

## Overall Analysis of Groundwater Samples for Drinking Quality in Eight Districts of the Malwa Region of Punjab

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### ABSTRACT

This paper presents the groundwater quality of Malwa region of Punjab. 240 Villages from the eight districts were selected for the study and compared. The parameters studied were PH, total alkalinity, total hardness, turbidity, total dissolved solids, sodium, potassium, calcium, magnesium, Sulphate, nitrate, chloride, , iron, lead, arsenic, cadmium, chromium, zinc, mercury sand specific conductance or conductivity. From overall analysis, it was found that there was a variation in the physico-chemical parameters among the groundwater samples studied from the eight districts i. e. Bathinda, Muktsar, Ferozpur, Faridkot, Mansa, Moga, Barnala and Sangrur. Comparison of the physico-chemical parameters of the water samples with **BIS** limits showed that the groundwater is highly contaminated and not fit for human consumption and domestic applications.

**Keywords:** Groundwater, Water Quality parameters, BIS Guidelines, Malwa region, Punjab.

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### I. INTRODUCTION

Punjab is one of the leading food grain producing states in India. It is also the region with the highest cancer rates. The cancer prevalence (per million per year) in the Malwa region is indicated to be 1089. Four of the 11 districts in the Malwa region are most afflicted by various cancers: Muktsar, followed in order by Mansa, Faridkot and Bathinda (DHFV, 2013). Studies indicate that drinking water, particularly in the Malwa belt, can be a source of heavy metals, including fluoride and pesticides (Sharma R., 2012; Aulakh M. Khurana M, singh D,2009).

The surface and sub surface water become contaminated due to Increasing population and

necessities (Dhiviyaa Pranavam, 2011). Studies indicate that excessive use of mineral fertilizers and pesticides has led to water and soil contamination, affecting farming communities (Singh, 2008). The area under study is used for agriculture all over the year but many industries like thermal power plants, fertilizer factories, chemical factories, cement factories are established in the region. The indiscriminate use of pesticides, fertilizers, as well as poor groundwater quality is considered to be the main reasons for the high incidence of several diseases in the Malwa belt (Koutros S, 2010).

### II. MATERIALS AND METHODS

#### Study Area

The study area comprises of eight districts of the Malwa region in Punjab as shown in table 1. Overall 240 groundwater sources (locations) showing distribution as 61 from Bathinda, 36 from Muktsar, 33 from Ferozpur, 14 from Faridkot, 48 from Moga, 28 from Mansa, 10 from Barnala and 10 from Sangrur

in 8 districts of Malwa Punjab were selected for monitoring from where the people are getting water mainly for drinking purposes. All these water samples were taken from hand pump. The map of the study region and the geological map of Punjab is given in Figure 1.

**Table 1:** District Wise Number Of Groundwater Samples Taken From Study Area

Survey 2010-2012	
District	Number of Water Samples Taken
Bathinda	61

Muksar	36
Faridkot	14
Ferozpur	33
Moga	48
Mansa	28
Barnala	10
Sangrur	10
Total	240

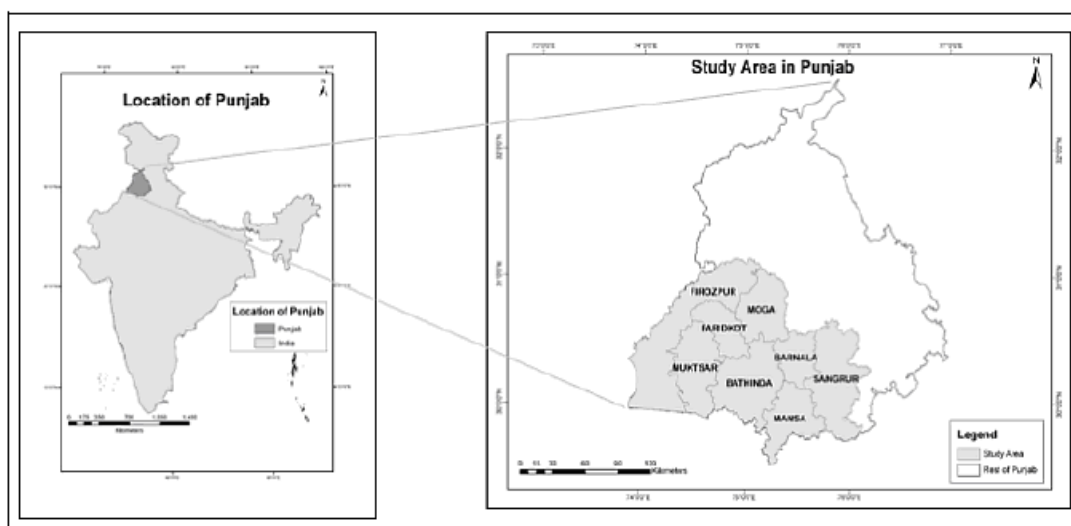


Figure 1: Site Map of Study Area in Malwa Region of Punjab.

**Methods**

A total of 26 water quality parameters were analyzed in collected water samples as shown in table 3. Field work began immediately after the identification of 240 villages in the study area from a period of May 2010 to May 2012. Samples were collected into pre-cleaned, into 5 L pre-cleaned, acid washed high density linear polyethylene sample bottles. The

parameters viz. pH and conductance were determined immediately after collection. For determinations of the other parameters, the storage and preservation of the samples were done following standard procedure (APHA,1998). The sample collected from study areas were analyzed by using different methods as shown in table 2.

Table 2: Methods used for estimation of various physical parameters of groundwater

Name of parameter	Instrument used for determination	Method used	Method reference
pH	pH meter	-	APHA (1998)
Conductivity	Conductivity meter	-	Trivedi and Goel (1986)
TDS	TDS meter	Evaporation	Trivedi and Goel (1986)
Total hardness	Burette	Titration	Trivedi and Goel (1986)
Calcium	Burette	Titration	Trivedi and Goel (1986)
Magnesium	Burette	Difference	Trivedi and Goel (1986)
Sodium	Flame photometer	Calibration	APHA (1998)
Potassium	Flame photometer	Calibration	APHA (1998)
Chloride	Burette	Titration	APHA (1998)
Nitrate	Spectrophotometer	Phenol disulfonic acid	APHA (1998)
Fluoride	Spectrophotometer	SPADNS	APHA (1998)
Heavy Metals	Polarograph and atomic absorption spectrophotometer	Standard addition	Khandekar and Mishra (1984)

**Table 3:** Categories of Different Analyzed Water Quality Parameters

Category	Total Parameters	Parameters
Aesthetic and Physical	7	Color, Odor, Taste, Turbidity, pH, Temperature
Chemical-I (Macro Constituents)	12	EC, Bicarbonates, Alkalinity, Calcium, Magnesium, Hardness, Sodium, Potassium, Chloride, Sulfate, Nitrate, Phosphate, TDS
Chemical II (Trace and Ultra Elements)	7	Fluoride, Arsenic, Cadmium, Chromium, Mercury, Lead, Zinc

### III. RESULTS AND DISCUSSION

The results revealed that there were considerable variations in the examined samples. Water quality parameters were compared with the given permissible values of BIS (Bureau of Indian Standards, 2012) which shown most of the groundwater samples were

falling beyond permissible limits and their overall percentage of unfitness for human consumption. The results of analysis of various physico-chemical parameters of groundwater of Malwa region was summarized in table 4 given as:

**Table 4:** Percentage of Samples Beyond Permissible Limits (Punjab)

S. No	Parameter	IS: 10500	IS: 10500	Units	Total Number of Samples taken	No. of Samples beyond Permissible Limits	%age of Samples beyond Permissible Limits
		Desirable Limit	Permissible Limits				
1	Colour	Colourless (5)	Colourless (15)	Hazen	240	50	21
2	Taste	Tasteless	Tasteless	-----	240	122	51
3	Odour	Unobjectionable	Unobjectionable	-----	240	72	30
4	pH	6.5-8.5	No relaxation	-----	240	49	20
5	Turbidity	1	5	NTU	240	146	61
6	TDS	500	2000	mg/l	240	73	30
7	Total Hardness	300	600	mg/l	240	65	27
8	Alkalinity	200	600	mg/l	240	73	30
9	EC	750	3000	µs/cm	240	187	78
10	Ca	75	200	mg/l	240	73	30
11	Mg	30	100	mg/l	240	174	73
12	Na	200	200	mg/l	240	92	38
13	Cl	250	1000	mg/l	240	144	60
14	SO <sub>4</sub>	200	400	mg/l	240	96	40
15	F	1	1.5	mg/l	240	174	73
16	NO <sub>3</sub>	45	No relaxation	mg/l	240	219	91
17	Pb	0.01	No relaxation	mg/l	240	219	91
18	As	0.01	0.05	mg/l	240	161	67
19	Cr	0.05	No relaxation	mg/l	240	128	53
20	Cd	0.003	No relaxation	mg/l	240	152	63
21	Hg	0.001	No relaxation	mg/l	240	223	93
22	Zn	5	15	mg/l	240	11	5
23	Fe	0.3	No relaxation	mg/l	240	98	41
24	K	12	No relaxation	mg/l	240	235	98

The contamination issue is more serious from health point of view both in urban and rural communities. It is matter of encouraging that the concentrations of trace elements viz. Pb, Cd, Cr, Hg, F and As etc. were found in most of water samples beyond permissible limits. Similarly, other parameters viz. pH, Total dissolved Solids (TDS) and Zn with most of the water samples were found within permissible limits. The Turbidity and Hardness due to Magnesium are found on higher side in 61% and 73%

water samples respectively as a whole. On the same pattern, 73% water samples have been identified with high Fluoride values than that of BIS guidelines. The 30% water samples have excess concentration Calcium ions may be due to calcareousness of land parent materials in Malwa Punjab. More than 98% and 38% water samples have more ionic concentrations of Potassium and Sodium than permissible limits. The NO<sub>3</sub> concentration in 91% water samples has been determined beyond the

permissible limits (BIS, 2012). Overall groundwater quality picture can be seen in Figure 2.

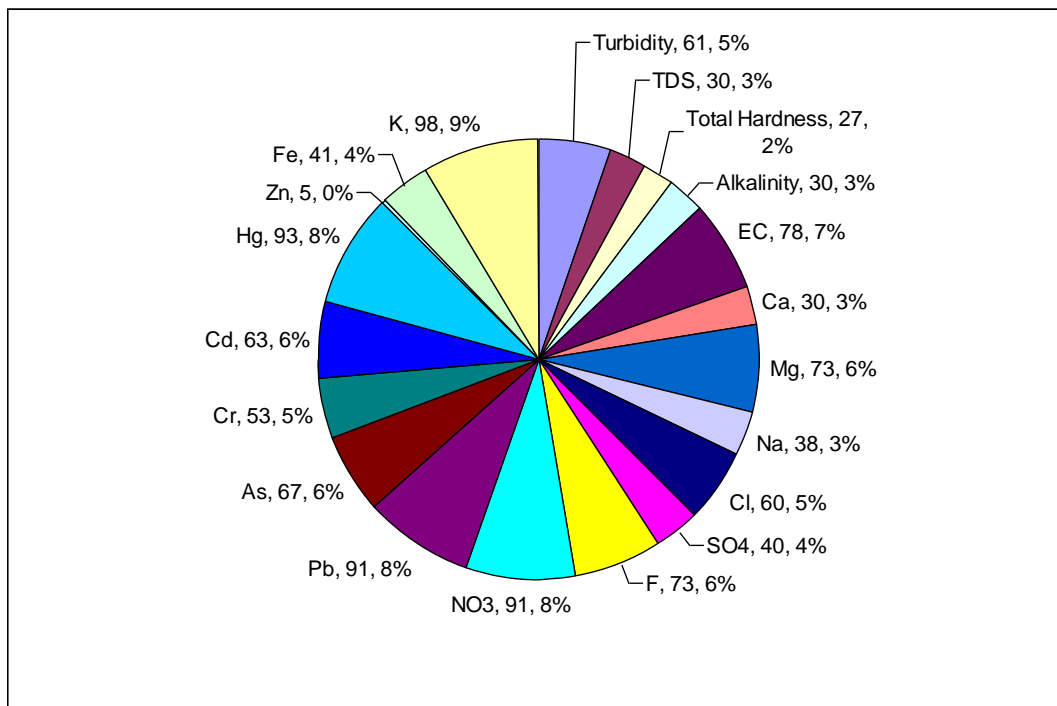


Figure 2: Pie Chart Showing the Total Groundwater Quality of Malwa Area of Punjab

Thus, on the basis of results found, it can be said that the groundwater of the Malwa region is highly contaminated with various physico-chemical

parameters and Heavy metals and thus, not suitable for drinking purposes.

#### IV. CONCLUSION

On the basis of Table 4 and Figure 2 it was concluded that the groundwater samples of the eight district of the Malwa region was contaminated with various physico-chemical parameters and these parameters

are present above the permissible limits of BIS (Bureau of Indian standards, 2012). Thus, the Malwa Punjab is highly contaminated with groundwater pollution.

#### REFERENCES

- [1]. American Public Health Association; 1998. APHA. Standard methods for the examination of water and waste water.
- [2]. Aulakh M. Khurana M, Singh D. water pollution related to agricultural, Industrial, and urban activities and its effects on the food chain: case studies from Punjab. Journal of New Seeds. 2009; 112-137.
- [3]. Bureau of Indian Standards (BIS), 2012. Indian standard specification for drinking water. New Delhi, India. BIS publication No. IS:10500.
- [4]. DHFW. State Wide Door to Door Campaign, Cancer Awareness and Symptom Based Early Detection, Government of Punjab, Chandigarh, India. Directorate of land Reclamation Punjab, Irrigation and power Department, canal Bank, Mughalpora, Lahore. Assessment of surface Water for Drinking water Quality. March; 2013.
- [5]. Dhiviya Pranavam TS, Venkatesa Rao T, Punithavathi L, Karunanithi S and Bhaskaran A (2011) Groundwater pollution in the Palar Riverbed near Vellore, Tamil Nadu, India. Indian J. Sci. Technol. 4 (1), 19-21. Domain site: <http://www.indjst.org>.
- [6]. Khandekar RN, Mishra
- [7]. UC. Environmental lead exposure of an urban Indian population. Sci Total Environ. 1984 Dec;40:269-78.
- [8]. Koutros S, Alavanja M, Lubin J, Sandler D, Hoppin J, Lynch C, Knott C, Blair A, freeman L. An update of cancer incidence in the

- Agricultural Health Study. *J Occup Environ Med.* 2010; 52:1098-105.
- [9]. Singh B. Cancer deaths in agricultural heartland: A study in Malwa region of Indian Punjab. Master thesis. International Institute for Geo-Information Science and Earth Observation (ITC), University of Twente, Enschede; 2008.
- [10]. Sharma R. Analysis of Water quality parameters of groundwater in Malwa region, Bathinda, India. *Asian J of Adv Scientific and Engineering Res.* 2012;1.
- [11]. Trivedi RK, Goel PK. *Chemical and Biological Methods for Water Pollution Studies.* Karad: Environmental Publications; 1986.

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