Analysis of Physiochemical Characteristics of Industrial Effluents of H.I.E (Industrial State) Haripur.

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Summary: Effluents samples from 6 industries of HIE (an industrial area of Haripur) and two nullahs were collected and analyzed for physio-chemical characteristic. The research result show that temperature of the sample was 23-43 °C, pH from 3.3 – 13 6, total solid from 660-110668 mg/ l, total suspended solid from 114-6590 mg/ l, total dissolved solid from 546-76892 mg/ l, total hardness from 14-268 mg/ l, total alkalinity from 70-3550 mg/ l, dissolved oxygen from 0-408 mg/ l, chemical oxygen demand from 0-644 mg/ l, chloride from 7.1-1952 mg/ l, sulphates from 103-1827 mg/ l and oil and grease from 1.004-3.949 mg/ l. Comparison of these value with the standard show that effluents show deviation from the standard and thus beside effecting the human life, also effect the fertile land and aquatic life.

Introduction

The extent of industrialization of a nation is the measure of its economic development. As Pakistan is a developing country, its development is based on the industrial growth. The soap, ghee /oil, textile, steel and glass etc [1] can make significant and beneficial contribution to a country's overall economic development. Infact, Industrialization has brought immense benefit to the humankind but they have also brought new dangers, largely through waste generation and the manner in which waste is disposed [2]. These wastes in solid, liquid and gaseous form may adversely affect land, water and air, thus causing pollution [3]. This pollution has adverse effect on plants [3-5], animals [6-7] and human being life. Although Pakistan has got a number of industrial units installed but among the demanding industry, fertilizer industry is at the top. The fertilizer industries, installed at Haripur, throwing its waste in air, water and soil without proper treatment that cause great damage to the flora, fauna and the area nearby. Effluents of phosphate fertilizer industry are found to be acidic having pH 1.5-3, while nitrogenous effluents are alkaline having pH 9.0-10.5 due to ammonia. Therefore it is not unexpected that these are harming our environment. Further, most of the fields around HIE (an industrial estate of Haripur) irrigated by natural nullahs have now been contaminated with these toxic effluents. Ghee and soap industries of HIE are releasing biodegradable organic matter in bulk, the natural mullahs are served as a sink for this matter. The aim of this project is to analyze some representative industrial effluent sample collected from various sites and to identify their adverse affects upon the local community surrounding HIE.

Earlier research workers have investigated various parameters in the industrial effluents as well as in drinking water using different techniques and their impact [6-13].

The effluents samples of following industries were selected for analysis,

1-Gul Ghee industry
2-Chemical processing industry
3-Khurshid soap industry
4-Neelam paper mills
5-Hazara phosphate fertilizer industry

Beside these some samples were also collected from the spots where effluents were joining to the natural mullahs, Dotali nullah and Takhara nullah.

Results and Discussion

Table-1 shows that the temperature of the effluent samples was in the range of 23-43 °C. On the basis of National Environmental Quality Standards (NEQS) temperature, all representative samples were found within permissible level except Gul Ghee Industries- II temperature. This increase in temperature of receiving H_2O is due to heat generated due to exothermic reaction or by heating process in industries. This heat may disturb ecological balance. Due to this the suspended solids

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Table- 1: Physico-Chemical analysis of Industrial Effluents.

Sampling sites	Temp (°C)	pH	T.S (mg/ l)	T.S.S (mg/ l)	T.D.S (mg/ l)	T.Hard. (mg/ l)	T.Alk. (mg/ l)	Dissol. Oxy. (mg/ l)	Chem.Ox Demand (mg/ l)	Cl (mg/ l)	SO4 (mg/ l)	Oil & Grease (mg/ l)
Gul ghee Ind.I	24	6.8	660	114	546	48	110	4	412	113	1203	0.388
Gul ghee Ind.II	43	6.8	110668	6590	4478	14	3550	Nil	Nil	422	1808	3.456
Khurshid Soap Ind.	23	13.6	3612	2260	76892	152	1866	Nil	Nil	28.4	1827	3.949
Chemical Processing Ind.	23	9.0	7336	88	7248	106	Nil	408	644	7.1	517	1.004
Neelam Paper mills.	23	11.4	3424	400	3024	268	250	16	176	71	764	1.039
Hazara Phosphate Fertilizer	23	4.3	1228	88	1140	128	Nil	8	12	1952	769	0.742
Dotali mullah	24	9.8	3612	2400	1212	80	300	5	572	177.8	254	0.7822
Takhara mullah	24	6.8	3738	1780	1985	128	70	4	148	27.7	103	0.64
NEQS	40	6-10	-	150	3500	-	-	-	150	1000	600	-

settle at a faster rate about 2.5 times fast at 35 °C than at 0 °C. And this temperature rise leads to faster depletion of oxygen.

pH measurements result show that the value of pH of industrial effluents ranges from 4.3 to 13.6 whereas the acceptable limit given by NEQS is 6 to 10. Samples collected from M/ S Khurshid Industry, M/ S Chemical processing Industry and M/S Gul Ghee Industry II were highly basic while the samples collected from Dotali Nullah and Takhare Nullah were in permissible level. This was due to the dilution of effluents as they are mixed with fresh water.

Suspended solids contain extremely small particles of insoluble substance such as clay, silt, organic matter and microscopic organisms and cause turbidity in H_2O. NEQS recommended value for total suspended solids (TSS) is 200 mg/ lit. But most of the industrial effluents have been found to discharge very high number of TSS. TSS released by Gul Ghee industry II is 6590 mg/ lit. This huge quantity of TSS is severely affecting the ecology of Dotali nullah, which has 2400 mg/ lit TSS.

Effluents taken from chemical processing industry, Hazara phosphates fertilizer and Gul Ghee Industry I have TSS within the required limits as recommended by NEQS, all other have highest as shown in Table-1. Heavy discharge from industries causes an increase in total dissolved solid (TDS) in natural H_2O (such as salt of Ca, Mg, Na, K, Fe and traces of heavy metal).

M/S Khurshid industry has been found to discharge maximum number of TDS i.e. 76892 mg/ lit in natural H_2O and the effluents from the chemical processing industry have 7248 mg/ lit TDS. All other effluent samples taken from different industries have value of TDS within limit as required by NEQS (3500 mg/ lit).

All the effluent samples taken from different sites have chloride ion concentration within permissible limit by NEQS (1000 mg/ lit) except Hazara Phosphate Fertilizer, which has 1242 mg/ lit. This high concentration of chlorides results in an undesirable taste of water and is also corrosive to metal in distributing system.

Only effluent samples taken from Gul ghee industry II and Khurshid soap industries have greater value of alkalinity as compared to the recommended value i.e. 3550 and 1866 mg/lit respectively while the other samples have alkalinity within permissible limits (400 mg/ lit). All the representative effluent samples have sulphate value above the permissible level while the samples from chemical processing industry, Dotali nullah and

Takhara nullah have sulphate value within limit as recommended by NEQS (600 mg/ lit). The presence of dissolved oxygen in water is necessary to keep it fresh and sparkling, but Gul ghee industry II and Khurshid soap industries have nil dissolved oxygen which show high contamination, while the effluent from other sites have very low concentration of dissolved oxygen except from chemical processing industries (408 mg/ lit).

The NEQS recommended permissible limit for chemical oxygen demand (COD) is 159 mg/ lit, but the effluents discharge by Neelam paper mill (176 mg.lit), Gul ghee industry I (412 mg/ lit), chemical processing industry (644 mg/ lit) and Dotali nullah (572 mg/ lit) have high COD. The analysis of samples for oil, grease (Table- 1) , Mn and Zn (Table- 2) show that all effluents have value within permissible limit. Analysis of samples for Cu and Fe (Table- 2) show that only Khurshid soap industry has been found to violate the permissible level (100 mg/ lit) and Gul ghee industry- II (5.2 mg/ lit of Fe and Khurshid soap industry (4.27 mg/ lit of Fe) have Fe value beyond the permissible limit (2 mg/ lit).

Table- 2: Concentration of Mn, Cu, Zn, Fe in the Industrial Effluents .

No:	Sampling sites	Mn (ppm)	Cu (ppm)	Zn (ppm)	Fe (ppm)
1	Gul ghee Ind.1	Nil	Nil	Nil	Nil
2	Gul ghee Ind.11	0.08	0.22	2.86	5.21
3	Khurshid Soap Ind.	Nil	1.39	0.12	4.27
4	Chemical Processing Ind.	Nil	Nil	0.256	2.1
5	Neelam Paper mills.	Nil	Nil	Nil	Nil
6	Hazara Phosphate Fertilizer	0.16	0.25	1.9	1.2
7	Dotali mullah	Nil	Nil	Nil	0.23
8	Takhara mullah	Nil	Nil	1.64	Nil
9	NEQS	1	1	5	2

Experimental

Reagent:

All the chemicals were of A.R. quality and obtained from E. Merck Germany. All the solvents were distilled before use.

Instrumentation:

The instruments used during analysis were pH meter of corning EEL model 12 England and atomic absorption spectrophotometer of Perkin Elmer analyst USA.

Samples:

The sample of effluents from above mentioned industries and mullahs were collected in polyethylene bottles directly from the effluents canals after washing the bottles carefully and rinsing them with the effluents twice before the collection. In order to preserve samples standard techniques were used so that no significant changes occur in the samples composition before the analysis.

Procedure:

The collected samples were analyzed for both physical and chemical parameters like pH, temperature, TDS, SS, TS, total alkalinity, total hardness, dissolved oxygen, a chemical oxygen demand, chloride (Cl^-), SO_4^{-2}, oil and grease. Temperature and pH were recorded in the laboratory. Total hardness and total alkalinity were determined by titration with standard EDTA. TDS, SS, Chloride, SO_4, dissolved oxygen, chemical oxygen demand, oil and grease were also analyzed by adopting standard techniques [1]. Copper, Manganese, iron and zinc concentration were analyzed by atomic absorption spectrophotometer.

Conclusion

From the above investigations it is quite clear that all of the selected industries are discharging toxic material as effluents without any treatment process and there is no strict check and balance from the provincial EPA on the industrial zone. One of the adverse affect of this pollution is on the soil and crops of the nearby region. Most of the fields around the HIE are irrigated on the natural mullahs but now these natural mullahs are highly contaminated by the toxic effluents .As a result fertile lands are going to be converted into dumped pools of toxic chemicals. This practice has affected the soil and ultimately the human beings and animals are affected by using crops from the same soil. The Ghee and soap industries of the region are releasing bulk amount of biodegradable

organic matter in the natural nullahs, which may have adverse affect on aquatic life.

Recommendations

To provide a clean and safe environment tot he population and surroundings of HIE following recommendations are suggested.

It is recommended to setup treatment plants in the industries so that toxic material can be eliminated from effluents before mixing into natural water bodies. For this purpose, the industrial wastes can be filtered by activated charcoal /synthetic resins, electrostatic precipitator, ion exchange method, wet scrabbles, coagulation, aeration, electrodialysis and trickling filter etc.

It is highly recommended to establish recycling plants in order to recycle the industrial wastes. Recycling plants that are used to burn the waste to get rid of it or to use it as a fuel to generate power are in fact one of the cleanest sources of energy power in the world.

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