

## PHYSICOCHEMICAL ASSESSMENT AND EFFECTS OF CONTAMINANTS PRESENT IN GROUND WATER OF BHADRA TEHSIL RAJASTHAN

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### Abstract

A Systematic study has been carried out to assess the water quality index of Bhadra tehsil of Hanumangarh district. 600 water samples from 30 stations were collected and analyzed for Physico-chemical parameters likes hydrogen ion potential, electrical conduct, alkalinity, chloride, total hardness, total dissolved Solid (pH, EC, Cl<sup>-</sup>, TH, TDS) etc respectively. Beside these parameters some ions of inorganic salts like calcium, magnesium, nitrate, fluoride, and sulfate ions are also carried out under trial respectively. The analytical data of various Physico Chemical parameters indicates that some parameters like pH, EC, TDS, TSS, Ca<sup>2+</sup> and Mg<sup>2+</sup> are found to be in excess than the prescribed limit in some water samples of the study areas. The WQI(Water quality parameters) value indicates that water samples of some sampling stations are quite unfit for drinking purpose because of high value of Ca<sup>2+</sup>, Mg<sup>2+</sup>, and TH etc suitable suggestions were made to improve the water quality.

**Keywords:** Water, Impurities,

### Introduction

Water is an essential natural resource and a treasured national treasure. It is a necessary component of all living things and one among the most basic need on the

planet. Water is a necessary component of human existence and is critical for the growth of any society and the maintenance of ecological equilibrium. Water is utilised for a variety of reasons, including household, agricultural, industrial, and allied. Water is arguably the only natural resource that has an impact on every facet of human civilization, from industrial and agricultural growth to the cultural and religious values ingrained in society. It comes in two primary forms: surface and ground water. The term "surface water" refers to the water contained in lakes, marshes, glaciers, and reservoirs, as well as the water flowing in streams. In the broadest sense, surface water refers to all water on the earth's surface, which includes ocean water.

Ground water occurs in worn portions of the rocks, along their joints and cracks. Ground water is a significant natural resource that also plays a critical role in satisfying the fast expanding needs of a growing population and rising living standards, not just in dry land areas. In Maharashtra, ground water has historically been the principal source of water for household, agricultural, and industrial purposes. It is the single largest and most easily available source, accounting for over 8% of rural drinking water

requirements, 50% of urban water requirements, and more than 50% of the nation's irrigation requirements. While ground water is a renewable resource that replenishes itself annually, its availability is not consistent in place or time.

Thus, the sustainable development and management of ground water resources require exact evaluation based on acceptable and legitimate scientific standards, since ground water is critical to the state's economy and thus requires scientific monitoring in terms of both quality and quantity. Thus, accurate evaluation of ground water resource dynamics becomes critical for planned expansion. Mineral ions are naturally present in ground water.

**Area of study:** In the present study the Bhadra tehsil of the Hanumangarh district was selected. Out of 216 villages of Bhadra tehsil water samples were collected from different locations/villages of the Bhadra tehsil and analyzed for different parameters e.g. E.C., pH, TDS, Chloride, Nitrate, Fluoride, Sulphate, Hardness, Alkalinity etc. as per standard methods and analyzed values recorded. These data were compared with the common diseases appearing in the human being living in this area.

**Ground water sample:** Ground water samples will be collected in the different season (pre and post monsoon) and from different location in Bhadra. The water samples will be collected from Hand-pumps, Bore-well and Tube-well. The samples will be collected in new 1-l HDPE bottles pre-washed with dilute HCl and rinsed four to five times with the water samples before filling it to capacity and

then labelled accordingly. Samples for metal analysis will be collected separately and acidified at the site ( $\text{pH} > 2$ ) with conc. ultra-pure  $\text{HNO}_3$ . All the samples will be collected in tight capped high quality polyethylene will be immediately transported to the laboratory under low temperature conditions in ice boxes. The samples will be stored in the laboratory at  $4^\circ\text{C}$  until process/analysis.

The study of characteristic of ground water account the basic requirements of it which has been harnessing fulfil the natural assets of water contaminants. The manner and managements of sources of soil, water and air are clearly explained inside the Vedas and Upanishads which are the historic Hindu literature of Indian people which focused on the purity of these contents. Since in last century there are exceptional boom in population of each community of living being.

So for the completion of necessity of living being it is highly required to speedy development in industrialization and urbanization. The overcome of these factors caused rapidly degradation in herbal sources. Ground water is utilized everyday by human being.

The three important sectors which used ground water broadly are domestic delivery, corporate sector and agriculture. Corporate sector includes the energy technology which is very useful in the growth of environment. The Two third part of water obtained from different water resources like river and other floor water bodies is used for irrigated agriculture. One more factor which is responsible for suffering of water from pollutant is an interaction among above sectors.

The pleasantness for agricultural use was affected by domestic water and vice-versa.

The exploitation and unsustainable of the useful resource are the main unfastened commodity which dealt with water. On the analysis of this factor it is concluded that there are a lot of commodities in atmosphere but water is one of them scarcest commodities.

The various experiences of water analysis stands that there is a risk of misuse of water scarcity but it have no longer received due to its interest in exercise related to water bodies. The smoothness of water aquifers is an additional for immoderate withdrawal of floor water. It is the great possibilities of scarce the water resource from the naked area of the earth. The general volume of the water on the earth was found 1386 million km<sup>3</sup> approximately.

About 96.5 Percent water is saved as ocean water which is saline in nature. This water is available for plants and in addition to human. The water which is found on earth is available in various form such as 3.5 percent, thirty five meter km as sparkling, 2.4 m km as ice sheet and glaciers, 0.91 m km as clean water lakes etc.

If the pH values from 6.4 to 6.5 was consisted by water samples than they represent that the water sample follows the restricted line which was according to direction of standards. The excessive values of alkalinity are discovered due to greater domestic sewage and wastes.

The full hardness of combine form of hydrogen and oxygen is also inside the permissible limit except some cases. Some health problems like heart illnesses and kidney stone arises due to the moreover quantity of hardness.

The line of creating disease may also lead the digestive disorders and some other fearful problems. Some specimens out of

total samples have chloride contents inside the acceptable limits. Sulfate content in high amount present in detergents which have sour taste.

These detergents are used for cloth washing so taken samples have no permissible restriction related to sulphate content. According to world health organization and bureau of Indian standard the water which contain permissible limit of tiers and biological oxygen demand is good for uses.

The specific quality of polluted water is that it has great degraded particles because of human activities in high quantity it posses less appropriate quality for its supportiveness. The materials which correlate with foreign places are accountable for the degradation of water pleasant. This degradation can be natural, inorganic, biological or bodily basis so it is referred to as pollution.

This pollution caused deleterious impact on human health that is related to human fitness and aquatic activities. In addition there are creates an inability in water parameters. It has harmful effect on supportive nature of agriculture, business and unique related financial sports.

Latrine and septic tank also mentioned the pollute substances that caused supply of pollution in groundwater. These pollutants provide the energy for microorganism so there are effective surplus in biological and chemical oxygen call of water for cod, nitrate, inorganic chemical substances and pathogens. This type of outbreak of illnesses is found in growing countries. The countries like Africa, Asia and South America are includes in growing countries. Chemical Parameters are concluded as follow:-

**pH:-**

When the pH of samples was studied by Digital pH meter then we found that the water samples have pH range between 7.1 to 8.1.

Only 2.6% water samples show deviation from desirable limit. The desirable limit of pH is 7.0-8.5 and the maximum permissible concentration of pH is 6.5 to 9.2 these standard values of parameters were guided by ICMR. The found range of pH shows the basic nature of water which is useful for us for drinking and other purpose of life.

- Out of 600 samples total 581 samples were found in range whereas only 19 samples were found out of range. Nearly 97.4% water samples have pH range between 7-8.5 pH and only 2.6% water samples were found out of range.
- Out of 30 sampling stations, 21 stations show pH range in desirable limit but 9 sampling station shows out of pH range.
- In Main sampling station only 11 sample were found in range but 7 samples were found out of range which shows highest deviation from desirable pH range 7.0 to 8.5
- In second sample shows deviation from desirable pH range. From Banwas sampling station only 13 samples were found in range but 4 samples were found out pH range.

Thus after the study of pH range from different sampling station of Bhadra tehsil we concluded that only 2.6% samples show deviation from desirable pH range but 97.4% water samples were found in maximum desirable range.

In 2.6% deviation quantity nearly 4% samples have very close range to desirable

range which can be made desirable for drinking by very short treatment of evaporation or filtration thus we can say that the water of Bhadra tehsil is very good for drinking purpose with respect to pH range.

#### **Electrical Conductivity:-**

- 600 water samples were taken to study the EC of water in which only 174 samples were found in desirable range while 326 samples show deviation from permissible range.
- Nearly 41% water samples were found in desirable range but 59% water samples were found out of permissible range of EC.
- Only Two sampling station shows EC range in desirable limit. Whereas 35 sampling station shows deviation from desirable limit of electrical conductivity.
- Only one sampling station i.e. fardia totally shows electrical conductivity in desirable limit with 100%.
- Two sampling station were found 100% out EC range from permissible limit.
- Three sampling station i.e. Budher Dabri and Gheu shows only one, Two or three sample in desirable limit sequentially. In Gadra sampling station 50% samples show EC range in permissible range while 50% samples were found out of permissible EC range.

Thus after the study of EC of different samples of different sampling station we can conclude that 60% samples show deviation from desirable limit of EC and only 40% water samples were found in permissible limit. It means that water is

very polluted and suspended particles are present in large amount in water which increase the conductivity of water. So there is needed necessarily some wide treatment of water with respect to EC so that water can be good for drinking and other uses with respect to EC range.

The electrical conductivity of water samples was studied by digital Digital conductivity meter method. Then the value of electrical conductivity was found between the average ranges 1.17 to 2.39 mhos/cm.

Nearly 10% of water samples have the normal range of EC but most of water sample shows deviation from the desirable and maximum permissible concentration which determined by ICMR.

The high range of EC shows the presence of pollutants particles in drinking water. These particles decomposed the  $H_2O$  molecule  $SOH^+$  and  $OH^-$  Ion are present in water which is responsible for the conductivity of water. To remove the pollutant particles drinking water is needed to purify by boiling methods or other useful methods.

### Alkalinity

The alkalinity of water samples was studied by Titrimetric method using concentrate HCL acid. As a result we found the alkalinity range between 120-2450 while the desirable range of alkalinity is 200 mg/l. Only 10 % of water samples are found in desirable range.

To determine the alkalinity of water in Bhadra Tehsil, total 600 water samples were taken and studied then we get that 84.6% water samples shows desirable limit whereas 15.4% samples shows deviation from desirable range of alkalinity.

- Total 600 samples were taken from 30 different location of Bhadra Tehsil in

which 499 samples were found in range while 101 samples were found out of range from desirable limit of alkalinity.

- Total 8 sampling station out of 30 shows 100% desirable range while 22 sampling station shows deviation.

- Total 6 sampling station shows negligible deviation from permissible range it means that the water of 15 sampling station included above six stations is good for drinking purpose.

- Only one sampling station shows highest deviation from desirable range i.e. Bhangwa sampling station. In Bhangwa 50% water samples were found in desirable limit while 50% samples shows deviation from permissible range. Two sampling station Rambas and Kikrali also shows maximum deviation after Bhangwa.

- The water of Kushalpura also not good for health because 12 sample out of 20 were found out of permissible range.

- Thus we can say that except some samples maximum samples were shows permissible range of alkalinity. It means that the water is good for drinking purpose with respect to alkalinity and the samples which shows deviation from desirable limit can be made better for health by using some purifier technique like evaporation, distillation etc.

### 5.2 Chloride

To study the presence of chloride in water samples of Bhadra Tehsil in Hanumangarh district, total 600 water samples were collected in which 540 samples shows Chloride range in permissible range of ICMR while 60 have shows deviation from permissible range.

- 84.40% water samples have the chloride range in desirable limit whereas 15.60% water samples



were found out of range from desirable limit.

- Out of 30 sampling station only Two sampling station i.e. Bheerani and Dhani Swamiyan were found 100% desirable limit and one sampling station i.e. Gadra shows 95% desirable range.
- Two sampling station i.e Ratanpura and Jogiwala gives 90% samples in permissible range.
- One sampling station shows 100% deviation from desirable limit it means that no one sample was found in desirable limit. While Jagasari shows only Two sample in desirable range it means that only 10% water samples were found in desirable range.
- Two sampling station were found 80% in desirable range while 20% out of range.
- The above conclusions indicates that the water of Bhadra Tehsil is good for drinking purpose with respect to Chloride because the amount of chloride content is very low in water. The amount of chloride content increased using bleaching powder to clean water. So it is very necessary to treatment of water by using methods to make it good for drinking purpose of all regions.

#### Total Hardness

EDTA complex metric method is used to check the hardness of water sample.

- To study the total hardness (TH) of water in Bhadra Tehsil of Hanumangarh District, total 600 water samples were taken from 30 sampling station of Bhadra tehsil. 560 samples out of 600 were found

in desirable range whereas 40 water samples shows deviation from desirable range.

- Out of 600 samples only 88.3% water samples were found in desirable limit whereas 11.7% samples shows deviation from desirable limit.
- Highest desirable range was shown by Gadra with 17 samples in range while Motipura with 16 samples in range.
- There is no one sampling station which shows maximum samples in desirable limit.
- Three sampling station shows minimum samples in range like Kasni Khurd, Surpura and Doongrana with 3, 4 and 5 samples respectively.

Thus the above conclusion shows that there are minor samples out of range. It means that the water of Bhadra Tehsil is lowest polluted with respect to total hardness. So it is not harmful for human health. So there is a small need of treatment of water so that it may be used for drinking purpose.

#### 5.3 TDS

Grave metric method is used to check TDS of water.

- To study the concentration of total dissolved solid, 600 water samples were collected. When we analysed these water samples then we found that 391 samples have TDS range in desirable limit whereas 209 samples have TDS range from out of desirable limit.
- The TDS samples were studies from 30 different location of Bhadra Tehsil. Only samples of 20

stations were found 100% desirable limit while 10 sampling stations shows deviation from permissible limit.

- 81.25% water samples were found in desirable TDS limit while 18.75% water samples shows deviation from desirable TDS range which is marginal deviation in desirable range.
- The highest desirable range was found in four sampling station in which all 20 samples from each station found in permissible range.
- In Two sampling station i.e. Ramsara and Dabri, 19 samples were found in desirable limit and only one sample shows deviation from desirable range.
- The lowest desirable range was found in Sherara sampling station in which only three water samples were found in desirable range.
- Thus on the basis of above study we can say that the TDS range in maximum sample was found in desirable limit but a marginal samples shows deviation from desirable limit which is responsible for water pollution so there is needed water treatment with respect to TDS range.

#### **5.4 Calcium**

EDTA complex metric method is used to check calcium in water samples.

To determine the calcium concentration level in water of Bhadra Tehsil in Hanumangarh District, total 600 samples were taken from 30 different sampling station and concluded that only 92.2% water samples were found in desirable limit (75-200 Mg/L) while 7.8% water

samples shows deviation from desirable range it means that out of 600 samples only 553 samples found in range whereas 47 samples found out of range.

Thus we concluded that there is very low deviation from desirable range of calcium ion because nearly 8% samples were found out of permissible range. This deviation arises due to water pollution. Which are responsible for disease in human body so water is good for drinking purpose with respect to calcium ion concentration.

#### **5.5 Mg<sup>2+</sup>**

To study the magnesium concentration in water of Bhadra Tehsil in Hanumangarh district in Rajasthan totally 600 water samples were studies. In which only 553 samples were found in desirable range while 47 samples were found out of desirable range.

- Out of 600 water samples only 92.16% samples shows permissible range while 7.84% water samples shows deviation from desirable range which is marginal deviation from permissible range.

Thus we can say that there is a marginal deviation in permissible range of magnesium concentration. So the water is good enough for drinking purpose with respect to magnesium ion. So it is very necessary to treat water by various purification methods such as boiling, distillation, evaporation etc. to make it pure for drinking purpose.

All above problems are created because the surface level of water is present in very deep in earth. Its reason is that the quantity of rainfall is very low or irregular. so the important salt which is present in rain water is not provided to the ground water so the quality of water decreased.

#### **5.6 C.O.D**

C.O.D is checked by titrometric method. COD is a general parameter indicating a content of oxidizable substances both organic and inorganic. Thus the values vary depends on water chemistry. In surface water COD is mostly related to organic substances but in groundwater it is also affected by iron and manganese. The chemical oxygen demand (COD) is a parameter used to assess the quality of water and wastewater. The COD test is frequently used to determine the effectiveness of water treatment plants. This test is based on the notion that a powerful oxidising agent may completely oxidise practically any organic component to carbon dioxide under acidic circumstances. The COD value represents the quantity of oxygen utilised during the chemical oxidation of organic water pollutants to inorganic end products. The COD is frequently determined under acidic circumstances using a powerful oxidant (e.g. potassium dichromate, potassium iodate, or potassium permanganate). The sample is contaminated by a known excess of the oxidant. Once oxidation is complete, the quantity of oxidant left in the solution is used to determine the concentration of organics in the sample. This is often accomplished by titration using an indicator solution. COD is measured in milligrammes per litre, which represents the mass of oxygen used per litre of solution. The COD exam takes around 2-3 hours. The concentrations of COD observed in Bhadra tehsil water is found 40 mg/l.

### **5.7 B.O.D**

Five days are required for the biochemical (or biological) oxygen demand (BOD) test. It is capable of detecting all organic pollutants, even those that are non-

biodegradable. The biochemical oxygen demand (BOD) method is a chemical procedure that determines the quantity of dissolved oxygen necessary for aerobic biological organisms in a body of water to degrade (disintegrate) organic matter contained in a given water sample at a certain temperature and time period. Additionally, it is a significant indicator of the effluent's contamination level. The Environmental Protection Agency establishes standards for the quality of treated wastewater and its safe disposal (EPA). B.O.D value in Bhadra tehsil ground water is found almost 3-4 mg/l.

Common measures for controlling water pollution-

The water pollution can be controlled or minimized by using following some aspects-

- To stop the mixing of polluted water in water sources such as rivers, ponds, lakes etc.
- Proper remedy of municipal and home effluents before draining to rivulets and rivers.
- Domestic waste water must be released in to water resources after using for irrigating plants.
- Sewage must be discharged into drains after use of it for growing soil fertility.
- The areas that are nearby consuming water resources must be wiped clean.
- Each institute must be prepared their own effluent remedy plan.
- The pesticides which are used in agriculture maintain good quality related to controlling water pollution.



- There is a need to preserve numerous water purifying organisms.
- The waste water treatment project should be developed for sewage water purification.
- Fish aquarium and aquarium for that micro-organism which help in water purification should be developed.
- Water bodies ought to no longer be used for disposal of useless our bodies and idols.
- The industries and factories are stabilized far from water resources.

To create public consciousness about the harmful effect of polluted water and properly trained the human beings not to pollute water.

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