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Studies on Characterization and treatment of industrial Waste Water near Dera-Bassi area (Pb) in Ghaggar River

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***Abstract*— In our project industrial wastewater in Ghaggar River near dera bassi was collected from various sources and the sample water was characterized for their pollution characteristic. The characteristics was made through the estimation of temperature, pH, EC, TDS, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-}, PO_4^{3-}, F^-, Na^+, K^+, Ca^{2+} and Mg^{2+}. What are the concentrations of different substances in effluents? It provides water quality assessments to governments, the scientific community and the public. Central Pollution Control Board categorized Dera Bassi in Punjab as 'Critically Polluted' area.**

***Keywords*— Potential of Hydrogen (pH), Total Dissolved Solid (TDS), Effluents.**

I. INTRODUCTION

The various types of pollution such as domestic and industrial wastewaters may affect the river water quality .There are two reasons for characteristics and treatment of wastewater prevention of pollution[1] and protecting the public health.The different types of industries located in Dera Bassi area,each producing effluent is of varying wastewatercharacteristics.The Ghaggar, a major river of Punjab originates from the lower Siwalik Hills of Himachal Pradesh[2]. It runs along the foot of the Siwaliks and flows through Haryana and Punjab to Rajasthan and then disappear itself in the sands of the Thar Desert[2]. The previous data of Ghaggar River indicates that the values are not well within the permissible limits[3]. The Central PollutionControl Board has categorized polluted areas on the basis of Expedience Factor[2]. It has categorizedDera Bassi in Punjab as 'Critically Polluted' area.Dera Bassi Industrial Estate is spread in about 150 acres and having more than 200 different sized plots for industries are functional and 12 numbers of industries are non-functional. The remaining plots are vacant which have already been allotted to the entrepreneurs for setting of the industries. Dera Bassi municipal council[1], Mohali district, Punjab, is located on the National Highway No.22, (Chandigarh-Ambala-Delhi Road), 20 km from Chandigarh. It is strategically located near the boundary of Haryana, HimanchalPradesh and Union territory of Chandigarh.

II. OBJECTIVES

Research work is aimed at characterization of waste water with the help of important pollution indicator parameters like pH, BOD, COD, TDS, sulphide, sulphate, hardness, alkalinity, calcium and magnesium. It is also aimed to assess the pollution potential due to effluent discharged by industries inGhaggar River.Jharmal Choe Left side of Ghaggar River. Jharmal Choe received industrial and domestic sewage ofDerabasi in river. Pharmaceuticals industries of this area discharge their effluent in JharmalChoe. Jharmal Choe received industrial and domestic sewage of Derabasi, Lalru and Zirakpur.

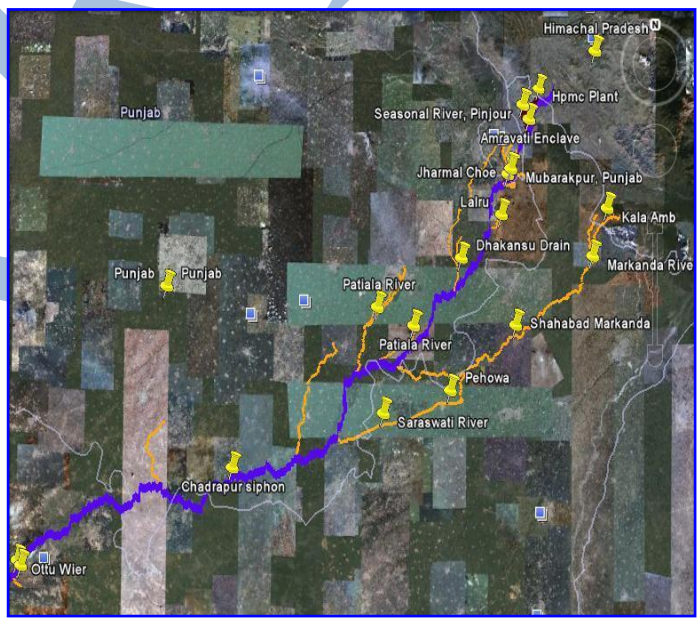

Fig-a

Sukhdev Kunduin year 2012 studied that Ghaggar River System Surface Water Quality for Drinking and Irrigation Purposes[4]. Assessment of water quality[12] has been carried out to determine the concentrations of different ions present in the surface waters. The quality assessment was made through the estimation of temperature, pH, EC, TDS, CO_3^{2-}, HCO_3^-, Cl^-, SO_4^{2-}, PO_4^{3-}, F^-, Na^+, K^+, Ca^{2+} and Mg^{2+}.

III. STUDY SAMPLE

A total of 31 surface water samples were collected from different sources viz., Ghaggar River and its point sources [2](tributaries, choes etc.) The small streams viz. Kaushalya, Jhajra and Ghaggar get combined together near

Chandimandir to form the main Ghaggar River. Further, at downstream sites various point and non-point sources are joining the Ghaggar River and discharging their untreated effluents into it. The area under investigation lies between North latitudes 30˚00′00″ to 30°50′00″ and East longitudes 76˚11′24″ to 77˚07′20″ Area under investigation covers parts of different districts of Haryana and Punjab like Panchkula, SAS Nagar (Mohali), Patiala, Ambala and Kaithal[5]. At the time of sampling,bottles were thoroughly rinsed two to three times with water to be sampled. The physical parameterssuch as pH, electrical conductivity (EC), total dissolved solids (TDS) and temperature were measuredin the field using water and soil analysis kit (Electronics India, Model 16 E). Rest of the characteristics of water samples were measured in the laboratory immediately after transportation to the laboratory. Chloride (Cl^-), sulphate (SO_4^{2-}), phosphate (PO_4^{3-}), fluoride (F^-), carbonate (CO_3^{2-}),bicarbonate (HCO_3^-), sodium (Na^+), potassium (K^+), calcium (Ca^{2+}), magnesium (Mg^{2+}), and total hardness (TH) were estimated using standard procedures. Samples showed high concentration or value of some of the sensitive parameters like temperature, potassium, sodium and pH. River water at most of the sites was highly influenced by the point sources pollutants at the joining points.

IV. PREVIOUS DATA

Sukhdev Kundu also studied the Categorization of Pollution Load in surface Water System using Multivariate Techniques[4]. The pollution loadings in the Ghaggar River Basin surface waters arrive from various point and non-point sources. Multivariate statistical techniques, including cluster analysis (CA), principal component analysis (PCA) and factor analysis (FA), were used to characterize most significant variables and to check their spatial variations[6]. The data sets which contained 15 parameters and 31 monitoring sites were generated during 2006. The significant concentrations of different parameters (highly, moderately and weakly) were determined by using PCA/FA methods[6]. CA results classified the surface water stations based on their similarity and dissimilarity among the parameters.The data sets of the 31 monitoring sites, which comprise 15 water quality parameters monitored for 2006 were subjected for spatial characterization using principle component analysis (PCA)/factor analysis (FA) and cluster analysis (CA) [6].

Some trace elements[7] investigation in surface water of Ghaggar River. In the present study, a total of 21 surface water samples were collected from Ghaggar River from Haryana and Punjab regions during September (2006). Collected water samples were analyzed for seven heavy metals viz., Fe, Zn, Cu, Cd, Pb and Hg. Concentration of heavy metals in the river water exhibited order: Cd > Hg > Fe > Cu > Zn > Pb. High concentrations of heavy metals in the river water may be due to discharge of industrial and agricultural wastes. Some of the trace elements are useful or essential in physiological function of living beings. Al-Khashman [8](2008) attributed the low concentration of trace elements in water to the alkaline nature of the water.

Central Pollution Control Board in year 2009 studiedmany settlements of Ghaggar andHakra rivers[2]. Desk inventory: To carry out the present study, first desk inventory was performed basedon background information available in-house. During desk inventory, sites were finalizedfor the survey & monitoring of the basin as per satellite image (fig-a) of river Ghaggar. Theconcerned State Pollution Control Boards (SPCBs) were also informed about the2programme to depute those officers who have sufficient knowledge of drains, industries etc.discharging into the river in their areas to accompany with the CPCB's team.Wet Inventory: The team visited the Ghaggar Basin spread over the areas of HimachalPradesh, Haryana, Punjab, and Chandigarh& Rajasthan during September 2009. Theidentified sampling points from the possible sources were selected as outlets of drains,Sewage Treatment Plants (STPs) and industries and confluence points of the river with itstributaries. The sampling locations are summarized in Table 1.

Table-1: Sources of Effluent and Sewage discharging into River Ghaggar

Left side	Right side
Jharmal Choe a combined source of Sewage &Industrial Effluent of Derabasi, Lalru and Zirakpur	Sukhna Nalla (Parwanoo)
Markanda River a combined source of SewageIndustrial Effluent of Jatawala Nalla,)	Seasonal Rivulet at Pinjore, Kalka

A large number of rivulets and Choes bring their surface run-off into river Ghaggar from left and right sides.Jatawallah Nallah (left side): Sample was collected at downstream of Jatawallah Nallah, Kala Amb-Himachal. In Kala Amb, Himachal Pradesh, there are more than 200 industries comprising M/S Ruchira Paper Mills Ltd. (RPL), Steel Rolling mill, Pharmacutical Units etc. Industrial wastes alongwith untreated sewage of Kala Amb area falls directly into JatawalaNallah which ultimately meets the River Markanda. BOD load at Jatawalla Nalla was very high i.e. 1270.08 kg/day. BOD and TSS concentration was observed as 84 mg/l and 1930 mg/l, respectively.

V. STUDY AT JATAWALLAH NALLAH (HARYANA)

Jharmal Choe[2] received industrial and domestic sewage of Derabasi, Lalru and Zirakpur. Flow could not be measured due to heavy rains. BOD concentration at Jharmal Choe was 17 mg/l which is within the prescribed norms.Ghaggar River at Tiwana Village (Jharmal Choe) receives domestic and industrial sewage of Derabasi and Lalru. This sewage is directly discharged into Ghaggar Riverat Tiwana Village. Pharmaceuticals industries of this area discharge their effluent in Jharmal Choe in Table-2. BOD concentration at this point was observed as 4.6 mg/l which is above the prescribed standard.

Table-2: Industries inspected in Ghaggar Basin

Industry name	Region	Nearby drain	Remarks
ChandigarhDistillery	Banura, Patiala, Punjab	Jungapura Drain	Poor house-keeping and effluenttreatment plant condition
Nahar Ltd.	Punjab	Jharmal Choe	Not proper maintained house-keeping and ETP.
SuryaPharmaceuticals Ltd.	Banura, Patiala, Punjab	Jungapura Drain	Poor house-keeping/spillage of oil and bad ETP condition.

Table-3: Pollution Load of Ghaggar Basin from Drains

Location	Flow MLD	Parameters				BOD load Kg/day
		BOD	COD	pH	TSS	
BaltanaDrain,Chandigarh	14.43	57	157	7.5	107	822.5
Jatawalla Nalla, Haryana	15.12	84	246	9.7	1930	1270.08

Table-3 indicate that Baltana Drain, Chandigarh Jatawalla Nalla have very high level of BOD, COD & TSS concentration.The qualityof effluent generated from M/S Chandigarh Distillery and M/S Surya Pharmaceuticals is notsatisfactory. TSS, BOD, COD level of Surya Pharmaceuticals is not meeting the prescribedstandards. Wastewater generated from M/S Surya Pharmaceuticals is 43 kld and in-housemaintenance of the ETP is very poor.

Table-4: BOD Profile of River Ghaggar during 2004-06

AREA	2004			2005			2006		
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
MUBARAKPR (Punjab)	0.6	2.6	1.5	1.0	3.2	2.1	1.2	4.4	3.3
Tiwana Village, Punjab	0.6	3	1.7	2.4	8.0	4.3	8.0	10.0	9.3

This table-4 indicates that the results of BOD parameter monitored during the above stated period at Mubarakpur (Punjab), Tiwana Village (Punjab).In 2004 minimum value of BOD in Punjab. In 2005, at Mubarakpur, Punjab BOD concentration was found below the prescribed standard. In 2006, Maximum concentration was observed at Tiwana Village, Punjab. Maximum and Mean values of BOD were always above the prescribed standard.

Table-5: BOD Profile of River Ghaggar during 2007-2009

AREA	2007			2008			2009		
	MIN	MAX	MEAN	MIN	MAX	MEAN	MIN	MAX	MEAN
MUBARAKPR (Punjab)	0.8	3.4	2.1	3.6	10	5.4	3	24	11.85
Tiwana Village, Punjab	4.2	16	8.2	4.2	32	18.1	2	46	17

In 2008, all values found in Table-5 were always found above the prescribed standards. Similar pattern was observed in all locations. It may be indicated that Punjab BOD concentration was maximum during 2005-09 except 2007. The BOD concentration was always found above the prescribed standard. In 2009, BOD level was observed as high as compared to previous years at all monitoring points. Jharmal Choe (Punjab) is receiving industrial and domestic sewage of Derabasi, Lalru and Zirakpur. Flow of the choe could not be measured due to heavy rain. The BOD concentration at Jharmal Choe is 17 mg/l.A complaint received from Govt. of Rajasthan, CPCB[2] conducted ajoint inspection in the year 2001 and identified major polluting sources in Haryana,Punjab, Chandigarh and Himachal

Pradseh. Based on the findings of the report, CPCBIssued directions under 18 (1) (b) of Water (Prevention & Control of Pollution) Act, 1974to Haryana State Pollution Control Board, vide letter no. A-14011/1/2001/SUR dated06.02.2001/12.02.2001 for initiating actions against polluting industries andmunicipalities.

During 2007-08, CPCB conducted joint monitoring with concerned SPCBs at InterstateBoundaries of River Ghaggar and arranged review meetings with the SPCBs/PCC.Action Plans were prepared for remedial measures. The results were placed on CPCB'swebsite for mass awareness of the situation pollution through issue of directions under Section 33(A) of Water Act by concerned SPCB.Sewage Treatment Plant at Derabassi needs to be installed. Further study of Ghaggar River in needed for quality of water.

Arun Kumar in 2011 studied thatHydro-geochemical characteristics of groundwater of Sirhind Nala sub-basin (Ghaggar river basin, India) in relation to salinity hazard[9]. Hydro-geochemical investigation of groundwater of Sir hind Nala sub-basin of the Ghaggar river basin (Southwest Punjab) has been carried out to study the distribution and sources of various dissolved ions[13]. The levels of EC indicated that high salinity of groundwater was confined to small patches. The variations in EC levels seem to be related to non-flushing of water entrapped by clay beds, predominant in the region. High concentrations of SO_4^{2-}, K^+, $NO_3^-$and Cl^- indicated influence of anthropogenic activities. The present study reveals that the water quality of the Sir hind Nala sub-basin has significantly deteriorated; which makes it unfit for drinking, as well as for agricultural purposes.

Nazam Khan in 2013 studied that Ghaggar River impact of Polluting Agents and Microbial Components in River Water[10]. Water samples under investigations were

Collected from Panchkulla during February and March 2010 at the interval of 15 days from 5 different sites each at 50 m distance. The Physico-chemical parameters include temperature and turbidity, pH, total solids, Ca^{2+}, alkalinity, BOD, COD and the Inorganic constituents (Magnesium and Sulphite). Allthese are most significant parameters contributing to water quality variations and are responsible for water quality variations werecompared with standard values[11] provided by World Health Organization (WHO).The study suggested that the Quality of water of riverGhaggar become deteriorated in this area because of effluent discharge and unhygienic personal practices. The frequent effluent ofsanitary discharge in river Ghaggar should be stopped or discharged after proper treatment.

VI. CONCLUSION

The present study was aimed to investigate the water ofRiver Ghaggar, an important river of Haryana state situated in northern part of India, this river originated from outer range of mountain Himalaya Further, at Punjab sites various point and non-point sources are joining the Ghaggar River and discharging their untreated effluents into it. Physical and chemical properties of water samples were highly affected by contaminants. Samples were collected from five different points which were identified and having 50 m distance at time interval of 15 days. Differentparameters were studied and compared with standardvalues provided by W.H.O.

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