

# IMPACT OF UNPLANNED INDUSTRIAL WASTE DISPOSAL ON THE QUALITY OF GROUND WATER: A CASE STUDY OF HISAR INDUSTRIAL AREA

**Megha Bedi**  
Civil Engineering  
Department

MM Engineering College  
Maharishi Markandeshwar  
University  
MullanaAmbala  
bedimeghaa@gmail.com

**Satyam Gupta**  
Civil Engineering  
Department

MM Engineering College  
Maharishi Markandeshwar  
University  
MullanaAmbala  
satyam19992@gmail.com

**Annu**  
Civil Engineering  
Department

MM Engineering College  
Maharishi Markandeshwar  
University  
MullanaAmbala  
annubalhara91@gmail.com

## ABSTRACT

Hisar is one of the fastest industrializing cities of Haryana. Major industries include stainless steel strips, cotton yarn, sewing thread, medicines, gaur gums, m.s pipes and alloy steel ingots. Solid waste from industrial units is dumped near the factories which on reaction with infiltrated rainwater reaches the groundwater level. Untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills also contaminate groundwater. The present study monitors the effect of industrial effluents on the quality of groundwater. Samples were collected from auto factory, pop factory, steel industry, pipeline industry and paper con industry located in the Industrial area and physiochemical characteristics of groundwater samples were studied. Results obtained were compared with the standards prescribed by WHO and BIS. The results show that most of the physiochemical parameters were found within the permissible limits suggesting that the hand pump water is quite suitable for domestic purposes by workers. However, the values of chloride, total organic carbon (TOC) and total solids (TS) were found beyond the prescribed limits suggesting that the hand pump water is not portable for drinking purposes. Study also revealed that Steel Industry and Auto factories show maximum values for most of the parameters indicating that these have maximum impact on the quality of groundwater.

## Keywords

Groundwater pollution, industrial effluent, physiochemical analysis

## 1. INTRODUCTION

Hisar is one of the fastest industrializing cities of Haryana and lies between  $29^{\circ} 10' N$  and  $75^{\circ} 45' E$  and 215.2 m above the sea level. The area of Hiar district is 3787 km<sup>2</sup> and approximately 166 thousand people reside in the urban area (Garg, V. K., 2007). It is

surrounded by Fetahabad district in the North, Bhiwani district in South, Jind & Rohtak district in east and Rajasthan in the west. The geographical area of the district is 11% of the state. Hisar is India's largest galvanized iron manufacturing city. Due to presence of a large steel industry, it is also known as "The City of Steel" (Source: Wikipedia).

Major industries in the industrial area include stainless Steel Strips, Cotton Yarn, Sewing Thread, Medicines, Gaur Gums, M.S Pipes and Alloy Steel Ingots (Ministry of MSME, Govt. of India, 2008). Solid waste from industrial units is being dumped near the factories, and is subjected to reaction with percolating rainwater and reaches the groundwater level. Also, it is possible for untreated waste from septic tanks and toxic chemicals from underground storage tanks and leaky landfills to contaminate groundwater.

The research will provide an insight to the quality of hand pump water in the industrial area and whether or not it is fit for drinking. The objectives of the study is to analyze the physiochemical characteristics of groundwater samples collected from Auto Factory, POP Factory, Steel Industry, Pipeline Industry and Paper Con Industry located in the Industrial area and to compare the results obtained with the standards prescribed by World Health Organization (WHO) and Bureau of India Standards (BIS).

## 2. MATERIALS AND METHODS

In order to evaluate the groundwater quality in the industrial area water samples were collected from hand pumps installed in or near 5 different types of industries (Figure 1) namely auto market, pop factory, steel pipe line industry, steel industry and paper con. Table 1. shows the approximate age of hand pumps and the running hours collected by field survey.

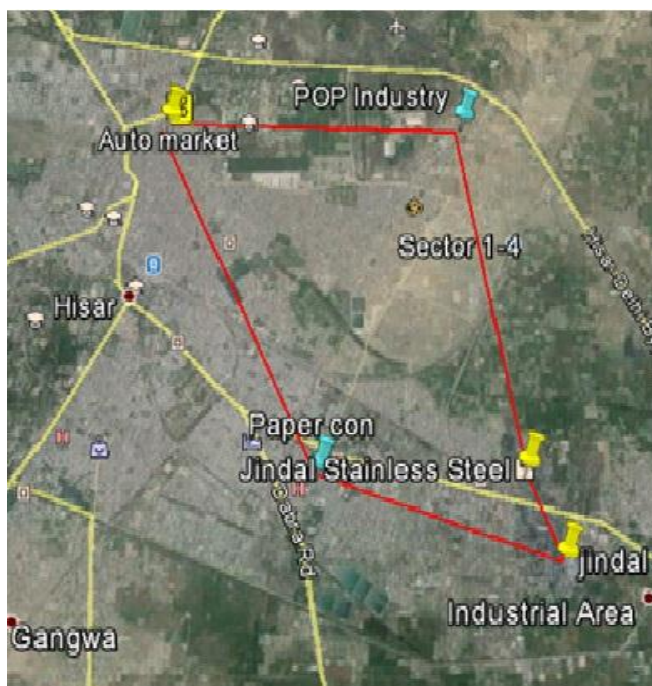


Fig 1: Sampling points in industrial area

Table 1. Hand pump age and running hours of the selected locations

Sample No.	Sample location	Hand Pump Age	Running Hours
1	Auto market	12	20
2	POP factory	10	18
3	Steel Industry(pipe line)	12	18
4	Steel Industry	11	18
5	Paper cone	12	20

The samples were tested for important physiochemical parameters namely pH, temperature, turbidity, acidity,

TABLE 2. Physiochemical analysis of selected groundwater samples

PARAMETER	Auto Market	POP Factory	Steel Pipe Line Industry	Steel Industry	Paper con
pH	8.23	8.332	8.156	8.416	8.831
Temperature ( $^{\circ}$ C)	28.3	28.2	28.2	28.1	28
Turbidity (NTU)	1	0	0	1	0
Acidity (mg/L)	12	12	8	8	8
Carbonate	16	15	13	17	18

carbonate alkalinity, bicarbonate alkalinity, total solids, chloride, sulphate, permanent hardness, total hardness and total organic carbon using standard methods (APHA, 1995).

### 3. RESULTS AND DISCUSSIONS

Samples were collected from 5 dominant industries in Hisar industrial area in order to monitor the impact of both solid and liquid waste from the industries on the quality of groundwater. Table 2 shows the results of the experiments. pH was observed in the range of 8.3-8.8 and temperature of  $28^{\circ}$ . The value of chloride was found exceeding the permissible limit for drinking water in the range of 261.63 to 467.34 mg/L. Chloride concentrations in excess of about 250 mg/litre can give rise to detectable taste in water (World Health Organisation, 1997). Groundwater samples also showed high values of total solids in the range of 1000-2000 mg/L. Steel pipeline industry showed maximum values for both the parameters 1979.2 mg/l and 6400 mg/L respectively. Due to seepage effect of various contaminants from industrial waste the concentration of total organic carbon was also found in excess of the prescribed limit having range of 1.5 to 3.5 mg/L.

The results (Table 2) show that most of the physiochemical parameters were found within the permissible limits (BIS, 1991 and WHO, 1997) suggesting that the hand pump water is quite suitable for domestic purposes by the residents. However, the values of chloride, total organic carbon (TOC) and total solids (TS) were found beyond the prescribed limits suggesting that the hand pump water is not portable for drinking purposes. Study also revealed that Steel Industry and Auto factories show maximum values for most of the parameters indicating that these have maximum impact on the quality of groundwater.

Alkalinity (mg/L)					
Bicarbonate Alkalinity (mg/L)	76	60	124	64	96
Permanent Hardness (mg/L)	88	28	68	24	16
Total Hardness (mg/L)	122	48	94	46	20
Total Suspended Solids (mg/L)	1200	600	400	400	200
Total Solid (mg/L)	2000	1200	6400	1000	1200
Chloride (mg/L)	397.44	369.47	1979.2	467.34	261.63
Sulphate (mg/L)	0.576	0.578	3.128	0.164	0.412
Total Organic Carbon (mg/L)	2	1.5	3.5	1.5	2

#### 4. CONCLUSIONS

Results have shown that most of the physiochemical parameters were found within the permissible limits indicating that industrial activities in Hisar are not polluting groundwater to a larger extent although the hand pumps are not safe for drinking purposes. Since the residents of industrial area and the workers in the industries are all dependent upon the ground water for their daily needs, it is very important to have planned disposal of the industrial effluents and solid wastes so as to conserve the existing groundwater aquifers. For making the water portable treatment plants may be installed to maintain the availability of clean and fresh water resource in the area.

#### 5. REFERENCES

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