

## STUDY ON PHYSICO-CHEMICAL CHARACTERISTICS OF GROUND WATER IN THE RURAL AREA OF JHUNSI, ALLAHABAD

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### ABSTRACT

Ground water quality is one of the most important criterions to ascertain its suitability for human beings and irrigation. As water is the most important commodity, rigorous urban ground water monitoring is needed for tracking the water table depletion and deterioration in water quality on regular basis. A study on physico-chemical characteristics of ground water in the rural area of Jhunsi, Allahabad was carried out during March to June 2016. The ground water samples were collected from five different locations and analyzed for physico chemical characteristics such as Temperature, pH, Electrical Conductivity (EC), Total dissolved solids (TDS). Total Hardness (TH), Ca. Hardness, Mg. Hardness, Alkalinity, Chloride, Turbidity. The results were compared with the standards prescribed Bureau of Indian Standard (BIS). All the physico-chemical parameters were found within the prescribed permissible limit except the total hardness. The total hardness varies in between 1300-1575mg/l, which indicates that water in the deep aquifer is moderately hard. Hence it is suggested to the villagers, who consume the water in the rural area of Jhunsi, Allahabad (UP) to soften the supply water before consumption.

**KEYWORDS:** Ground Water, Physico-Chemical Characteristics, Temperature, pH, Electrical Conductivity (EC), Total Dissolved Solids (TDS). Total Hardness (TH), Ca. Hardness, Mg. Hardness, Alkalinity, Chloride, Turbidity

### INTRODUCTION

Ground water with the growing competition for water and declining freshwater resources, the utilization of marginal quality water for agriculture has posed a new challenge for environmental management. In water scarce areas there are competing demands from different sectors for the limited available water resources. Though the industrial use of water is very low when compared to agricultural use, the disposal of industrial effluents on land and/or on surface water bodies make water resources unsuitable for other uses. Mukherjee and Prakash (2007)

Water plays an important role in domestic and industrial usage. The quality of drinking water is a powerful element for human health. Assessment of quality of drinking water has always been given priority in the field of environmental quality management. Shukla *et.al.* (2015)

### MATERIAL AND METHOD

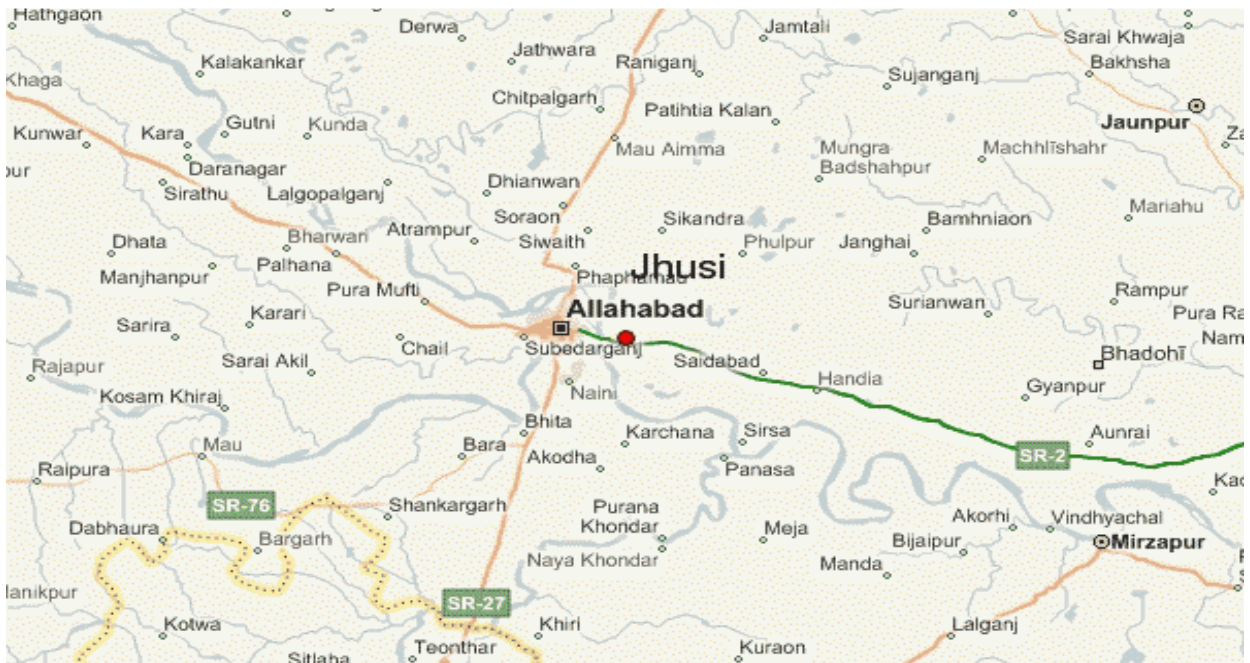
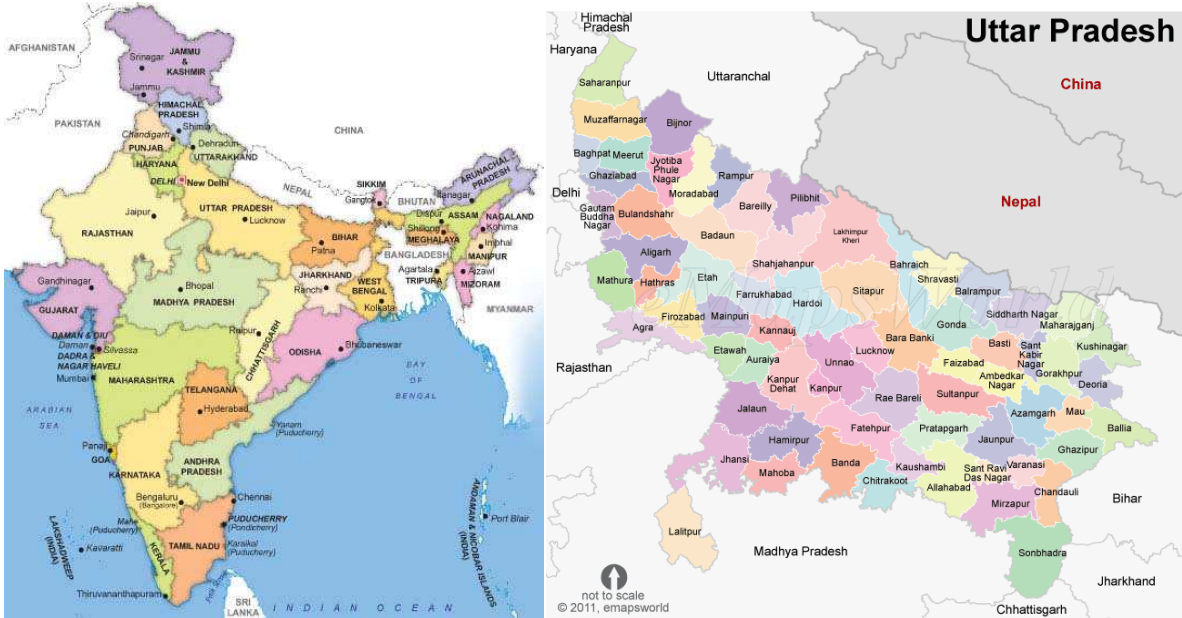
#### Sampling Area

The site for the present investigation was selected from Jhunsi rural area, Allahabad. Allahabad lies on 25.45<sup>0</sup> N latitude and 81.85<sup>0</sup> E longitudes at an altitude of 98.0m in the state of Uttar Pradesh. The city is spread over an area of about 3,424 sq. km. and as temperature varies from maximum 45.6<sup>0</sup>C to minimum 1.1<sup>0</sup>C. All the experimental analysis were conducted in laboratory of department of environmental science, school of forestry & environment, sam Higginbottom institute of agriculture technology & science, (Deemed to – be University), Allahabad.

**Sampling Sites**

Sites have been selected for collecting water samples were situated at Jhushi rural area. The source of samples collection is hand pump. Samples were collected from 5 different villages of Jhushi area.

**Sampling Locations:** S1. Haveliya S2. Saraytaki S3. Naika S4. Chatnak S5. Usthapur



## SAMPLING TIME

**Table 1: Sampling Time Period, Date & Day**

Time Period	Date	Day	Samples
March	01/03/2016	Tuesday	D1
March	16/03/2016	Wednesday	D2
April	01/04/2016	Friday	D3
April	16/04/2016	Saturday	D4
May	01/05/2016	Sunday	D5
May	16/05/2016	Monday	D6
June	01/06/2016	Wednesday	D7
June	16/06/2016	Thursday	D8

## RESULTS AND DISCUSSION

**Temperature:** Temperature in water samples were determined by thermometer. Represent that the maximum temperature (28) °C was observed on date D8 (16/06/2016) at site S1 (Haveliya) whereas minimum temperature (21) °C was observed on date D5 (01/05/2016) at site S4 (Chatnak). Temperatures of water sample were well below the permissible of BIS. The variations in temperature were found significant at different sites. (**Mahananda et al. 2010**)

**pH:** pH value of the water samples were determined by a digital pH meter. Represent that the maximum pH (7.45) was observed on date D7 (01/06/2016) at site S4 (chatnak) whereas minimum pH (6.7) was observed on date D8 (16/06/2016) at site S2 (saraytaki). pH is controlled by the carbon dioxide- carbonate-bicarbonate equilibrium system. An increase carbon dioxide concentration will lower pH, whereas a decrease will cause it to rise. (**Bhattacharya, 1988**)

**Electrical Conductivity:** The EC values of the water samples were determined by a digital EC meter. Represent that the maximum EC (1.19) µmhos/cm was observed on date D4 (16/04/2016) at site S2 (Saraytaki) whereas minimum EC (0.67) µmhos/cm was observed on date D6 (16/05/2016) at site S4 (Chatnak). The high electrical conductivity indicates the presence of high amount of dissolve inorganic substances in ionized form and low electrical conductivity indicates the presence of less amount of dissolved inorganic in ionized form (**Patil and Patil, 2009**).

**Total Dissolve Solid:** Total dissolve solid (TDS) in water samples were determined by Digital TDS meter. Represent that the maximum TDS (11.8) mg/L was observed on date D8 (16/06/2016) at site S4 (chatnak) whereas minimum TDS (7.80) mg/L was observed on date D2 (16/03/2016) at site S5 (usthapur). TDS of water sample were well below the permissible of BIS. The variations in total solids were found significant at different sites. Total dissolved solid is the term used to describe the inorganic salts and small amount of organic matter present in water. The principal constituents are usually calcium, magnesium, sodium, and potassium cations and carbonate, hydrogen carbonate, chloride, sulphate, and nitrate anions. The presence of dissolved solids in water may affect its taste. Most aquatic ecosystem involving mixed fish fauna can tolerate TDS levels off 1000 mg/l (**Boyd and Claude 1999**).

**Total Hardness:** Total hardness in water samples were determined by titration method. Represent that the maximum total hardness (1575) mg/l was observed on date D6 (16/05/2016) and D8 (16/06/2016) at site S1 (haveliya) whereas minimum total hardness (1300) mg/l was observed on date D6 (16/05/2016) at site S5 (usthapur). The entire sampling site gave more values of total hardness, is due to the source of water is more hard. In water hardness is mainly contributed by bicarbonates, carbonates, sulphates and chloride of calcium and magnesium, in case of non-availability of alternate water source it can be acceptable. (**Reo et al, 2012**)

**Calcium Hardness:** Calcium hardness in water samples were determined by titration method. Represent that the maximum calcium hardness (175) mg/l was observed on date D1 (01/03/2016) at site S1 (haveliya) whereas minimum calcium hardness (60) mg/l was observed on date D4 (16/04/2016) and D7 (01/06/2016) at site S5 (usthapur). Calcium hardness in all water within in the permissible limit value. The higher concentration of these ions in summer season may be resulted from dissolution or weathering of respective minerals from rocks whereas in post-monsoon season the concentration of following ions become slightly low. It may be attributed to dilution effect of rain through seepage and percolation of surface or sub-surface water. (**Kumar & kumar 2013**)

**Magnesium Hardness:** Mg hardness in water samples were determined by titration method. Represent that the maximum magnesium hardness (1480) mg/l was observed on date D4 (16/04/2016) at site S3 (Naika) whereas minimum magnesium hardness (1230) mg/l was observed on date D6 (16/05/2016) at site S5 (Usthapur). Magnesium hardness in all water not in the permissible limit value. The magnesium hardness was found over the permissible limit, due to the total hardness was found more at source of water. The values of mg hardness are not below the standard values of BIS. It indicates weathering of various minerals and rocks due to excess of water. (**Yadav et al. 2014**)

**Alkalinity:** Alkalinity of water samples were determined by the acid titration method. Represent that the maximum alkalinity (79) mg/l was observed on date D7 (01/06/2016) at site S5 (Usthapur) whereas minimum alkalinity (65) mg/l was observed on date D6 (16/05/2016) at site S3 (Naika). All the samples had the concentration within the permissible range 600mg/l. Alkalinity varies due to the presence of one or more ions in water including hydroxide, carbonates and bicarbonates. It can be define as capacity to neutralize acid. (**Moshin et al. 2013**)

**Chloride:** Chloride concentrations of water samples were determined by titration method. Represent that the maximum chloride (674) mg/l was observed on date D2 (16/03/2016) and D7 (01/06/2016) at site S3 (Naika) whereas minimum chloride (124) mg/l was observed on date D1 (01/03/2016) at site S3 (Naika) and S5 (Usthapur). Chloride in all samples within in the permissible limit value. The variations in chloride values were found significant at different sites was recorded in different months. The effect of chloride on taste may be critical to water use. Some containing up to 250 mg/l of chloride may have detectable salty taste if the predominant cation is sodium (**Hutton, 1983**) similar trends were also reported by **Paliwal, et, al; (2011)**.

**Turbidity:** Turbidity in water samples were determined by Digital Turbidity meter. Represent that the maximum turbidity (9) NTU was observed on date D8 (16/06/2016) at site S3 (Naika) whereas minimum turbidity (01) NTU was observed on date D4 (16/04/2016) at site S4 (Chatnak). Turbidity of water sample were well below the permissible of BIS. The variations in turbidity were found significant at different sites. Maximum turbidity is due to the presence of silt, clay and other suspended particles and minimum turbidity due to the settlement of silt, clay and other suspended particles. In most water, turbidity is due to colloidal and extremely fine dispersions **Patil and Patil (2009)**.

## CONCLUSIONS

The present research work assessment of Physico- Chemical Characteristics of Ground water in the rural area of Jhansi, Allahabad (U.P.) was the concern expressed for deterioration in the ground water quality. It is noticed that the analyzed parameter of ground water form 5 different sites at rural area of Jhansi, Allahabad showed that the pH, EC, TDS, Turbidity, Total hardness, Calcium hardness, magnesium hardness, Alkalinity, temperature, Chloride values are well within the permissible limit as per the standards given by the Bureau of Indian standards, except the total hardness & mg.

hardness therefore it is good for drinking purpose. Therefore the present study may be concluded that the water of Jhansi rural area is safe. But high total hardness can cause scaling in pipes.

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APPENDICES

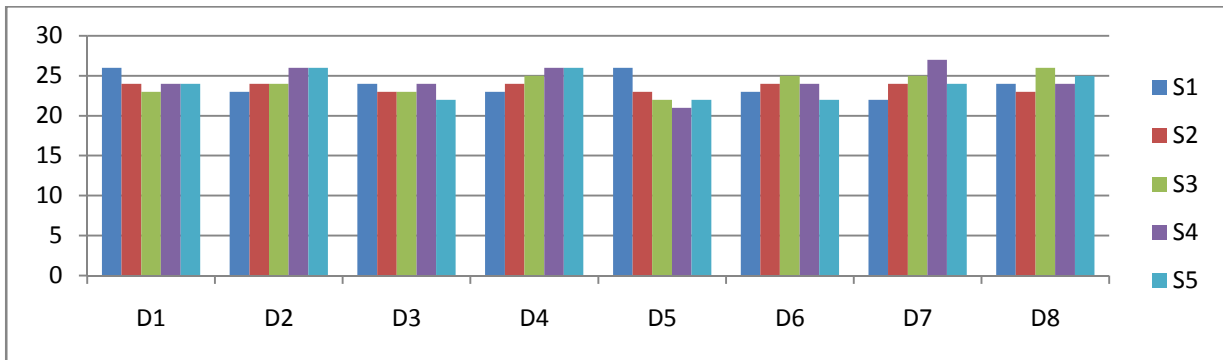


Figure 1: Temperature (°C) of Different Sites of Jhunki Rural Area

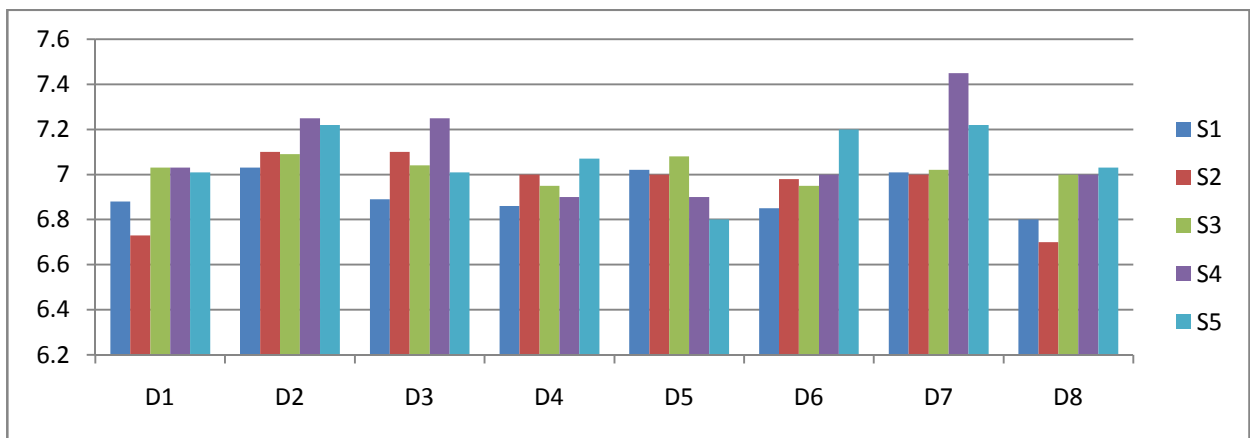


Figure 2: pH of Different Sites of Jhunki Rural Area

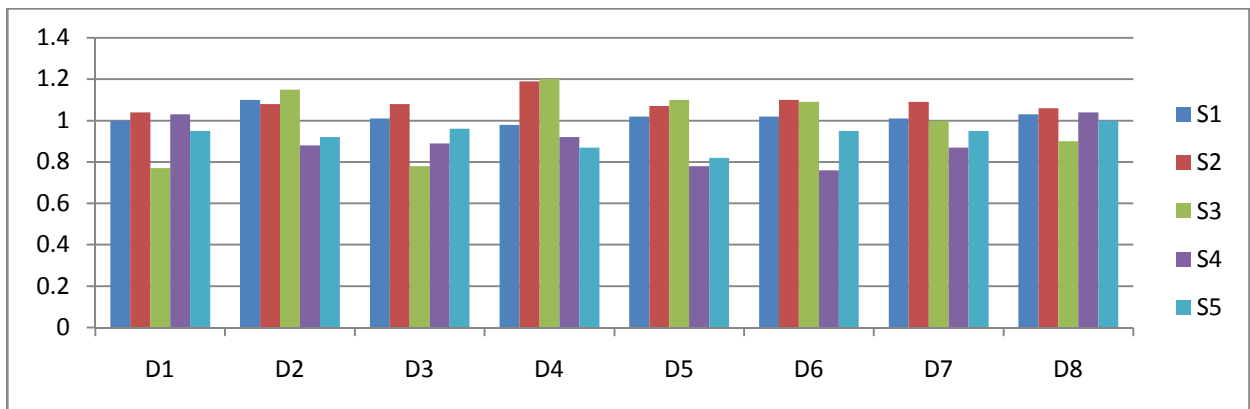


Figure 3: EC (mmhos/cm) of Different Sites of Jhunki Rural Area

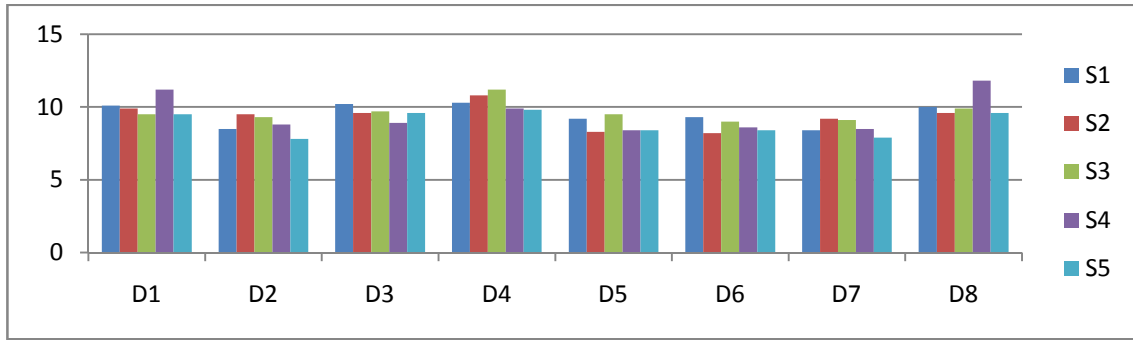


Figure 4: TDS (mg/L) of Different Sites of Jhansi Rural Area

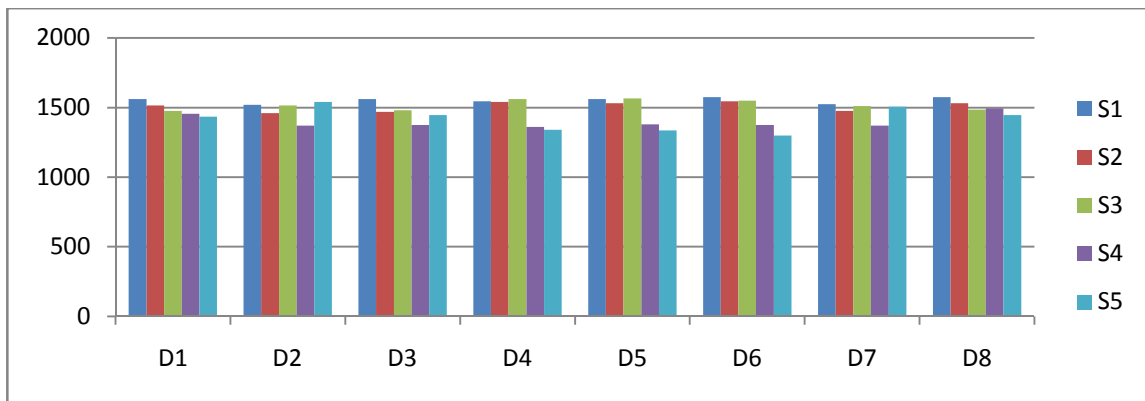


Figure 5: Total Hardness (mg/l) of Different Sites of Jhansi Rural Area

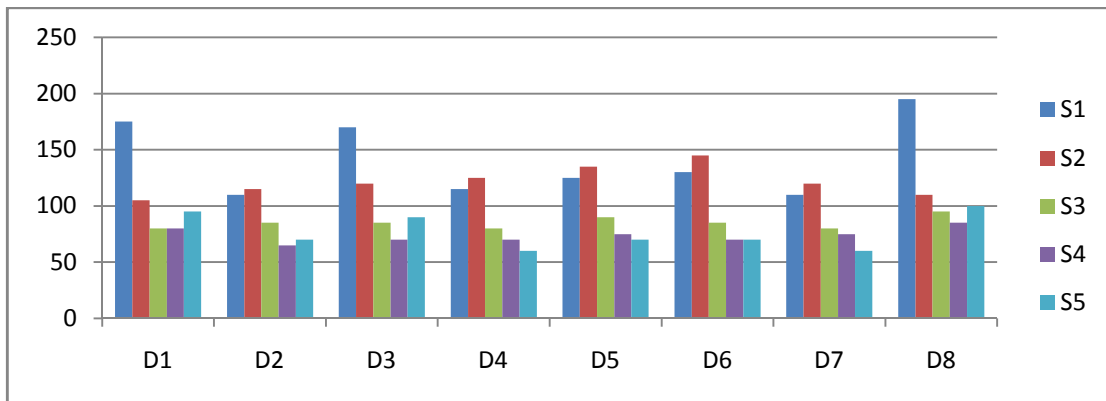


Figure 6: Calcium Hardness (mg/l) of Different Sites of Jhansi Rural Area

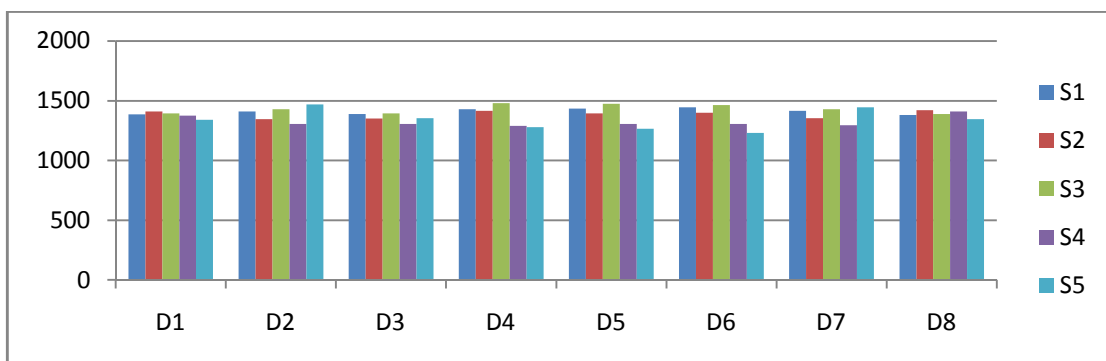


Figure 7: Mg Hardness (mg/l) of Different Sites of Jhansi Rural Area

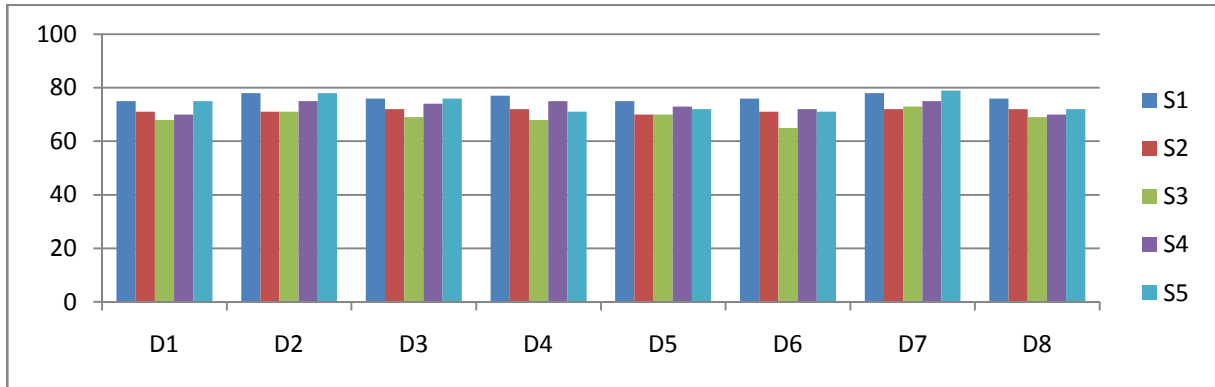


Figure 8: Alkalinity (mg/l) of Different Sites of Jhunsi Rural Area

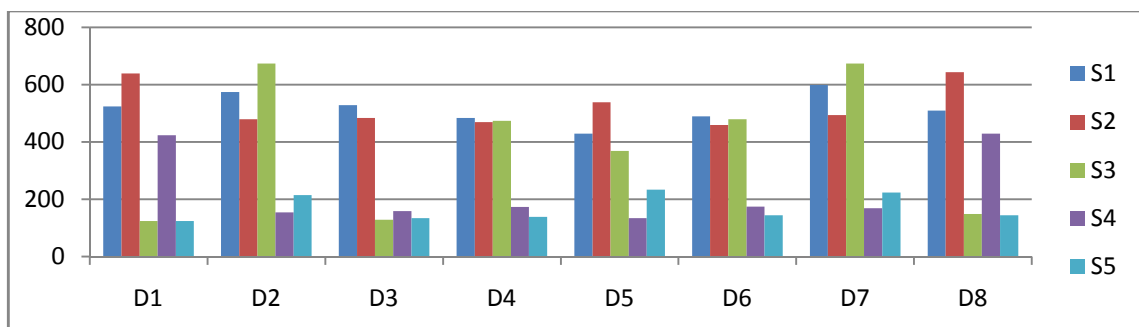


Figure 9: Chloride (mg/l) of Different Sites of Jhunsi Rural Area

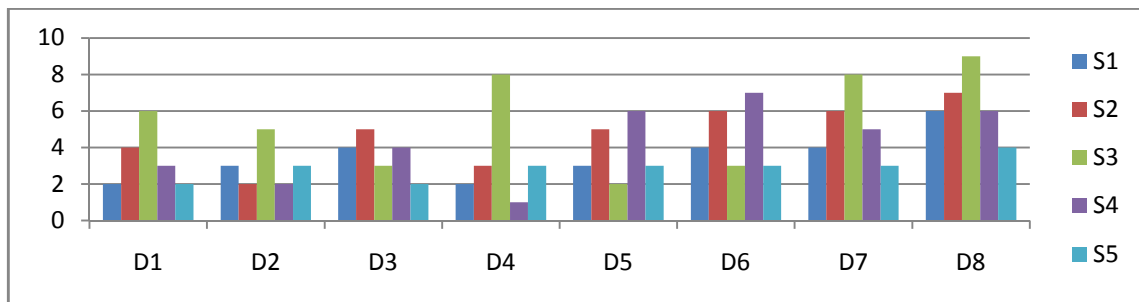


Figure 10: Turbidity (NTU) of Different Sites of Jhunsi Rural Area