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## Study of ground water quality in Barwani district with special reference to Pansemal Tehsil

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### Abstract

The study was carried out to assess the fluoride contamination status of groundwater in Pansemal Tehsil of Barwani District M.P. For this purpose, 24 water samples collected from Hand Pumps of village of study area were analysed for Dissolve Oxygen, Biological Oxygen Demand Chemical Oxygen Demand contain. DO, BOD and COD concentration in this sampling sides varied from in groundwater samples, with DO highest range in Pansemal 6.6 mg/l and lowest range in Junapani 4.4 mg/l. BOD highest range in Piprani 0.6mg/l and lowest range in Pansemal 0.1mg/l and COD highest range in Gongwada 8.0mg/l and lowest range in Piprani 4.0 mg/l.

**Keywords:** Biological oxygen demand, chemical oxygen demand, Pansemal Tehsil

### Introduction

Surface water and groundwater have long been considered separate entities, and have been investigated individually. Chemical, biological and physical properties of surface water and groundwater are indeed different. In the transition zone a variety of processes occur, leading to transport, degradation, transformation, precipitation, or sorption of substance<sup>[5]</sup>.

About 50% of all the underground used in urban areas of developing countries is derived from wells, springs and bore holes and more than 1000 million inhabitants in Asia and 150 million in Latin America rely on such resources<sup>[8]</sup>.

High concentrations of fluoride in drinking water are harmful to human health<sup>[3]</sup>.

Water is nature's most wonderful, abundant and useful compound. Of the many essential elements for the existence of human beings, animals and plants, water is rated to be of the greatest importance. Without food, human can survive for a number of days, but water is such an essential that without it one cannot survive. Water is not only essential for the lives of animals and plants, but also occupies a unique position in industries. Groundwater is an important source of water supply throughout the world. The quantity and the suitability of groundwater for human consumption and for irrigation are determined by its physical, chemical and bacteriological properties<sup>[6]</sup>.

Water in the atmosphere comes from evaporation from the oceans, lakes, rivers ice-fields and glaciers, moist ground transpiration from plants and animal respiration. Water available in the atmosphere is carried for long distances on land from the oceans by wind and convective moment under favourable conditions, it condition and precipitates over the earth's surface as rain, snow and hail<sup>[7]</sup>.

Groundwater is almost globally important for human consumption as well as for the support of habitat and for maintaining the river's base-flow. It is usually of excellent quality. Being naturally filtered in their passage through the ground, they are usually clear, colourless, and free from microbial contamination and require minimal treatment<sup>[1]</sup>.

### Materials and Methods

Groundwater samples from different hand pumps, bore wells were analyzed. Samples were collected in three different seasons June-May 2014-2015 Water sample could not be collected from the location during the post monsoons period due to mechanical problem in the hand pumps. The temperature pH and electrical conductivity were measured in the field using portable pH meter and EC meter. Cations and anions were analysed using ions chromatograph and standard titration method following standard procedures<sup>[2]</sup>.

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**Sampling station:** Four sampling stations were selected in the present investigation-

- S1.Pansemal
- S1.Pansemal
- S2.Junapani
- S3.Gongwada
- S4.Piprani

The water samples were collected 3-3 times these selected sampling station in a precleaned and rinsed plastic container of 1litter capacity for further analysis for necessary precaution [4].

### Temperature

#### Procedure

1. Immerse thermometer in the sample up to the mark specific by the manufacturer and read temp. After equilibration.
2. When a temp. Profile at a number of different depth is required a thermo stat with a Sufficiently long lead may be used.

### pH

#### Reagent

1. Standard buffer solution of known pH.
2. Shake vigorously one excess (5-10g.) of finely crystalline  $\text{KHC}_4\text{H}_4\text{O}_6$  with 100 to 300 ml distilled water at 25°C in a glass- stopper bottle.
3. Calcine a well washed, low alkali grade  $\text{CaCO}_3$  in a platinum dish by igniting for 1L. At 1000°C Cool.
4. 0.1 N NaOH, 0.1 N Hcl, 5 N Hcl and acid potassium fluoride solution.

#### Procedure

1. In each case follows manufacturer's instructions for pH meter and for storage and preparation of electrodes for use
2. Sample for 1 min. Blot dry, immerse in a fresh portion of the same sample and read pH.
3. Take a fresh sample to measure pH.

### Colour

**Reagent:** Dissolve 1.246 gm. Potassium chloro-platinate,  $\text{K}_2\text{PtCl}_6$  and 1.00gm crystallised cobalt us chloride,  $\text{CaCl}_2 \cdot 6\text{H}_2\text{O}$  in distilled water with 100ml conc. Hcl and dilute to 1000ml with distilled water.

#### Procedure

1. Pour sample in a nessler tube of 50 ml mark. Similarly fill three to four tube with colour standard which appear to correspond to the colour the of the sample
2. Compare colour of the sample with that of the standard by viewing vertically down words while the tube are placed on a white surface calculation.

**Calculation:** for dilute sample calculate colour units as:

$A \times 50$

Where: -

Colour units =

A= estimation colour dilute sample

B= ml sample in 50 ml dilute sample

### Odour

#### Procedure

1. Full of sample, insert stopper and shake vigorously for 2-3 sec. And then quickly observe the odour. The sample should be at ambient temperature.
2. Odour free, rotten egg. Burnt sugar, soapy, fishy, septic aromatic, chlorines, alcoholic odour or any other specific odour.

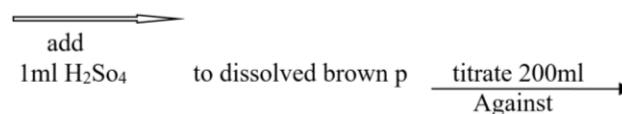
### DO (Dissolve Oxygen)

1. **Manganous sulphate solution:** Dissolve 480 gm  $\text{MnSO}_4 \cdot 4 \text{H}_2\text{O}$ , 400gm  $\text{MnSO}_4 \cdot 2\text{H}_2\text{O}$  or 364 gm  $\text{MnSO}_4 \cdot \text{H}_2\text{O}$  in distilled water, filter and dilute to 1 litter.
2. **Alkali iodine – Azid reagent:** Dissolve 500gm NaOH or 700 gm KOH and 135 gm NaI or 150 gm KI in dissolved water and dilute to 1 litter. Add 10 gm sodium azide ( $\text{NaN}_3$ ) dissolved in 40 ml distilled water.
3. **Sulphuric acid concentrated:** 1 ml is equivalent to about 3 ml alkali – iodide - azide reagent.
4. **Standard sodium thiosulphate 0.025N:** Dissolve 6.205 gm sodium thiosulphate ( $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$ ) in freshly boiled and cooled distilled water and dilute to 1 litter. Add 5 ml chloroform or 0.4 gm NaOH /L or 4 gm borax and 510 mg  $\text{HgI}_2/\text{L}$ . 0.025 N potassium dichromate solution dissolved 1.226 gm potassium dichromate in distilled water and dilute to 1 L.
5. **Standard potassium dichromate:** A solution potassium dichromate equivalent to 0.025 N sodium thiosulphate contains 1.226 gm /L.  $\text{K}_2\text{Cr}_2\text{O}_7$  at 103° C for 2 hrs before making the solution.
6. **Standard disation of 0.025 N sodium thiosulphate solutions:** Dissolved approximately 2 gm KI in an Erlenmeyer flask with 100-150 ml distilled water. Add 10 ml of  $\text{H}_2\text{SO}_4$ , followed by exactly 20 ml 0.25 N potassium dichromate solution.
7. **Starch Indicator:** Add cold water suspension of 5 gm soluble starch to approximately 800ml boiling water with stirring. Dilute to 1 L allow to boil for a few minute and let settle overnight.

### BOD (Bio Chemical Oxygen Demand)

#### Procedure

Fill BOD Bottle sample + 1ml  $\text{MnSO}_4$  + 1ml Azide solution. And shake well



0.025N  $\text{Na}_2\text{S}_2\text{O}_3$  using starch as indicator till the solution become colourless.

- A. Fill BOD Bottle with sample (incubate) at 27° C for three days (then) follow procedure as per 'A'.

#### Calculation

$\text{BOD \% mg /L} = \text{D1} - \text{D2}$

D1 = Ini DO of 1<sup>st</sup> day

D2 = final DO of 3<sup>rd</sup> day

#### Reagents

1. Monogamous sulphate: 480g  $\text{MnSO}_4 \cdot 4 \text{H}_2\text{O}$  dilute in 1 litter water.
2. Alkali iodide Azide: 500gm NaOH o 700 gm KOH and 135 g NaI on 150 gm KI in Distilled water.
3. Sulphuric acid : conc.  $\text{H}_2\text{SO}_4$
4. Starch solution :

5. Standard  $\text{Na}_2\text{S}_2\text{O}_3$  0.025 N: Dissolve 6.205 gm  $\text{Na}_2\text{S}_2\text{O}_3 \cdot 5\text{H}_2\text{O}$  in one liter distilled water.

**COD (Chemical Oxygen Demand)**

**Procedure**

20 ml sample add → 1gm  $\text{HgSO}_4$  + Glass beads add & mix → 30 ml  $\text{H}_2\text{SO}_4$

**Cool drops**

10 ml of 0.25 N  $\text{K}_2\text{Cr}_2\text{O}_7$  + → reflux for 2 hrs at 150 ° C → cool to room

While mixing temperatures wash condenser with 25 ml distilled water

Add 2-3 drops triturate against FAS till Blue Green to just reddish

Ferrouin indicator Brown.

“Reflux & Triturate a blank simultaneously.”

$$\text{Calculation: } C = \frac{(A-B) \times N \times 8000}{\text{ml of sample}}$$

Where,

C= COD as mg  $\text{O}_2/\text{L}$

A = ml of FAS used for sample

B = ml of FAS used for blank

N = Normality of FAS

**Reagent**

1. Std. Potassium Dichromate solution : 0.25 N Dry  $\text{K}_2\text{Cr}_2\text{O}_7$  at 103 ° C for 2 hrs and dissolved 12.259 gm of dried  $\text{k}_2\text{Cr}_2\text{O}_7$  in distilled water dilute to 1 liter.
2. Ferro in Indicator :  
Dissolved 1.485 gm 1:10 Phenanthrolein monohydrate + 695 mg.  $\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$  in distilled water dilute to 1 liter.
3. Td. Ferrous Amm. Sulphate Solution :0.25 N (FAS)
4. Dissolved 98.0gm FAS in distilled water. And 20 ml come  $\text{H}_2\text{SO}_4$  cool and dilute to 1 litre standardise against 0.25 N  $\text{K}_2\text{Cr}_2\text{O}_7$  solutions.

**Total solid**

**Procedure**

A. Dry evaporating Dish /Biker at 103± 1° C cool and store in a desiccators, weigh immediately before use.

B. While stirring pipette a measured volume in to the pre – weighed evaporating dish / Beaker using a wide pore pipette. Choose a sample volume to yield between 10 and 200 mg dried residue

**Calculation - mg Total solids/ L = (A-B) × 10<sup>6</sup> /ml sample)**

Where,

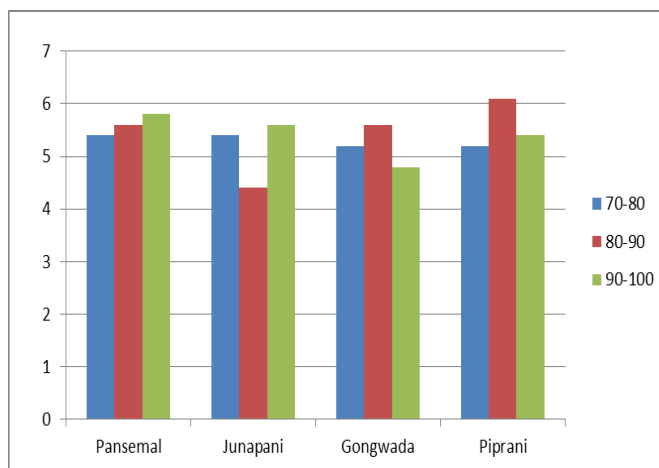
A= weight of dish /Beaker + residue, gm.

B = weight of dish / Beaker, g

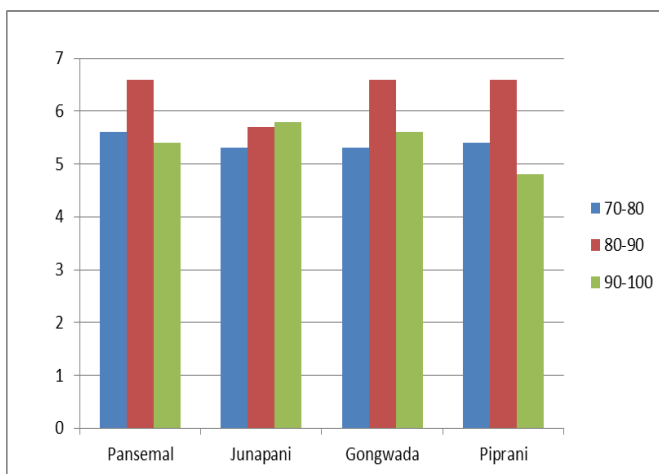
**Observation Tables and Results**

**Table 1:** Comparison of D O (dissolved oxygen) at different depth on Northern and southern Hand Pump and Bore well.

Depth in feet	Pansemal		Junapani		Gongwada		Piprani	
	H.P	B.W	H.P	B.W	H.P	B.W	H.P	B.W
70-80	5.4	5.6	5.4	5.3	5.2	5.3	5.2	5.4
80-90	5.6	6.6	4.4	5.7	5.6	6.6	6.1	6.6
90-100	5.8	5.4	5.6	5.8	4.8	5.6	5.4	4.8



**Fig 1:** Hand Pump

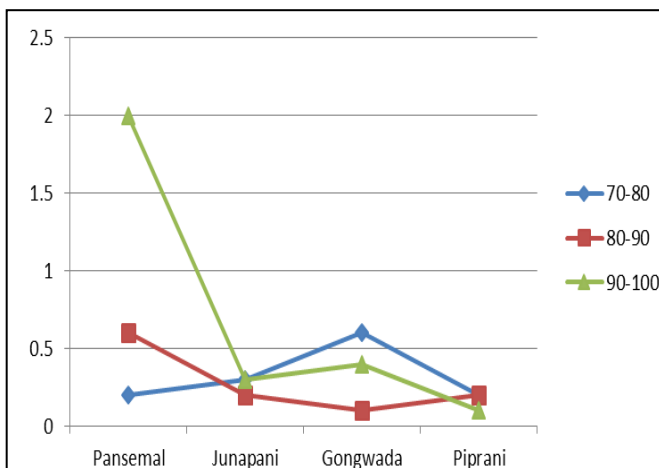


**Fig 2:** Bore well

**DO:** The Dissolved oxygen in the sampling station was ranged between 4.4 to 6.6 mg/L in the present study period.

**Table 2:** Comparison of B O D (Biological oxygen Demand) at different depth on Northern and southern Hand Pump and Bore well.

Depth in feet	Pansemal		Junapani		Gongwada		Piprani	
	H.P	B.W	H.P	B.W	H.P	B.W	H.P	B.W
70-80	0.2	0.3	0.3	0.4	0.6	0.4	0.2	0.4
80-90	0.6	0.2	0.2	0.4	0.1	0.6	0.2	0.5
90-100	0.4	0.1	0.3	0.2	0.4	0.2	0.1	0.6



**Fig 3:** Hand Pump

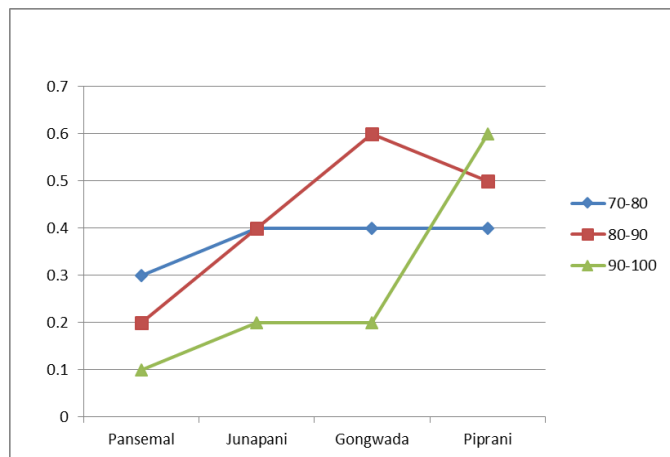


Fig 4: Bore well

**BOD:** Biological oxygen demand level of sampling station range between 0.1 to 0.6 mg/L. The value of B O D in different groundwater sample was also under the permissible limit.

**Table 3:** Comparison of C O D (Chemical oxygen Demand) at different depth on Northern and southern Hand Pump and Bore well.

Depth in feet	Pansemal		Junapani		Gongwada		Piprani	
	H.P	B.W	H.P	B.W	H.P	B.W	H.P	B.W
70-80	4.0	4.0	4.0	6.0	8.0	6.0	4.0	6.0
80-90	5.0	4.0	6.0	5.0	7.0	4.0	5.0	6.0
90-100	6.0	5.0	7.0	4.0	6.0	5.0	4.0	5.0

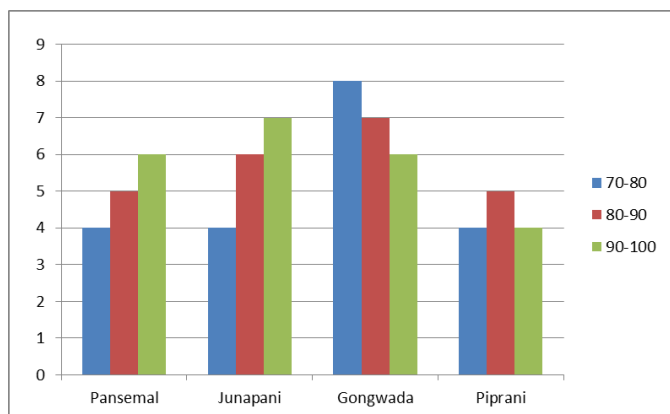


Fig 5: Hand Pump

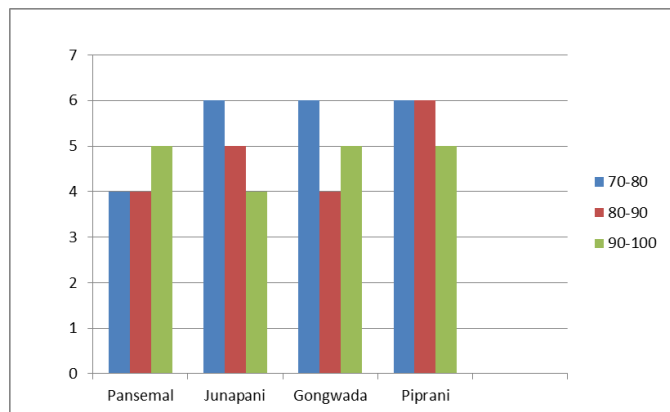


Fig 6: Bore well

**COD:** The C O D value of sampling station was range between 4.0 to 7.0 mg/L in competition to the low D O value, the C O D value always observed higher than B O D value.

**Table 4:** Comparison of Total solid at different depth on Northern and southern Hand Pump and Bore well.

Depth in feet	Pansemal		Junapani		Gongwada		Piprani	
	H.P	B.W	H.P	B.W	H.P	B.W	H.P	B.W
70-80	300	356	368	442	546	632	670	478
80-90	340	450	348	452	560	432	375	573
90-100	298	385	476	460	548	562	480	580

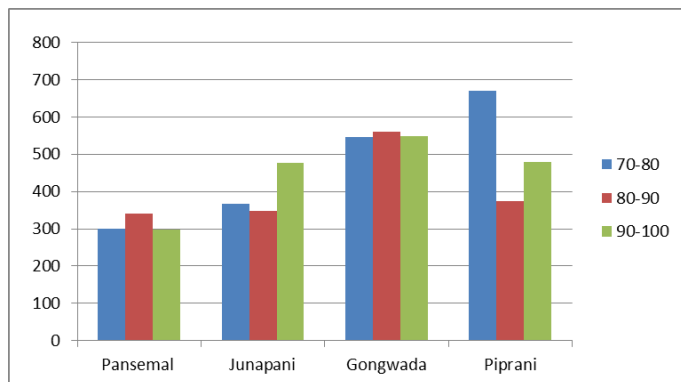


Fig 7: Hand Pump

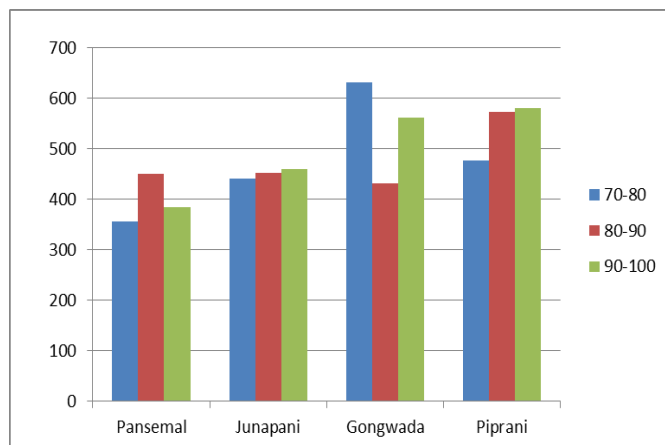


Fig 8: Bore well

**Total solid:** The total solid content of sampling station was ranged between 298 to 670 mg/L the observed result of total solid indicate that all the sampling station were suitable for drinking purpose after necessary treatment.

**Conclusion**

The present study investigates the hydrochemistry of water and DO, BOD, COD and Total Solid in ground water.

**DO:** The Dissolved oxygen in the sampling station was ranged between 4.4 to 6.6 mg/L in the present study period.

**BOD:** Biological oxygen demand level of sampling station range between 0.1 to 0.6 mg/L. The value of BOD in different groundwater sample was also under the permissible limit.

**COD:** The COD value of sampling station was range between 4.0 to 7.0 mg/L in competition to the low D O value, the C O D value always observed higher than B O D value.

**Total solid:** The total solid content of sampling station was ranged between 298 to 670 mg/L the observed result of total solid indicate that all the sampling station were suitable for drinking purpose after necessary treatment.

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