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STUDY OF WASTE WATER GENERATED FROM STEEL INDUSTRIES ANDTEXTILE INDUSTRIES

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ABSTRACT

The research is carried out to study the quality of water generating from various industries present in MandiGobindgarh in Punjab as MandiGobindgarh is also known as "LohaMandi" because in this district large number of steel factories is located and waste water effluent of Steel industries contains large number of various heavy metals and the study also includes the study of physio-chemical properties of waste water generated from textile industries specifically located in Ludhiana district of Punjab state as Ludhiana's is the largest hub for hosiery manufacturing.The rapidly growing population, urbanization, and industrialization are putting more stress on water resources and in the repercussion of this the quality of water deteriorating day by day due to tremendous industrialization or due to anthropogenic activity. The availability of fresh water for drinking and sanitation services becoming a problem for municipal from both rural to the urbanization.

Keywords: Heavy metals, Waste water, Waste water treatment

- **INTRODUCTION**

In many developing countries the bulk of domestic and industrial wastewater is discharged without any treatment or after primary treatment only (Jayashree Dhote , Sangita Ingoleb and Arvind Chavhan, 2012).From various sources like as in residential areas, commercial areas, industrial properties, agriculture lands etc the waste water is generated. Wastewater contains inorganic substances like solutes, heavy metals, and metal ions, ammonia along with gases, complex organic compounds such as excreta, plant material, food, protein, natural organic matter, nitrate and other pollutants present in surface water, ground water and/or industrial water (Ibraheem et al., 2012).

Domestic wastewater may be treated in centralized plants, pit latrines, septic systems or disposed of in unmanaged lagoons or waterways, via open or closed sewers (UNEP, 1993). In some cases industrial wastewater is discharged directly into water bodies, while major industrial facilities may have comprehensive in plant treatment (Carter et al., 1999; Doorn et al., 2006).

In developed nations, treatment and discharge systems can sharply differ between countries and between rural and urban users, with respect to urban high income and urban low-income users (*Doorn et al., 2006*). The most common wastewater treatment methods in developed countries are centralized aerobic wastewater treatment plants and lagoons for both domestic and industrial wastewater (Duncan Mara; 2013).In fact as far as India is concerned polluted water is one of the major factors behind the general low levels of health in India, especially in the rural areas. Polluted water can lead to diseases such as cholera, tuberculosis, dysentery, jaundice, diarrhoea, etc. In fact, around 80% stomach ailments in India happen because of consuming polluted water (*Samudranil, 2016).*

This research includes the study of physio-chemical properties of waste water generated from steel manufacturing industries located in MandiGobindgarh district it is also known as "LohaMandi" because in this district large number of steel factories is located and waste water effluent of Steel industries contains large number of various Heavy Metals and study also includes the analysis of waste water generated from textile industries located in Ludhiana District because large number of textile industries located in Ludhiana.

Major pollutants in textile wastewaters are high suspended solids, chemical oxygen demand, heat, colour, acidity, and other soluble substance. Environmental problemsof the textile industry are mainly caused by discharges of wastewater (D.A Yaseen& M. Scholz, 2018). Textile industries aremajor sources of these effluents due to the nature of theiroperations which requires high volume of water that eventually results in high wastewatergeneration. Textile effluents are high in BOD due to fiber residues and suspended solids(AEPA, 1998). They can contaminate water with oils, grease, and waxes while some maycontain heavy metals such as chromium, copper, zinc and mercury (EPA 1974**).**

Ground Water Scenario of Mandi Gobindgarh

Water bearing formations in the area mainly include fine to medium grained sand or sand with little admixture of clay. At shallow depth the ground water occurs under unconfined water table conditions and in deeper aquifers occurs under confined conditions. The depth to ground water table in the area ranges from 4.05 m below ground level (mbgl) in the central to 18.10 mbgl in the north eastern parts.

The quality of ground water in shallow aquifers confirm to maximum permissible limits for drinking water standards except along western part where high values of fluoride (1.5 to 2.10 ppm) have been noticed and in central Fatehgarh Sahib showing high values of sodium, zinc, iron, sulphate, nitrate and chloride.

The deeper waters in general are found to be suitable for irrigation and domestic purposes.

Ground Water Scenario of Ludhiana

As per Central Ground Water Board, Ludhiana states that the shallow ground water is getting polluting by heavy metals like copper, lead, manganese and iron. However, in deeper aquifer the concentration of these heavy metals is low as compare to shallow aquifer. The overall review of trace elements analysis indicates that the presence of heavy metals in the ground water at shallow and deeper aquifers, which is due to industrial pollution.

As per Brief Industrial Profile of Fatehgarh Sahib stated that MandiGobindgarh, the Steel Town which was blessed by the sixth Guru of Sikhs Shri Guru Hargobind Sahib as “Steel City” also falls in this district. Today this small city produces 25 percent of the total steel productions of India. So, Industrial effluent also becoming the major concern for sustainable development.

MATERIALS AND METHODS

Samples of wastewater from two steel industries and three textile industries from Ludhiana have been taken and demonstrated the physio-chemical properties and types of heavy metals also demonstrated. Samples were collected in good quality screw capped high density pre sterilized polypropylene bottles, each of 1lt capacity, labeled properly and analyzed in laboratory. Water samples consisting of industrial effluents were collected in sterile sampling bottles. For industrial effluents, samples were collected at the discharge points of each industry. These included: Sample 1 (steel industry), Sample 2 (steel industry), Sample3 (textile industry) Sample4textile industry) and Sample 5 (textile industry).

Determination of phsico-chemical parameters:

During sampling, water samples were analysed on site for Ph by using test method of APHA-4500, 23rd edition 2017, Total Dissolved Solids (TDS) by using test method of APHA-2540C, 23rd edition 2017.

Determination of Heavy Metal Analysis:

This experiment was conducted to assess the levels of some heavy metals, Pb, Cd, Cu, Zn were determined in water samples collected from (Steel Plant) an industrial area and textile industry.

Samples were collected in good quality screw capped high density pre sterilized polypropylene bottles, each of 1lt capacity, labelled properly and analyzed in the NaBL approved laboratory.The selected heavy metals (lead, Zinc, Cadmium, and Chromium,) were analysed by Atomic Adsorption Spectrophotometry (AAS). Along with heavy metal analysis some other parameters were also analysed.

S.NO	SAMPLE
SAMPLE 1	Effluent from Steel Industry1
SAMPLE 2	Effluent from Steel Industry 2

SAMPLE 3	Effluent from Textile Industry
SAMPLE 4	Effluent from Textile Industry
SAMPLE 5	Effluent from Textile Industry

Table 1:- Waste water Samples

Atomic Absorption Spectrometry (AAS) is a very common and reliable technique for detecting metals and metalloids in environmental samples. In order to measure the concentration of heavy metals in water and mud samples, a typical set of standard calibration curves with good linear regression and better relative standard deviations were achieved. Atomic Absorption Spectroscopy (AAS) is the preferred analytical technique due to the following reasons:

FIG1: WASTE WATER SAMPLE COLLECTION

RESULTS AND DISCUSSIONS: Results of phsico-chemical characteristics of all 5 wastewater samples and analysis of quantity of heavy metals in waste water is tabulated below:-

Table 2: Chemical analysis and pH value of wastewater collected from different industries.

Parameters	pH	TDS	Concentration (ppm)			
Samples			**Pb**	**Zn**	**Cd**	**Cr**
Sample 1 (Steel Industry)	6.82	870	0.6	4.9	ND*	1.8
Sample 2 (Steel Industry)	7.24	858	0.4	3.2	ND*	1.4
Sample 3 (Textile Industry)	4.3	25600	0.04	0.07	0.16	0.9
Sample 4 (Textile Industry)	8.1	30000	3.6	2.8	0.25	1.34
Sample 5 (Textile Industry)	8.2	16000	4.31	0.4	0.14	1.5

The selected heavy metals (Lead, Zinc, Cadmium, and Chromium,) were analyzed by Flame Atomic Absorption spectroscopy.

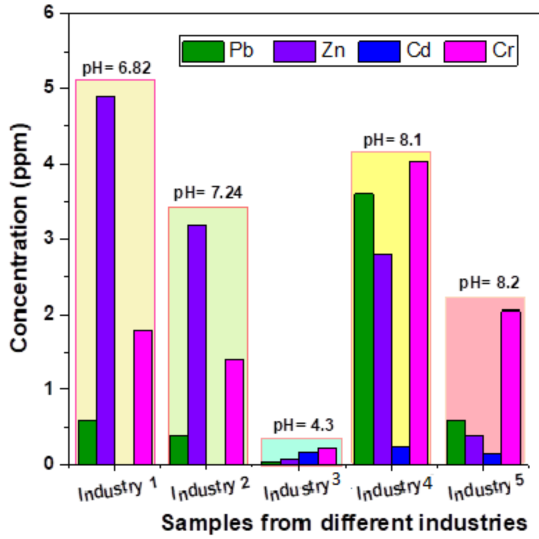

Fig.4.2: Concentration of heavy metals and pH of the different samples.

TABLE3:GENERAL PHYSICAL STANDARDS FOR DRINKING WATER PRESCRIBED BY BIS (IS 10500:2012)

S. No.	Parameter	Inland surface water	Public sewers	Land for irrigation
	2		3	
	.	(a)	(b)	(c)
1	Colour and odour	See 6 of Annexure-1I		See 6 of Annexure-1I
2	Suspended solids mg/l, max.	100	600	200
3	Particle size of suspended solids	shall pass 850 micron IS Sieve	-	-
4	pH value	5.5 to 9.0	5.5 to 9.0	5.5 to 9.0
5	Temperature	shall not exceed 5°C above the receiving water temperature		
6	Oil and grease, mg/l max,	10	20	10

7	Total residual chlorine, mg/l max	1.0	-	-
8	Ammonical nitrogen (as N),mg/l, max.	50	50	-
9	Total kjeldahl nitrogen (as N);mg/l, max. mg/l, max.	100	-	-
10	Free ammonia (as NH3), mg/l,max.	5.0	-	-
11	Biochemical oxygen demand (3 days at 27^{o}C), mg/l, max.	30	350	100
12	Chemical oxygen demand, mg/l, max.	250	-	-
13	Arsenic(as As).	0.2	0.2	0.2
14	Mercury (As Hg), mg/l, max.	0.01	0.01	-
15	Lead (as Pb) mg/l, max	0.1	1.0	-
16	Cadmium (as Cd) mg/l, max	2.0	1.0	-
17	Hexavalent chro-mium (as Cr + 6),mg/l, max.	0.1	2.0	-
18	Total chromium (as Cr) mg/l, max.	2.0	2.0	-
19	Copper (as Cu)mg/l, max.	3.0	3.0	-
20	Zinc (as Zn) mg/l, max.	5.0	15	-
21	Selenium (as Se)	0.05	0.05	-
22	Nickel (as Ni) mg/l, max.	3.0	3.0	-
23	Cyanide (as CN) mg/l, max.	0.2	2.0	0.2
24	Fluoride (as F) mg/l, max.	2.0	15	-
25	Dissolved phos- phates (as P),mg/l, max.	5.0	-	-
26	Sulphide (as S) mg/l, max.	2.0	-	-

27	Phenolic compounds (as C6H50H)mg/l, max.	1.0	5.0	-
28	Radioactive materials: (a) Alpha emitters micro curie mg/l, max. (b)Beta emittersmicro curie mg/l	10^{-7} 10^{-6}	10^{-7} 10^{-6}	10^{-8} 10^{-7}
29	Bio-assay test	90% suivival of fish after 96 hours in 100% effluent	90% suivival of fish after 96 hours in 100% effluen	90% suivival of fish after 96 hours in 100% effluen
30	Manganese	2 mg/l	2 mg/l	-
31	Iron (as Fe)	3mg/l	3mg/l	-
32	Vanadium (as V)	0.2mg/l	0.2mg/l	-
33	Nitrate Nitrogen	10 mg/l	-	-

While survey of the industries it has been observed that being a developing country industrialization growth is important in many ways as it provide employment to many people and that too help in increasing livelihood of the people. It is important for creating employment opportunities, promotion of education, training and research.

It is also observed that present treatment methods for final disposal of effluent are very costly not suitable for medium scale industries. Most conventionaltechniques like as extraction, sedimentation, trickling filterationand chemical oxidation are generally effective but they often prove to be very expensive. The capability to decrease toxic substances to safe levels effectively and at a reasonable cost is consequently very important (A.J. Englande, Peter Krenkel and J. Shamas, 2015).

Accumulating evidences constantly indicate that the transition of the existing industries into eco-industrial network through successful implementation of green approaches provides a viable solution to preserve the natural resources of the region while concurrently enhances the regional economy on a sustainable basis. It calls for an appropriate planning and integrated framework in harmony with the environment, after careful assessment of past and prevailing conditions.

It has been observed that the textile industry uses high volume of water throughout its operation, from the washing of fibers to bleaching, mercerizing, dyeing, printing and washing of finished products.

The present research work deals with the study of four heavy metals (Cd, Zn, Pb, and Cr). The analysis is performed using AAS.

Results indicated that the range of concentration of Cd found in wastewater of textile industry i.efrom 0.14-0.25 mg/l and not detectable in other steel industries.

The concentration of Pb (lead) is found from 0.4-4.31 mg/L has been observed and maximum concentration was found in textile industry.

Results indicated that the range of concentration ofChromium was found from 0.9-1.8mg/l and maximum concentration of chromium was found in steel industry.

The study has shown that almost all the heavy metals are at higher levels or near to the higher level than the prescribed limits as mentioned in table no 3. Especially waste water of textile industry has higher level of all heavy metals. Hence proper treatment methods are needed for waste water treatment before final disposal or to within prescribed limit.

CONCLUSION AND RECOMENDATION

Industrialization, commercialization, growth in population are the important aspects that lead to increased contamination of water sources (Tyagi, et al., 2013). So it is of utmost important to ensure clean and hygienic water to the public (Tiwari, et al., 2008). For ensuring the clean and safe water, there are more treatments available and practiced throughout the world.

The conventional methods of treatment have its own challenges such as environmental hazards, economic feasibility, time spent, energy consumption etc. To overcome these limitations, there is a technology called Nanotechnology, which has its greater extent of application in water treatment area.Removal of contaminants in wastewater, such as heavy metals, has become a severe problem in the world. Numerous technologies have been developed to deal with this problem (Yang, 2019).

As an emerging technology, nanotechnology has been gaining increasing interest and many nanomaterials have been developed to remove heavy metals from polluted water, due to their excellent features resulting from the nanometer effect (Anjum et al, 2016).

Nanoparticle based treatment ensure ecofriendly, environmental friendly, cost-effective, energy and time saving approaches when compared to the traditional and conventional methods of waste water treatment (Prachi, et al., 2010). From the study it is recommended that proper treatment should provide to the industries for discharging waste water to the surface water or make it reusable and it is also recommended to adopt ecofriendly low cost technique for proper treatment of wastewater.

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