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# Study of Physico-Chemical Parameters of Ground Water Quality of Indira Nagar, Gorakhpur

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**Abstract—***In recent 20 years the environmental issues regarding environmental problem like hazardous waste, global climate change, stratospheric ozone depletion, groundwater contamination, disaster mitigation and removal of pollutant have become the focus of environmental attention.*

*In this Dissertation work the quality of ground waters from Indiranagar Gorakhpur and its environs was conducted between December, 2016 to March, 2017. This study was undertaken to determine physical and chemical parameter of ground water sources (shallow and deep hand pump) in Indiranagar Gorakhpur, is as a result physical parameters (pH, Total Dissolved Solids (TDS), Electrical Conductivity (E.C), Temperature, turbidity) and chemical parameters (Alkalinity, total Hardness, Acidity, chloride, fluoride) in water resources were determined. Water samples were collected from 10 sampling points including 7 shallow hand pumps and 3 deep hand pumps (India mark hand pump). The result was compared with WHO, and IS: 10500-2012 standards. The usefulness of these parameters (Physico-chemical) in predicting ground water quality characteristics were studied. Thus an attempt has been made to find the quality of ground water in Indiranagar area of Gorakhpur suitable for drinking purposes or not, and what its impact on human health.*

## 1. INTRODUCTION

Water is a prime need for human survival and industrial development. Ground Water quality is very essential in a sense of practical utility for domestic, agricultural and industrial purposes and plays significant role in the living organism that existing in this world water. For many rural and small scale communities, ground water is the only source of drinking water. Assessment of ground water for drinking and irrigation has become a necessary and important task for present and future ground water quality management. Ground water quality depends on the quality of recharged water, atmospheric precipitation, inland surface water and subsurface geochemical processes. Temporal changes in the origin and constitution of the recharged water, hydrologic and human factors may cause periodic changes in ground water quality. The geology of a particular area has a great influence on quality of water and its environment. The quality of ground water varies due to a change in chemical composition of the underlying sediments and aquifer. The modern civilization and urbanization, frequently discharging industrial effluent, domestic and solid waste dump causes ground water gets pollute. This pollute water not only affects water quality but also threats human health, economic development and social prosperity. So, the assessment of water quality is very important factor for knowing the suitability for various purposes and continuous monitoring of ground water is necessary for the health of human, animals and crops.

Hence an assessment of the ground water quality in Indira Nagar area is taken in the present study as the most of the people are using hand pumps water for drinking. The objective of present work was to study the water quality of ground water in Indira Nagar area of Gorakhpur district, UP, (India).

Water covers about 70 percent of the earth's surface, only 2.53 percent is fresh water while the remaining is salt water. The World Water Council also records that of the 3 percent of fresh water, only 0.3 percent is found in rivers and lakes,

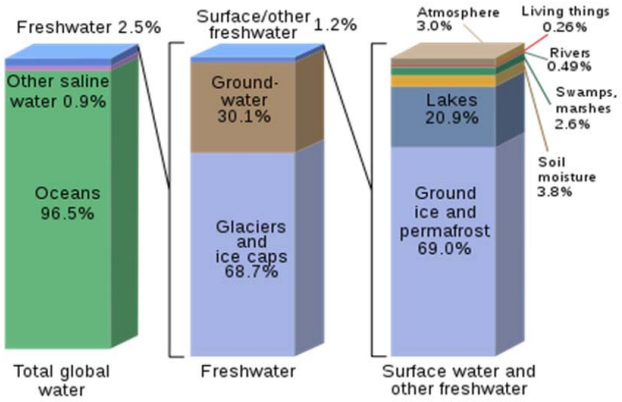



**Fig. 1 World water scenario**

## 2. AIM AND OBJECTIVES

The study aims to determine the quality of ground water in the Indira Nagar area in order to evaluate their suitability for drinking and domestic use.

| St. | PUMP TYPES | LOCATION | |
|---|---|---|---|
| | | LATITUDE | LONGITUDE |
| A | Shallow hand Pump | 26.74234°N | 83.38445°E |
| B | India Mark II Hand Pump | 26.74140°N | 83.38635°E |
| C | Shallow hand Pump | 26.74088°N | 83.38551°E |
| D | Shallow hand Pump | 26.74048°N | 83.38384°E |
| E | Shallow hand Pump | 26.73895°N | 83.38315°E |
| F | India Mark II Hand Pump | 26.74062° N | 83.38107°E |
| G | Shallow hand Pump | 26.73852° N | 83.37958°E |
| H | India Mark II Hand Pump | 26.73769°N | 83.38465°E |
| I | Shallow hand Pump | 26.73602°N | 83.37667°E |
| J | Shallow hand Pump | 26.73358°N | 83.38317°E |

## 3. THE SPECIFIC OBJECTIVES ARE TO:

1. To examine the water quality with respect to physico-chemical parameters.
2. To investigate Indira Nagar ground water quality variations with respect to the Shallow hand pump and India mark –II hand pump in different locations.
3. Determining the physical (pH, temperature, turbidity, electrical conductivity and TDS) and chemical (Chloride, acidity, total alkalinity, total hardness and Fluoride) parameters of the water sources under study.
4. To understand the degree of pollution by inferring the physico-chemical parameters of ground water for Indira Nagar Gorakhpur.
5. To compare the results of the present study with World Health Organization (WHO) guidelines and IS 10500:2012 standards.
6. To identify the potential sources of pollution and relative interactions to reduce the measures for controlling pollutants.

### 3.1 STUDY AREA

#### 3.1.1 Selection of study area

The study area, Indira Nagar was selected for this study because of the fact that ground water sources are extensively used for drinking and domestic purposes. The ground water quality of Indira Nagar, Gorakhpur appeared to be poor, because of extracting the color of ground water which changes yellowish color in some hours. After therefore, Indira Nagar area was identified to study the quality of ground water and check the pollution level and effects on human health.

#### 3.1.2 Location

Indira Nagar is located in the Gorakhpur Region of UP. Indira Nagar is located between latitude $26.76895^0$N and longitude $83.38315^0$E having an approximate circumference area of 5 km and a 2017 estimated population of about 3247. It is situated on bank of Ramgarh Tal (Big Source of surface water in Gorakhpur) and 3 km east away from Rapti River.

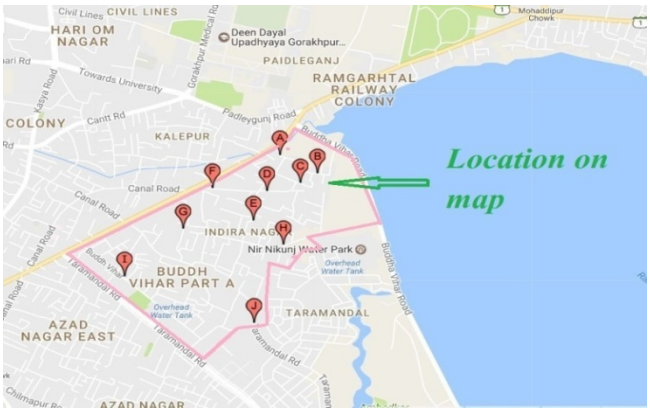



**Fig. 2 Water Sampling point on Earth Map**

Sampling points were carefully chosen in order to assess the general characteristics of ground water quality in Indira Nagar and its environs. Out of ten (10) sampling points: seven are shallow hand pump water bodies (A, C, D, E, G, I and J) and three India mark-II hand pump samples (B, F and H) were chosen to investigate the potential source of pollution and establish the possible impact on the ground water quality.

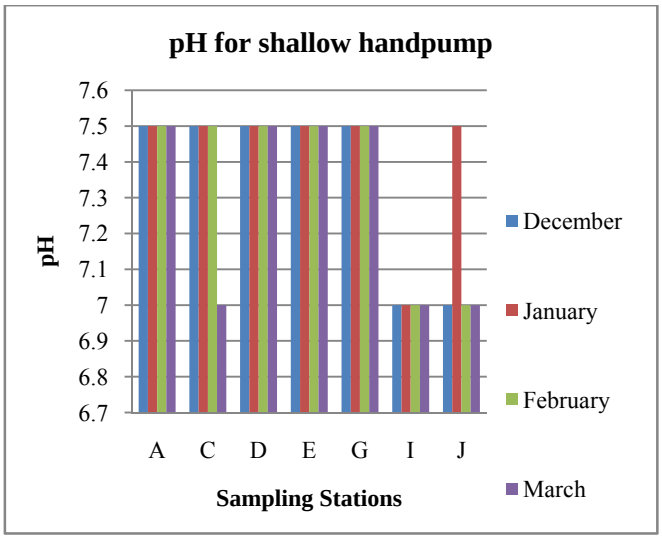
#### 3.1.3 Experimental Method

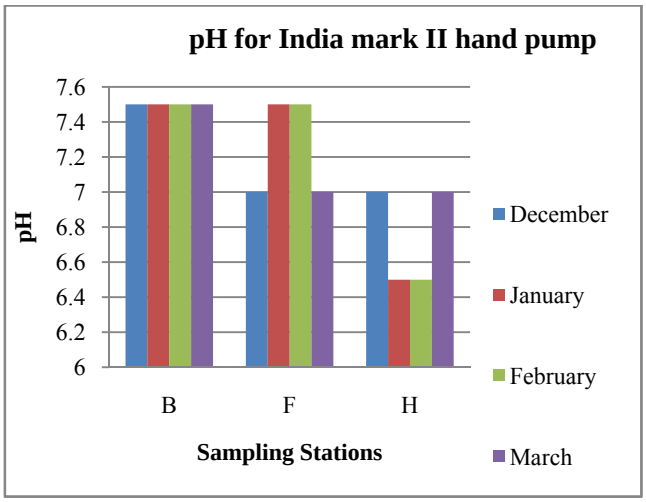
The water samples were analyzed for various parameters in the laboratory of Environmental Engg. (P.H.E) Madan Mohan Malaviya University of Technology Gorakhpur. Various physical and chemical parameters like Temperature, pH, Turbidity, Total Dissolved Solids (TDS), Hardness, Chloride, Acidity, Alkalinity, Electrical Conductivity, Fluoride have been monitored for the ground water of different locations by digital/ titration/other methods.

## 4. RESULTS AND DISCUSSION

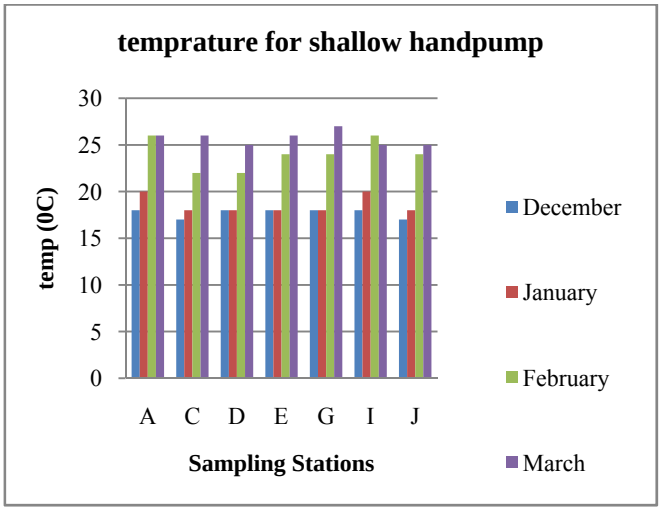
### 4.1. pH graph

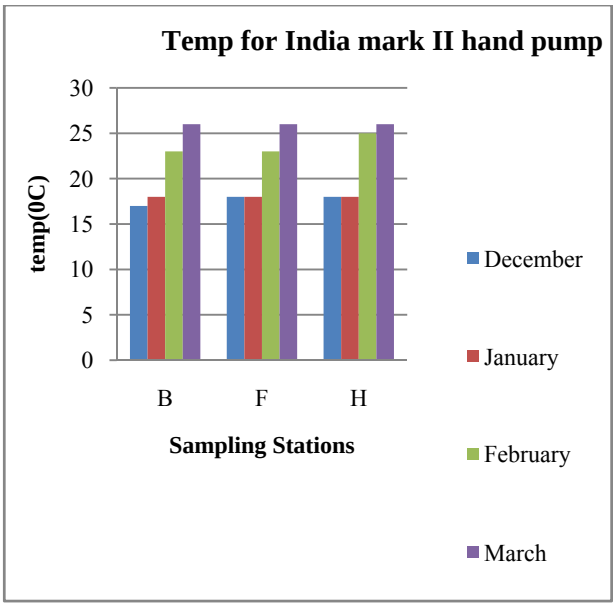
pH value range varies from 6.5 to 7.5 pH units for both shallow hand pump and India Mark II hand pumps (Fig.4.1). This gives the general indication that the water bodies under study ranges from being weakly acidic to neutral. The highest desirable level for pH stipulated for drinking and domestic purposes is within the range of 6.5 to 8.5 (IS: 10500-2012; WHO, 2004) (Fig. 4.1).



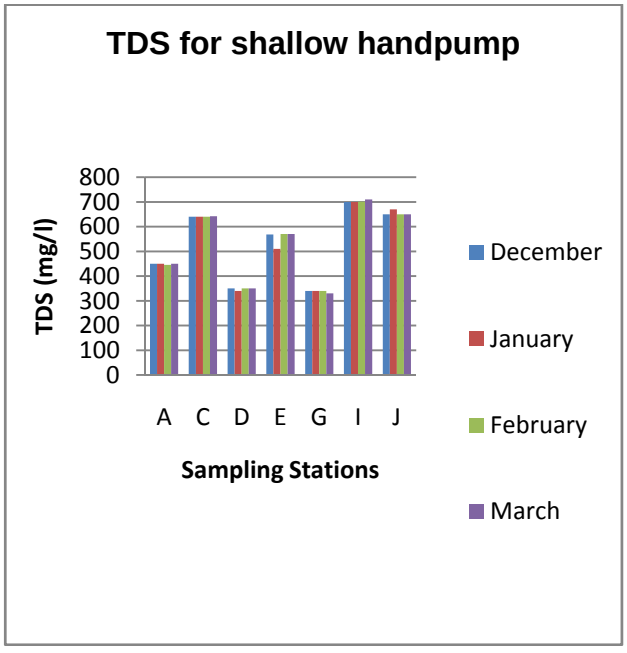

### 4.2. Temperature graph

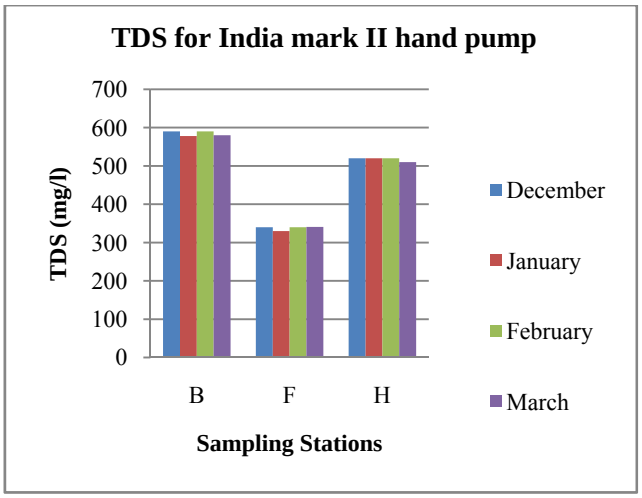



The temperature value of all the water samples analyzed ranged from $18^0$C to $26^0$C (Fig.4.2). There was no (IS: 10500-2012; WHO) guideline value for temperature to be compared with. Ground water temperature for both shallow hand pump and India Mark II hand pumps (Fig.4.2) ranged from the minimum value of $18^0$C (December,2016)to a maximum of $26^0$C (march,2017) .

### 4.3. TDS graph

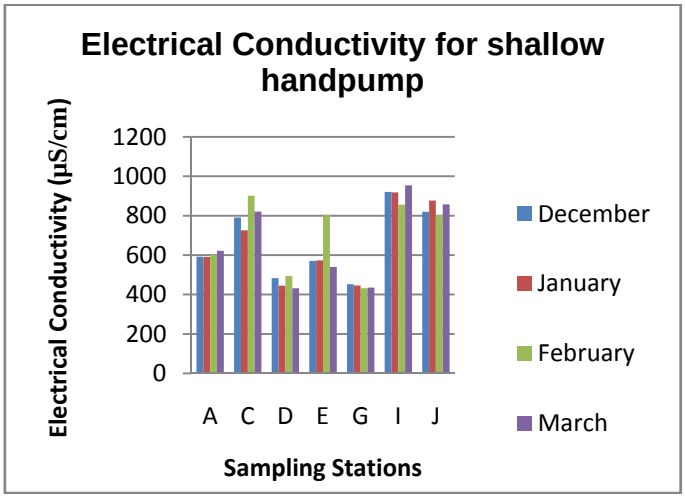


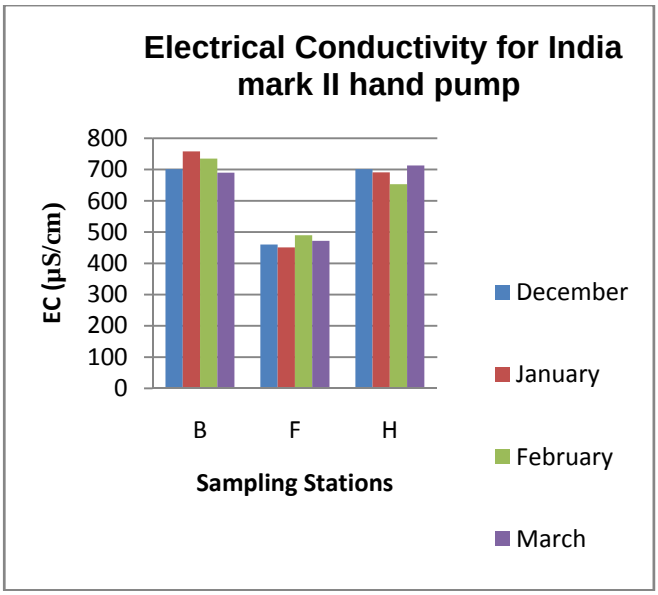



These TDS values were obtained at Shallow hand pump (station-A, D and G) and India mark-II (station-F) respectively within acceptable limit of IS: 10500-2012 and WHO guideline value. But Ground water station B, C, E, H, I and J, TDS concentration level exceed the acceptable limit of IS: 10500-2012 and WHO guideline value. Ground water concentration values ranged from 330 to 710 mg/l (Fig.4.3). The exceed in TDS may be attributed to higher percolation of dissolved impurity laden raw water into the shallow aquifer zone.

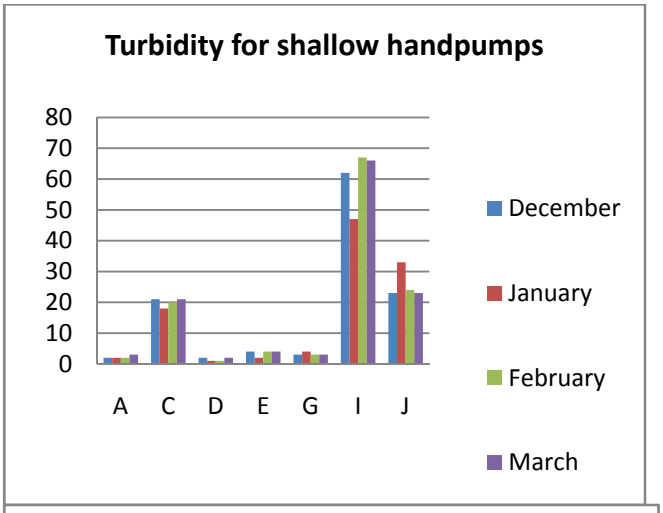
**4.4. Electrical Conductivity graph**

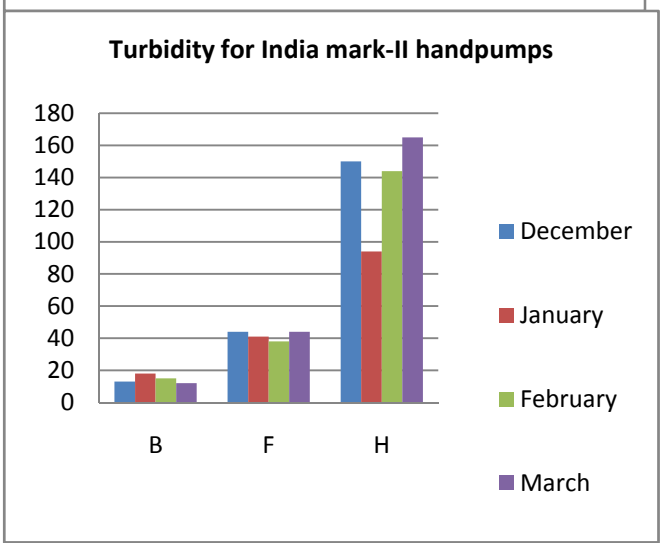
Recorded E.C. values for ground water in the study area varied between 432 to 954 µS/cm (Fig.4.4). There was no IS: 10500-2012 guideline value for E.C. to be compared for Ground water E.C., So all the values had been compared with WHO guideline limit .These values were within the WHO guideline limit of 1000 µS/cm (WHO, 2004) stipulated for drinking and domestic water. The conductivity values (all stations) are under limit, and there is no problem due to E.C.



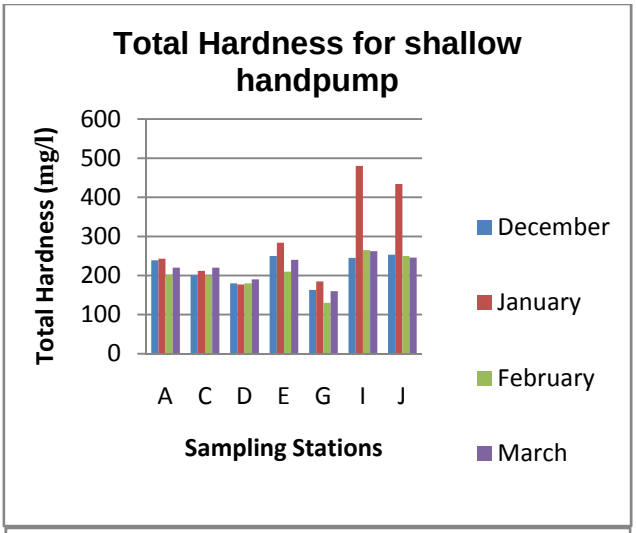

**4.5. Turbidity graph**

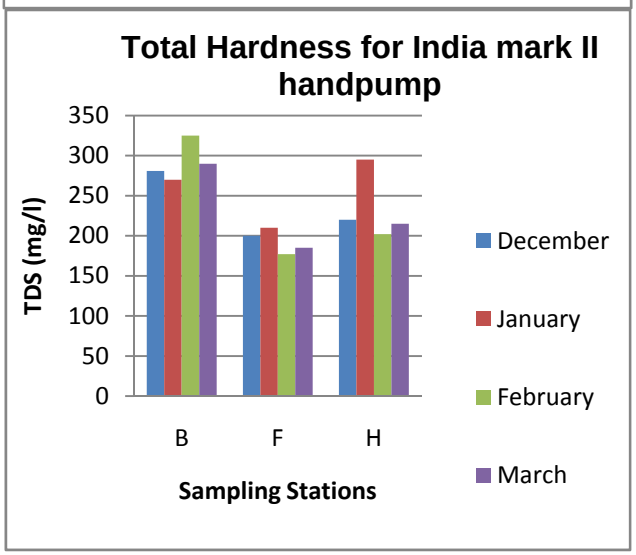


Recorded turbidity values for ground water in the study area varied between 1 to 165 NTU (Fig.4.5).These Turbidity values were obtained at Shallow hand pump (station-A, D, E and G) and India mark-II (station- not any) respectively within acceptable and permissible limit of IS: 10500-2012 and WHO guideline value. And Ground water station B, C, E, F and J, turbidity concentration level (13 to 44 NTU) exceed the acceptable limit of IS: 10500-2012 and WHO guideline value. But station H & I was highly turbid water, its ranged from 47 to 165 NTU (Fig.4.5). Thus making aesthetically unfit for domestic and drinking water purpose, It was very poor quality of ground water.

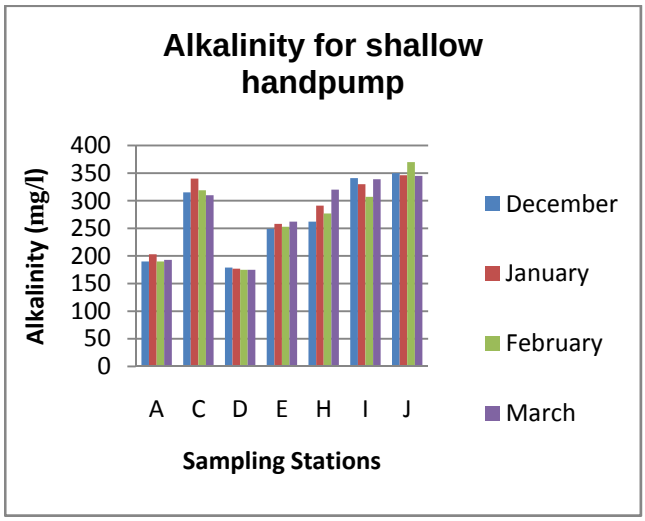
### 4.6. Total Hardness graph

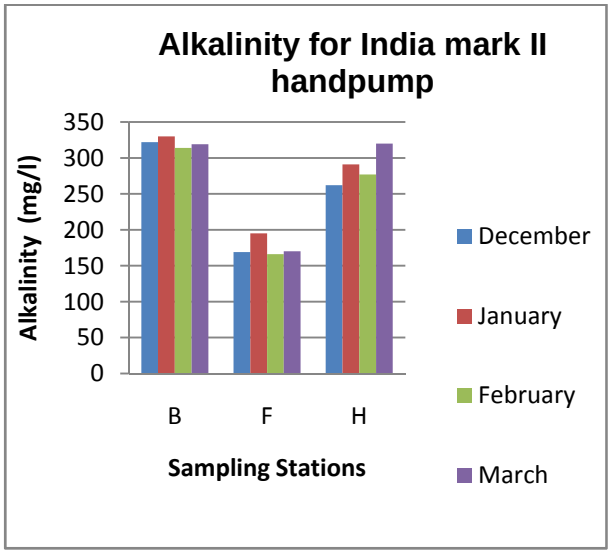



Total hardness concentrations recorded during the study ranged from 130 to 480 mg/l (CaCO3) (Fig.4.6). Total Hardness values were obtained at Shallow hand pump (station- D and G) and India mark-II (F) respectively were within acceptable limits of IS: 10500-2012 guideline value. And other Ground water station A, B, C, E, H, I and J, hardness concentration level exceed the acceptable limit of IS: 10500-2012 But within permissible limit of IS: 10500-2012 and WHO guideline value. The hardness even in shallow hand pump may be attributed to the contact with soil formations.

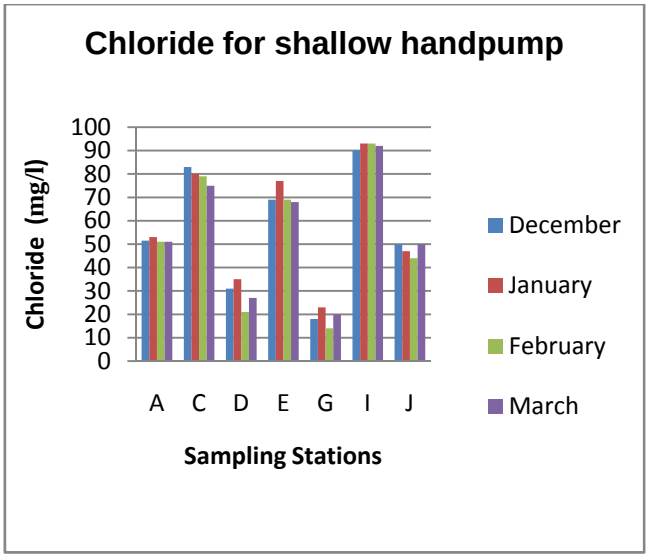
### 4.7. Alkalinity graph

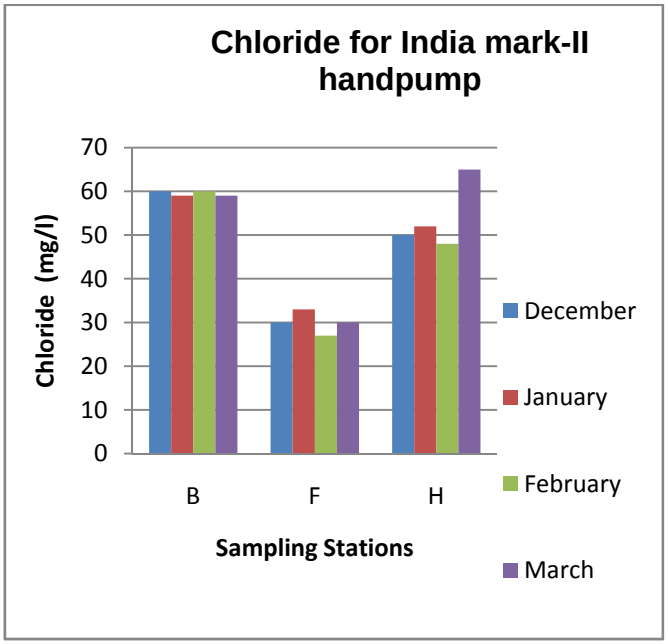



Alkalinity concentrations recorded during the study ranged from 166 to 370 mg/l (CaCO3) (Fig.4.7). Alkalinity values were obtained at Shallow hand pump (station- A and D) and India mark-II (station- F) respectively within acceptable limit of IS: 10500-2012 guideline value. And other Ground water station B, C, E, F, H, I and J, alkalinity concentration level exceed the acceptable limit of IS: 10500-2012 But within permissible limit of IS: 10500-2012 and WHO guideline value.

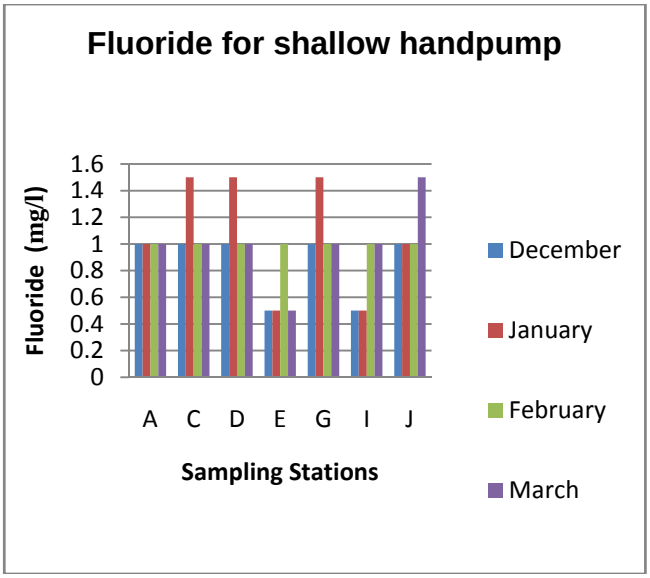
**4.8. Chloride graph**

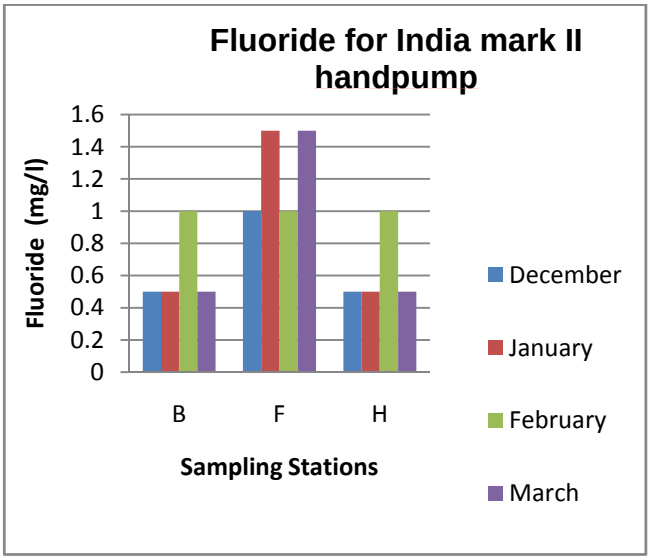



Chloride value ranged varies from 14 to 93 mg/l for both shallow hand pump and India Mark II hand pumps (Fig.4.9) during the study. The highest desirable level for chloride stipulated for drinking and domestic purposes is within the range of 250 to 1000 (IS: 10500-2012; WHO, 2004) (Fig. 4.9). Chloride values were obtained at both Shallow hand pump and India mark-II respectively within acceptable limit of IS: 10500-2012 guideline value. Its indicates that ground water is protected against certain kind of waste water treatment.

**4.9. Fluoride graph**




Fluoride value ranged varies from 0.5 to 1.5 mg/l for both shallow hand pump and India Mark II hand pumps (Fig.4.10) during the study. The highest desirable level for fluoride stipulated for drinking and domestic purposes is within the range of 1 to 1.5 (IS: 10500-2012; WHO, 2004) (Fig. 4.9). Fluoride values were obtained at both Shallow hand pump and India mark-II (all station) respectively within acceptable & permissible limit of IS: 10500-2012 guideline value.

## 5. CONCLUSIONS

In the whole study of this project the contamination of physico-chemical parameter in groundwater has emerged as one of the most prominent problems being faced by public health engineering department, in particular and public at large in both urban and rural areas. The assessment of the physico-

chemical parameter concentration in groundwater in Indiranagar, Gorakhpur district revealed the following recommendations and conclusions:

**1.** The evaluation of physico-chemical parameter concentration in 10 groundwater samples (including 7 shallow hand pumps and 3 India Mark-II hand pumps) of Indiranagar, Gorakhpur district, Uttar Pradesh, India has provided useful insight into the extent of physico-chemical parameter toxicity in the study area. It was found that physico-chemical parameter (5 out of 10) concentration in 3 samples taken from India Mark-II hand pumps was higher than the Acceptable limit of IS:10500-2012 and WHO guideline. And turbidity concenration India Mark-II hand pumps was higher than the permissible able limit of IS:10500-2012 and WHO guideline in With this in view, a detailed investigation about local sources of physico-chemical parameter and mechanisms of physico-chemical parameter release is required.

**2.** The evaluation of physico-chemical parameters concentration in 7 shallow hand pumps of Indiranagar, Gorakhpur district, Uttar Pradesh. It was found that physico-chemical parameter (5 out of 10) in 4 samples from shallow hand pumps taken monthly was higher than the Acceptable limit of IS:10500-2012 and WHO guideline. The use of groundwater for drinking purposes from contaminated ground water hand pumps should be restricted.

**3.** The test result of physico-chemical parameter concentration in 10 groundwater samples (including 7 shallow hand pumps and 3 India Mark-II hand pumps) of Indiranagar, Gorakhpur. The results of 3 station out of 10 (station A, D & G) physico-chemical parameter concentration are within Acceptable limit of IS: 10500-2012 and WHO guideline. But other 7 hand pumps exceed the acceptable limit of IS: 10500-2012 and WHO guideline. It is very big issue for ground water contamination for Indiranagar Gorakhpur.

**4.** The test results (on the basis of physico-chemical parameter) of station E, F, H, I & J is very poor because most physico-chemical parameter exceed the acceptable limit of IS: 10500-2012 and WHO guideline. The color of these stations is highly yellowish and turbidity ranges 11 to 165 NTU which are exceed all standard limits. So this station ground water not must be taken directly for drinking.

**5.** The appropriate testing facilities and field kits should be made available to the people at reasonable cost.

**6**. Any scheme for intangible from deep-water aquatic material should be subject to monitoring of both the quality and quantity of available resources and for the purposes of irrigation there should be no intangible to the deep water. Deep aqueous material can be drained if only a separate layer of soil separates shallow and deep water and preserves deep water for a long period of time.

**7**. Deep hand pump should be constructed with adequate caution against cross contamination.

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