, Cr (Hexavalent), Total Chromium, Cd, Fe, Zn Cu, Pb, CN by standard methods prescribed by APHA [5].

Method and Apparatus

pH meter - manufactured by EI was used for pH measurement, Digital TDS meter was used to determine the TDS of the waste water sample, The BOD tests were carried out using standard procedure using a five-day BOD test while Chemical Oxygen Demand (COD) was determined by the Dichromate Reflux Method.Nickel, Chromium, Cadmium, Iron, Zinc, Copper, lead, Cyanide and were determined using Atomic Absorption Spectrometer (model AA6800- SHIMADZU) according to APHA, 1998.

RESULTS AND DISCUSSION
Physico-chemical parameters of effluent from industrial areas Bagru and VKI was studied. Parameters like BOD, COD, pH, F, TSS and metals viz, Ni, Cr (Hexavalent), Total Chromium, Cd, Fe, Zn Cu, Pb, CN were analyzed by implementing the standard method of APHA. To assess the quality of treated waste water, each parameter was compared with the effluent discharge standards of CPCB.

Table 1: Summary statistics of Effluent Water Quality of Bagru Industrial Area Phase II extension

Variable	Observations	Minimum	Maximum	Mean	CPCB standards (mg/l)
BOD	26	14.400	18.700	16.242	30
COD	26	110.500	189.230	169.258	250
pH	26	2.090	3.750	3.087	5.5
Ni	26	2.210	5.200	3.305	3
Cr	26	0.050	0.170	0.099	0.1
Total Cr	26	0.250	0.450	0.349	2
Cd	26	0.140	0.260	0.203	2
Fe	26	189.970	289.910	247.853	3
Zn	26	15.230	33.900	21.252	5
Cu	26	1.130	2.250	1.623	3
TSS	26	132.000	189.000	160.308	100
Pb	26	0.960	1.520	1.200	0.1
CN	26	0.184	0.190	0.188	0.2

Table 2: Summary statistics of Effluent Water Quality of VKIA

Variable	Observations	Minimum	Maximum	Mean	CPCB standards (mg/l)
BOD	26	13.240	15.300	14.256	30
COD	26	158.200	190.000	170.888	250
pH	26	1.870	3.000	2.402	5.5
Ni	26	11.600	15.550	13.748	3
Cr	26	0.040	0.110	0.070	0.1
Total Cr	26	0.190	0.410	0.302	2
Cd	26	0.110	1.320	0.648	2
Fe	26	90.200	216.500	116.138	3
Zn	26	15.890	44.210	26.104	5
Cu	26	0.740	1.230	0.998	3
TSS	26	147.000	174.000	159.919	100
Pb	26	0.940	1.380	1.175	0.1
CN	26	0.185	0.190	0.188	0.2

Correlation Analysis: Correlation analysis of wastewater of Bagru Industrial Area Phase II extension and VKIA is summarized in Table 3 &4 respectively.

Table 3: Correlation matrix (Pearson) for Bagru Industrial Area Phase II extension

Variables	BOD	COD	pH	Ni	Cr	Total Cr	Cd	Fe	Zn	Cu	TSS	Pb	CN
BOD	**1**												
COD	0.283	**1**											
pH	**0.426**	0.232	**1**										
Ni	**-0.542**	**-0.424**	**-0.641**	**1**									
Cr	**0.477**	0.364	0.293	-0.352	**1**								
Total Cr	**0.564**	0.240	0.338	**-0.682**	0.352	**1**							
Cd	-0.281	**-0.460**	**-0.474**	0.375	**-0.593**	-0.275	**1**						
Fe	0.105	0.300	-0.132	-0.259	0.031	0.268	-0.083	**1**					
Zn	-0.302	-0.253	0.182	0.345	-0.217	-0.149	-0.074	-0.306	**1**				
Cu	-0.239	-0.241	-0.059	-0.081	-0.073	-0.059	-0.066	-0.099	0.252	**1**			
TSS	0.377	0.016	0.000	-0.251	-0.108	0.116	0.293	0.177	**-0.618**	**-0.436**	**1**		
Pb	0.346	0.367	0.365	**-0.492**	**0.602**	**0.460**	**-0.426**	-0.076	-0.151	0.224	-0.256	**1**	
CN	0.247	0.125	**0.510**	**-0.479**	0.018	0.225	-0.155	0.048	-0.027	0.000	0.125	0.098	**1**
Values in bold are different from 0 with a significance level alpha=0.05													

Table Error! No text of specified style in document.**: Correlation matrix (Pearson) for VKIA**

Variables	BOD	COD	pH	Ni	Cr	Total Cr	Cd	Fe	Zn	Cu	TSS	Pb	CN
BOD	**1**												
COD	**-0.488**	1											
pH	**0.725**	**-0.452**	1										
Ni	**-0.754**	**0.481**	**-0.812**	1									
Cr	**-0.591**	0.337	**-0.653**	**0.688**	1								
Total Cr	**-0.666**	**0.437**	**-0.612**	**0.762**	**0.642**	1							
Cd	**-0.708**	**0.456**	**-0.675**	**0.786**	**0.735**	**0.811**	1						
Fe	-0.307	0.159	**-0.458**	**0.424**	0.294	**0.540**	**0.464**	1					
Zn	**-0.693**	0.382	**-0.723**	**0.741**	**0.773**	**0.528**	**0.663**	0.094	1				
Cu	**0.804**	**-0.506**	**0.703**	**-0.790**	**-0.775**	**-0.718**	**-0.767**	-0.321	**-0.773**	1			
TSS	**0.698**	-0.320	**0.717**	**-0.732**	**-0.615**	**-0.586**	**-0.700**	**-0.456**	**-0.653**	**0.673**	1		
Pb	**-0.795**	0.352	**-0.625**	**0.724**	**0.622**	**0.689**	**0.720**	**0.447**	**0.632**	**-0.759**	**-0.663**	1	
CN	0.165	-0.254	0.340	**-0.405**	-0.077	-0.213	-0.104	**-0.432**	0.040	0.097	0.163	-0.124	1
Values in bold are different from 0 with a significance level alpha=0.05													

With the above result it was found that the parameter like TSS, Fe, Zn and Pb are found above the discharge limit standards prescribed by CPCB in both the industrial area. While, the parameter like Ni is found higher in VKIA industrial and Cr and Total Cr is found higher in bagru industrial area. The higher metal concentration indicates the fairly distribution of secondary metallurgical industries in both the industrial area. While, the higher chromium value in Bagru industrial indicates the dyeing industries contribution also.

No strong positive correlation is observed between any two parameters in the analysis of Bagru region. Only Pb and Cr show some positive correlation suggesting they are released from same industrial process or are treated by the same treatment process.

In case of VKIA, Ni, Pb and Cr shows positive correlation with most of the metals indicating these metals are generated from common process or may be treated by a same treatment process.

CONCLUSION

It is concluded from the study that both the industrial area's effluent characteristics are above the prescribed standards of CPCB. Thus, both industrial possess great threat of contaminating and degrading the ground water quality, if the effluent will be discharged without proper treatment.

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