ANALYSIS OF VARIATION GROUNDWATER QUALITY DUE TO AGRICULTURAL PRACTICES IN GROUND WATER: A CASE STUDY OF PHAGWARA

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Abstract:

Phagwara city is a part of the great Indo-Gangetic plains. It receives less than 686mm of rainfall annually. The low rainfall forces the need for other economical sources of drinking water. While the majority of irrigation water demand is met by canals drawn from rivers Sutlej and Beas, most drinking water is drawn from the ground by an arsenal of tube-wells. The high dependence of the populace on ground water shows the need for proper check on the ground water quality.

The following texts contain a detailed report aimed at studying the ground water quality of Phagwara City and, thus, its subsequent mapping. Various samples were collected from selected regions of Phagwara City and tests for their chemical and physical qualities, in an attempt to find any alarming abnormalities. All testes and survey were conducted and compared against Bureau of Indian Standards (BIS), drinking water specifications as per IS 10500:2012. Test for Chlorides, Hardness, Dissolved Oxygen, Alkalinity, Acidic content, Conductivity and pH were conducted on each sample in clean laboratory conditions. No control specimens were taken and as such all results were compared with the specifications of IS 10500:2012. All results were satisfactory. All ideologies and results are discussed hereafter.

Introduction:

Sanitation and safe drinking water are fundamental rights for the basic health of humans. Globally it is reported, merely two in ten percent population do not have access to safe drinking water; and four of every ten percent population, do not even have access to simple latrine. This condition is even worse in the developing countries where one in three people lack safe drinking water and sanitation. In such countries, the consumption of contaminated water led to more than 80% of diseases and one third of the total deaths. About half the population in developing countries, is suffering from diseases associated with water supply and sanitation at the same time, which may lead to waterborne diseases such as diarrhea, malaria, cholera and other water related disease (Ashbolt, 2004; WHO, 2005) thus, purity of drinking

water conforming to prescribed standards by WHO and APHA should be of primary concern of any water supply system.

Drinking water has a great potential of transporting microbial pathogens and toxic chemicals to great number of people, causing health issues, is well documented fact in all countries with every level of economic developments. People from such areas, in absence of inadequate availability of pure drinking water supply may be bound to consume water of uncertain quality and thus, falling prey to such health hazards.

Sunitha et al (2012) studied the groundwater contamination due chemicals used in agriculture in an irrigated environment and concluded that agricultural activities lead to increase nitrate and pesticide contamination in groundwater. Akinro (2012) and Brauns.B (2016) Nitrate leaching is a common issue in most agricultural regions of the world, especially where the crops with high water and nitrogen requirements tend to increase potential risk of nitrate pollution to the ground water. Marouane 2014 concluded that for pesticide, it has been estimated that less than 0.1% of the pesticide applied to crops actually reaches the target pest and the rest enters the groundwater environment needlessly,further contaminating soil and water where it can adversely affect non target organisms. Bigyan and Poonam, 2014). Vetrimurugan (2016) studied the impact on human exposure risk to heavy metals through groundwater used as water supply source in an irrigated river delta. It was found out that heavy metals determined in groundwater were silicon, lithium, lead, manganese, silver, nickel, aluminium, iron , cadmium, copper, zinc, chromium. Hariprasad N.V and Dayananda H.S (2013) also studied the environmental impact due to agricultural runoff containing heavy metals. It was found out that heavy metals in irrigation water changes the soil properties, there by affecting the growth of crops. The heavy metal being a part of crop thus enters the food chain and affects the organism part of it. Further, agricultural runoff containing heavy metals reaches natural water bodies affecting aquatic species. Shrivastava (2013) studied the adverse effects of pesticides contamination in ground water. It was found out that the interest of minimizing risks associated with pesticides, significant public resources have been allocated for the development and implementation of rational, pesticide use policies based on solid scientific evidence.

Pesticides, fertilizers, herbicides and animal waste are agricultural sources of groundwater contamination. Aakame (2014) and Ghanem (2011). Contamination of groundwater may also happen when chemicals are stored in non-engineered locations where the groundwater flows from the direction of the chemical storage to the well contaminating the groundwater source.

Study Area:

Phagwara is a city (Fig. 1) and the Municipal Corporation with area of 20 km2 supporting a population of 1.18 lakhs in Kapurthala district of Punjab state, India. The city lies on the National Highway 44 and located 124 km away from Chandigarh and 20 km away from Jalandhar and 361 km from Delhi. It receives an annual rainfall of 686mm. Drinking water is obtained from underground sources using tube-wells. The City of Phagwara depends very little on municipal water supply and mostly on underground sources.

Fig 1.0 Location of Phagwara

In Phagwara, the ground water is recharged by the Sutlej River and Beas River. River water accounts for only little of the recharge. Despite low rainfall of 686mm annually, and the intense dependence of the city on ground water, the ground water levels are fairly safe with good recharge sources. Phagwara is over exploiting its ground water . However, the water is still not falling dangerously low. Also due to low rainfall, very little surface pollution is being transmitted underground by the rain water.Thus, the ground water experiences little contamination. Phagwara has about 3162 deep tube-wells (1647 irrigation wells and 1515 tube-wells for rural water supply).

Phagwara is highly populated with large areas of residential blocks, its drawing their own water from the ground. The project was aimed at studying the characteristics of ground water around agricultural fields obtained in the outskirts of Phagwara.

The samples were taken from 5 residential areas close to the paddy field of Phagwara City,as shown in Fig 2, making sure that the sources drew underground water from the average depth of 200m. The samples were taken in containers, taking great precautions to avoid contamination during its transport and storage. All containers were cleaned with distilled water before use. No chemical substances were used in the sterilization of the containers as residual cleansing agents might contaminate the sample. The process of sampling were followed fro 3 months.

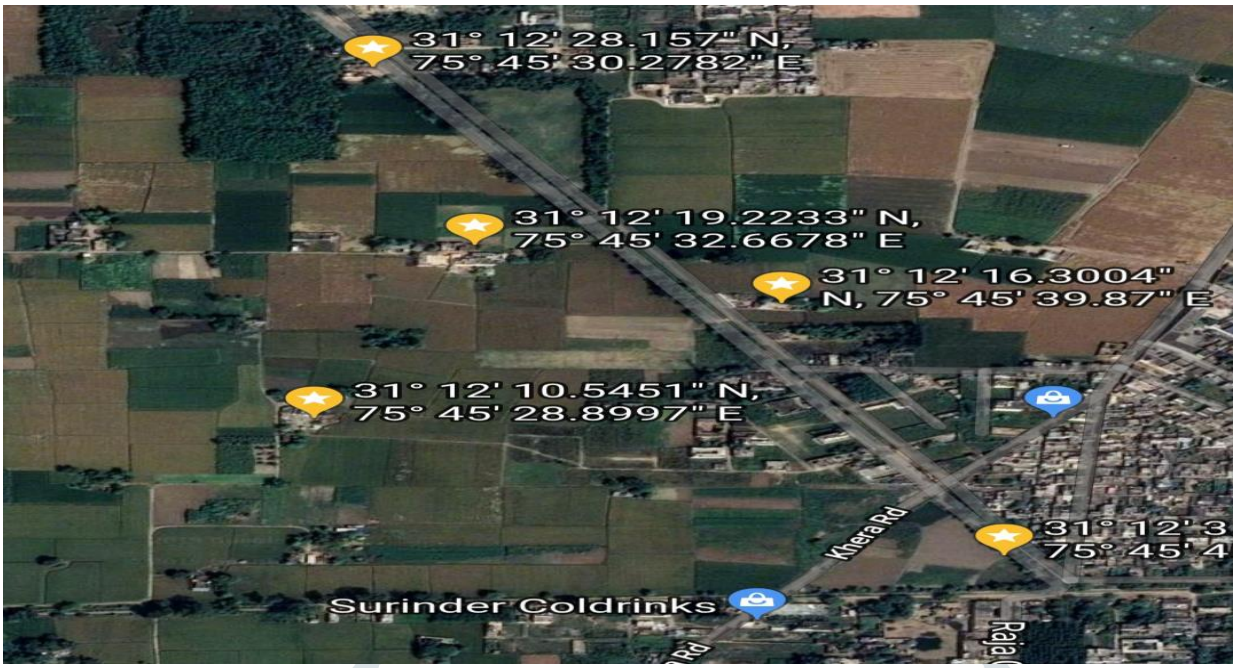

Fig No.2 Map of Location of sampling points

All gathered samples were stored under cool conditions and away from direct sunlight to discourage bacterial growth or contamination and tests were performed on the same day of sample collection and the physico-chemical characteristics were determined as per IS 3025.

Results and discussion

Physico-chemical tests were performed on the samples according to IS 3025 and results are discussed below:

Hardness: From Table 1 we can conclude that all 5 samples were found with hardness higher than desired limits.

Table 1: Total Hardness for the collected samples

Sample ID/ Month	**Hardness (mg/l)**		
	Feb	**March**	**April**
1	406	408.80	405
2	429.22	432	435
3	427	431	435.88
4	350	348.76	355
5	314	307	310

The hardness, although higher than desired limits, they are well within permissible limits. The water samples are safe for use, but may cause scaling and precipitation on utensils and pipes. This hardness is due to the calcareous soil of northern and central parts of Punjab.

pH Value:

From Figure 3 we can conclude that all samples are lying in neutral range as specified in IS 10500

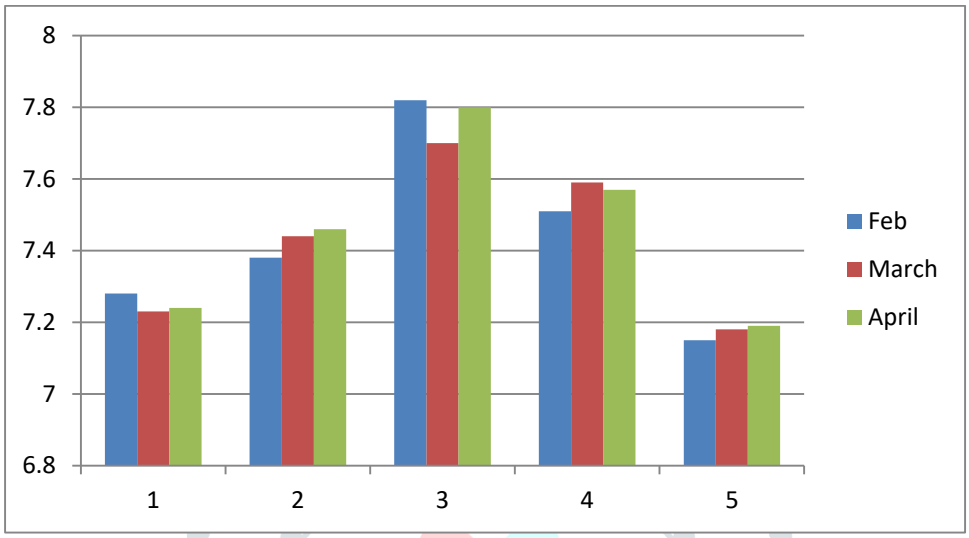

Fig 3 pH values value for samples in different sampling period

Alkalinity

From Fig 4 we can conclude that all samples exceeds the desired limits.The alkalinity for sustaining aquatic life (in Aquariums) is about 20 ppm. Thus this water is also very suitable for such applications. This alkalinity is due to water being underground. Underground water passes through several rocks that may be rich in carbonate, borates and hydroxides. And Phagwara has calcareous soil.

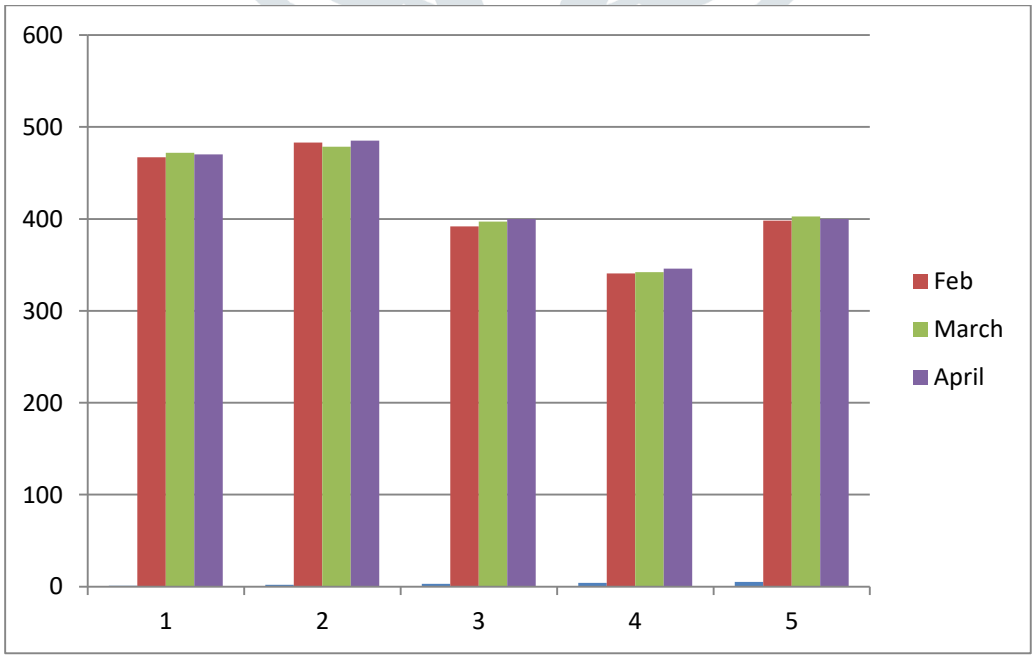

Fig 4 Alkalinity values for samples

Chloride content:

From Fig 5 we can conclude that the chloride content of all samples is higher than the desired limits.The chlorine content is within limits, the levels are high and therefore due to presence of salts in soils and residues from the pesticides and fertilizers.

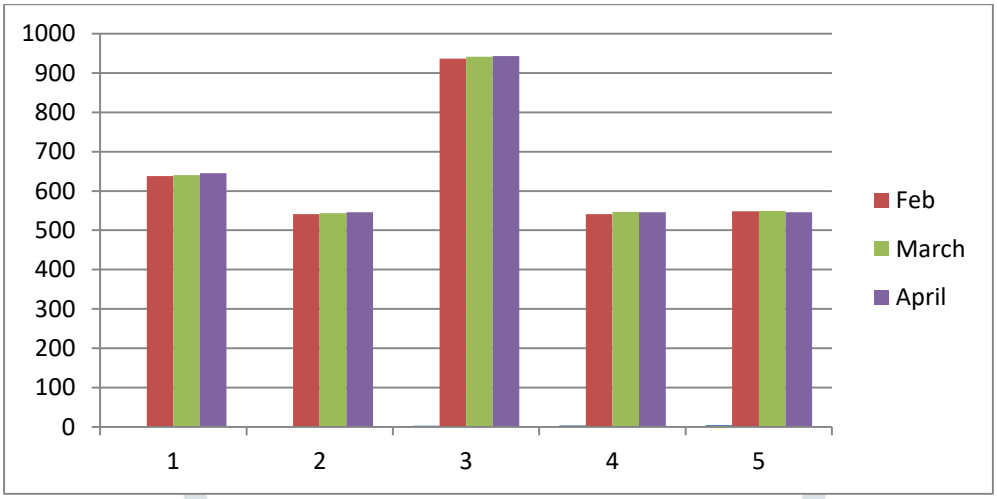

Fig 5 Chloride values for the samples

Acidity Test:

From Fig 6 we can conclude that The acidic content of all samples is higher than the desired limits this can be due to leaching of nutrients due to excessive use of agricultural products leading to soil acidification

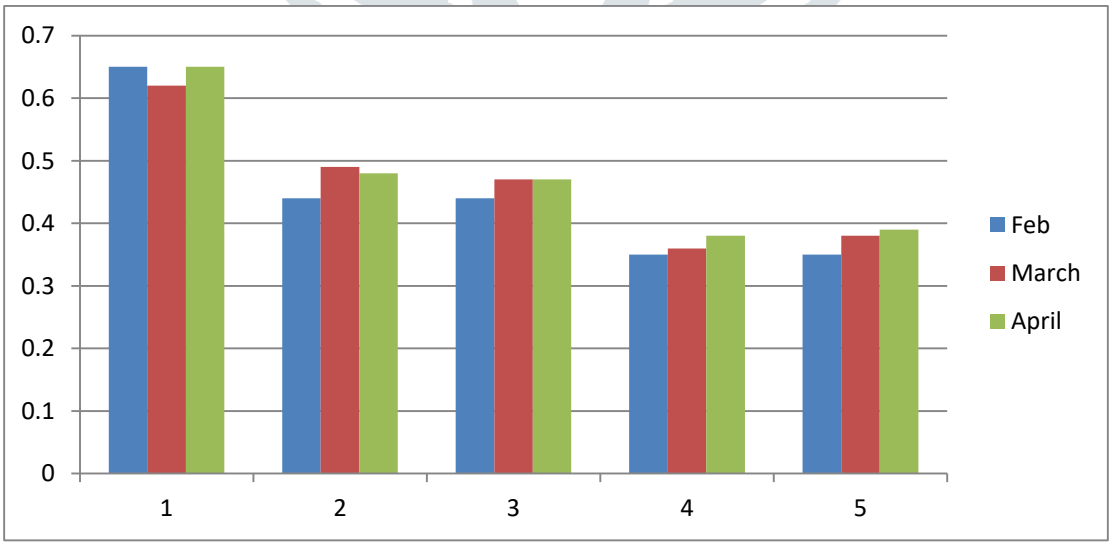

Fig 6 Acidity values for the samples

Dissolved Oxygen:

From Fig 7we can conclude that all samples are within permissible limit. All samples are fit for drinking purpose after providing basic treatment.

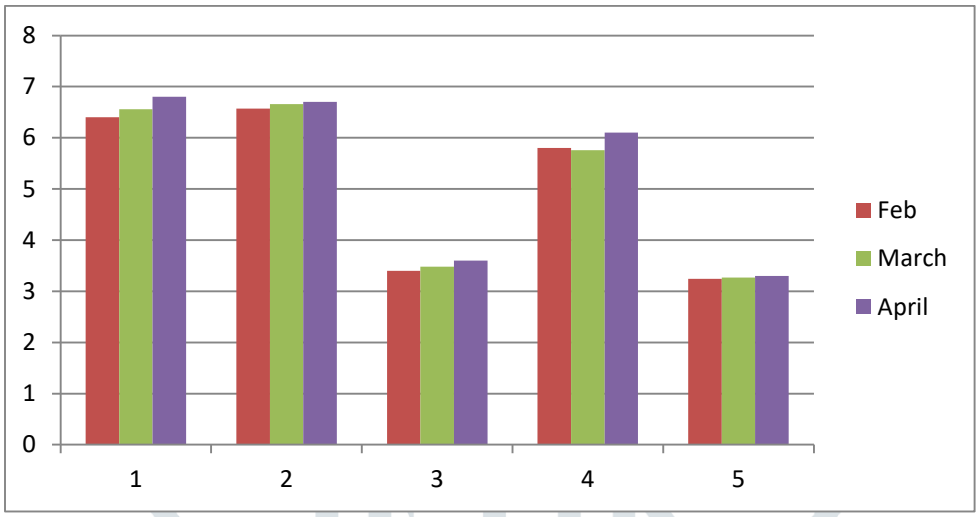

Fig 7 Dissolved oxygen concentration in samples

Conductivity:

From Fig 8 we can conclude that all samples are within permissible limit. Conductivity in groundwater is because of dissolved salts and minerals present in ground water. All samples are fit for drinking purpose.

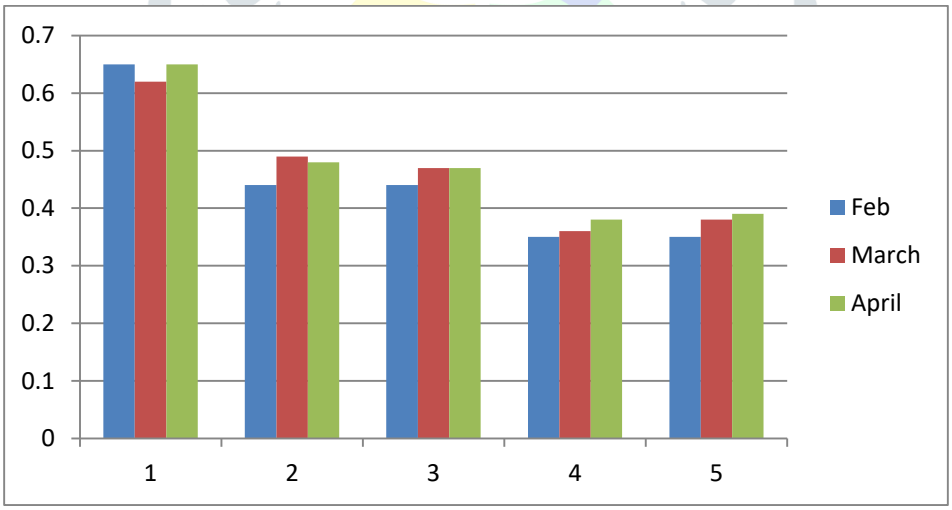

Fig 8 Conductivity of samples

Conclusion:

The water quality parameters of groundwater collected from 5 different sampling points from agricultural land in Phagwara, reveals that the pH, Total hardness, alkalinity, pH , DO, conductivity and chloride ion values are well within the permissible limits.. In conclusion, the groundwater of Phagwara is fit for domestic usage and drinking purpose and require basic treatments like aeration and disinfection in order to be used for drinking purpose

References

- Ashbolt, N. J., (2004). Microbial contamination of drinking water and disease outcomes in developing regions. Toxicology, 198, 229-238.
- Aakame R.B, Fekhaoui M, Elabidi A, Dussauze J, Laghzizal M, Saoiabi A., (2014). "Groundwater Contamination by Pesticides and Metals Elements in Agricultural areas of the Northwest of Morocco and Health hazard", IOSR Journal of Environmental Sciences, Toxixology and Food Technology, Volume 8, Issue 1 Ver. II, ISSN-2319-2402.
- Abbasi A, Sajid A, Haq N, Rahman S,MisbahZ, Sanober G, Ashraf M, Kazi A.G.,(2004),"Agricultural Pollution: An Emerging Issue", National University of Sciences and Technology, 007/978-1-4614-8830-9-13.
- Akinro A. O, Olorumtade A. J, Imoukhuede O. B.,(2012)."Impacts of Agricultural Wastes on Groundwater Pollution in Lipakala Farms, Ondo Southwest Nigeria", Journal of Environment and Earth Science, Vol 2, No.4, ISSN 2224-3216.
- Bigyan N, Poonam T., (2014). "Assessment of Pesticide Use and Heavy Metal Analysis of Well Water in JhikuKhola Watershed, Kavrepalanchowk, Nepal", International Research Journal of Environment Sciences, vol. 3(10), 79-83, ISSN-2319-1414.
- Brauns B., (2016)."Agricultural contamination in soil-groundwater-surface water systems in the North China Plain",
- Ghanem M, Samhan S, Carlier E, Ali W., (2011)."Groundwater Pollution Due to Pesticides and Heavy Metals in North West Bank", Journal of Environmental Protection, 429-434.
- Hariprasad N.V, Dayananda H.S., (2013)," Environmental Impact due to Agricultural runoff containing Heavy Metals", International Journal of Scientific and Research Publications, Volume 3, Issue 5, ISSN 2250-3153.
- Marouane B, Belhsain K, Jahdi. M, El Hajjaji S,Dahchour. A, Dousset S., (2014)."Impact of agricultural practices on groundwater quality: Case of Gharb region-Morocco",J. Mater. Environ. Sec, 2151- 2155, ISSN-2028-2508.
- Shrivastava P, Dr Singh P, Dr Bajpai A.,(2013)," Study of Adverse Effects of Pesticides Contamination in Ground Water", IOSR Journal of Environmental Science, Toxicology and Food Technology, Vol. 1 Issue. 3, 30-33, ISSN: 2319-2402.
- Sunitha V, Reddy B, Mm Reddy M. R., (2012),"Groundwater Contamination from Agro-Chemicals in irrigated Environment: Field Trials", Pelagia Research Library, 3382-3386.
- Vetrimurugan E, Brindha K, Elango L, Ndwandwe O.M., (2016)." Human exposure risk to heavy metals through groundwater used for drinking in an intensively irrigated river delta", Cross Mark, 3201-016-0472-6.