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Analysis Of Panitat Oil Refinery Effluent- A Case Study

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ABSTRACT

Industrialization at large scale has its unavoidable effect on the environment because plenty amount of industrial effluents are discharged daily in treated or untreated form in the rivers, canals and surrounding area which make its way to ground water and irrigation water. Its useful disposal is still a real problem for the environment and industries. In order to find out a suitable solution for its purposeful use in agriculture, systematic investigations were carried out to characterize physico-chemical properties of the oil refinery effluent. For this purpose, effluent collected from the dumping site of the oil refinery located at Panipat, Haryana was analysed for its physico-chemical properties.

Key Words : Oil Refinery, Effluent

INTRODUCTION

Indian petroleum product consumption has grown by 6.3% over the past 10 years ending 1997-98. The oil demand in India is expected to increase. The indigenous production of oil is 33 MMT. Our import dependence, which is 66.5% now, is likely to go up substantially (Petro-tech 2001).

The refining capacity in the country has reached 110 million tonnes. Indigenous production of oil has been hovering at 32 million tonnes. The problem of providing good quality oil at reasonable price in present scenario assumes significance. Indian refineries have been provided stable and higher returns than the predicted ones under the administered price mechanism (Petro Tech. 2001, Choudhary, 2001, Sangwan and Dhankhar 2010).

In an average petroleum refinery generates a large amount of waste water. This water was contaminated by waste oil and other impurities from refining processes. Effluent generation in the industry obviously depends upon the size and type of work in the industry. The industrial

waste can be defined as end by-product not usable for the industry, hence has been discharged out. The current practices adopted for disposal of the industrial wastes in India includes discharge into public sewers, river or in sea through creeks and gestures and on the land with little or no treatment Lodeiro, P., *et. al.* 2006. (Dhankhar, R. & Sangwan, S. 2004., Dhankhar, R. & Dahiya, JS. 2004., Khan H.J. 2000, Kumar, 2014).

Unlike domestic waste, the industrial waste is very difficult to generalize and it varies from industry to industry. It has been observed that about fifty percent of the wastes are toxic and deleterious. These effluents when discharged into nearby water bodies are known to produce alterations in the hydro-graphical parameters of water bodies (Arther and Vohra, 1995, Rao and Rao, 2002, Bahadir *et. Al.* 2007).

Most of the world's air, water and land resources are now partially poisoned by industrial effluents from industrial processes including those of crude oil and gas. Effluents that are discharged into water or on land cause harmful effects to aquatic organisms, plants, land, as well as on human health.

MATERIAL & METHODS

Haryana is located in north-west India. The natural geographical boundaries of Haryana state are: the Shivalik hills in north; Yamuna river in the east; the Aravali hills in the south-west and the Ghaggar river in the north-west. Panipat and Rohtak are physio-graphically classified as Indo-Gangatic plain and has sub-tropical and semi-arid climate. The major problem is environmental pollution by industrial effluents. One of the major oil refineries in north-west India is located in Panipat.

The effluent collected from the Panipat Oil Refinery was analyzed for different physico-chemical properties viz. Total dissolved solids, Hydrogen ion concentration; Electrical conductivity, Hardness, Calcium, Magnesium, Dissolved oxygen, Free and Total CO_2, Alkalinity, Acidity, Chloride, Sulphate, Iron, Carbonate and Bicarbonate etc.

Total dissolved solids, electrical conductivity were determined as outlined in Gupta (2000). Sulphate , hydrogen ion concentration were analysed as per the procedure outlined in Subramanian (1994). Ca and Mg, chloride, dissolved oxygen and total hardness were estimated as

per the procedure of Trivedy and Goel (1984). Iron, Alkalinity was determined by the method as described by Saxena (1987). Oil and grease were determined by solvent extraction method using petroleum ether as the solvent (NEERI, 1986). The concentration of heavy metals i.e. chromium, lead and nickel was determined by atomic absorption spectrophotometer as per APHA (1985).

RESULT & DISCUSSIONS

Analysis of the effluent and control water was done the laboratory and results found are shown in Table 1. The effluent water collected from oil refinery, Panipat was analyzed for different properties viz. hydrogen ion concentration, electrical conductivity, total dissolved solids, calcium, magnesium, hardness, sodium, potassium, iron, alkalinity, chloride, dissolved oxygen, sulphate, carbonate, bicarbonate and acidity.

The brownish grey coloured turbid effluent was found to be odourless. Total dissolved solids present in the effluent were 1390.70 mg/L which were higher than that of control water (1450.52 mg/L) but lower than that of the central pollution control board (CPCB, 1995). The effluent was slightly alkaline i.e., pH 7.79 while the control water was almost neutral having pH 7.07.

The electrical conductivity of the effluent was lower than the ISI standards while almost equal to the control water which consisted of very low electrical conductivity, 6.23 mmhos/cm. The amount of calcium, 389.48 mg/L and magnesium, 183.78 mg/L of the effluent were found to be in higher amount in comparison to that of control water where it was 42.14 mg/L and 34.98 mg/L respectively. Due to these cations the hardness of the effluent, 203.98 mg/L was also rich. Other cations like sodium and potassium present in the effluent were also in excess amount than that of the control water. The potassium contents, 410.00 mg/L were slightly high in the effluent as compared to that of the control water, 134.0 mg/l used for irrigation.

Carbonates, 13.1 mg/L were also present in effluent and found to be nil in the control water. Whereas, bicarbonates were in great amount, 189.19 mg/L in the effluent leading to the development of high alkalinity, 173.0 mg/L of the effluent. The anions, chloride and sulphate were also higher in the effluent than that of the control water. The dissolved oxygen, 4.5 mg/L was also observed in the effluent.

Refinery effluent at disposal site was found with heavy metals such as chromium, lead, nickel, copper, cadmium and zinc in the range 0.01 mg/L to 4.39 mg/L. There values found are shown in Table; (2).

Table; (1) : Physico-chemical Properties of refinery effluent and control water in comparison with the CPCB (1995) standards

Parameters	Oil Refinery Effluent	Control water	CPCB(Standards)
colour	Brownish grey	Clear	Clear
Odour	Greasy	Odourless	Odourless
Turbidity	Turbid	Transparent	Transparent
TDS	1390.70±0.68	1278.38±0.59	21.00
pH	7.78±0.25	7.07±0.41	5.5-9.0
EC mmohos/cm	6.23±0.49	4.40±0.53	2000
Ca^{2+}(mg /L)	39.48±0.42	42.14±0.27	–
Mg^{+2} (mg/L)	183.78±0.61	34.98±0.49	–
CO_3^{-2} (mg/L)	13.1±0.31	-	–
HCO_3^{-} (mg/L)	189.19±0.52	125.55±0.63	–
Hardness (mg/L)	203.98±0.62	43.68±0.38	–
TA (mg/L)	173±0.36	151.84±0.29	–
Cl^{-}(mg/L)	83.18±0.58	68.00±0.56	600
SO^{-2}(mg/L)	38.78±0.61	17±0.32	–
DO (mg/L)	4.5	6.5	–
PO_4^{-3}(mg/L)	68±0.49	9.00±0.48	–
Fe^{+2}(mg/L)	1.2±0.56	0.19±0.42	–
Oil & Grease (mg/L)	7.5	–	–
Na+ (mg/L)	94.0±0.51	58.0±0.69	–
K+(mg/L)	410	134	–

Mean values ±SD

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Table; (2) : Heavy metals of refinery effluent and control water in comparison with the CPCB (1995) standards

Parameter	Oil Refinery Effluent	Control water	CPCB (Standards)
Zn+2(mg/L)	4.39±0.63	58±0.69	–
Ni+(mg/L)	0.17±0.29	0.02±0.01	–
Cd+(mg/L)	0.01±0.001	–	–
Cr+3(mg/L)	0.120±0.018	–	–
Pb+2(mg/L)	0.080±0.009	–	–
Cu+2(mg/L)	0.05±0.46	0.02±0.05	–

Mean values ±SD

CONCLUSION

The oil refinery effluent was found to be having high amount of nutrients than that of control as well as CPCB standards. The effluent had normal hydrogen ion concentration within the range (5.5-9.0) of Central Pollution Control Board standards (1995). Electrical conductivity, Total dissolved solids and other characteristics were also higher than the control water but within the CPCB standards limit.

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