



TRAINING MANUAL & TOOLKIT

NEERJAAL

A DRINKING WATER AND SANITATION INITIATIVE

A JOINT VENTURE BY

Digital Empowerment Foundation (DEF)

Global Rainwater Harvesting Collective (GRWHC) &

Department of Science & Technology (DST)

WATER TESTING TUTORIAL/ GUIDELINES

Importance of Water as Resource

Water and fresh air are the unavoidable resources for life. More than 90 percent of human body is composed of water. But unfortunately, available drinking water and water table is shrinking across the globe. The major reason for this are:

1. Excess usage of underground water resource
2. Deforestation
3. Increasing population
4. High industrial development
5. Pollution Explosion
6. Climate/Environment change
7. High water demand
8. Lack of knowledge of water recycling and judicious usage

In developing country like India, population combined with industrial development is hard-pressing on water demand resulting in the shrinkage of water table. This table is shrinking even in the water rich areas in India. The low rainfall states are even worse hit. The shrinking water table, bad industrial waste management practices, improper sanitation are mostly responsible for the deteriorating drinking water quality. The situation demands immediate attention and this problem must be tackled at the smallest possible level.

ESSENTIALS TO ENSURE GOOD DRINKING WATER QUALITY

The most essential requirement to ensure good quality drinking water availability to all is regular testing of drinking water. These results must reside in the public domain. One of the access points can be internet domain. Neerjaal provides this solution by exposing public domain, which makes available water quality reports and various other informative reports based on water collected from various sources of water at the locality level (Lower than village level) in different parts of India.

We have from last few years regularly training people in the villages on water testing methods using water testing kits. We also follow BIS standards for drinking water, when we recommend water quality as portable or non-portable.

WATER TESTING METHODS

Water testing requires the following mechanism to be followed:

1. Samples collection
2. Physical Test
3. Biological Test
4. Chemical Test
5. Record Keeping - Data-form filling in physical format

COLLECTION OF SAMPLES

First of all, the testing team goes to the water body present in the vicinity to collect sample water to be tested. There could be various sources viz. Hand pump, Open Well, Tanka [or say underground water reservoir] etc.

Sampling from Hand pump

Materials Required

1. Paper and Match stick
2. A sampling bottle
3. A sticker label
4. Sketch Pen

Process

- Burn a piece of paper and keep the flame at the mouth of the hand pump and the water pipe for few seconds. It kills the bacteria present on surface.



Burning mouth of hand pump



Collecting water after cleaning



Labeling sample taken

- Operate the hand pump for 4-5 minutes
- Once water stream flows freely, wash your hands and the sample bottle properly.
- Fill 80%-90% of the bottle with sample water. Leave some space for oxygen to avoid killing the bacteria of sample water.
- Close the bottle tightly.
- Label the sample bottle with source, location, date and time. Ideally, the samples need to be tested within 12 hours sampling.

Sampling from Tanka

Materials Required

1. A bucket
2. Rope
3. A Sampling bottle
4. A sticker label
5. Sketch Pen

Process

- Wash the bucket before using it.
- Dip the bucket in the Tanka 3-4 times before drawing out the sample water.



Drawing water from Tanka



Collecting water after cleaning



Labeling sample taken

- Wash your hands and the sample bottle properly.
- Fill 80%-90% of sampling bottle with sample water from the bucket. Leave some space for oxygen to avoid killing the bacteria of sample water.
- Close the bottle tightly.
- Label the sample bottle with source, location, date and time. Ideally, the samples need to be tested within 12 hours sampling.

Sampling from Open Well

Materials Required

1. A bucket
2. Rope
3. A sampling bottle
4. Sticker Label
5. Sketch Pen

Process

- Wash the bucket before using it.
- Dip the bucket in the open well 3-4 times before drawing out the sample water.



Drawing water from Well



Collecting water after cleaning



Labeling sample taken

- Wash your hands and the sample bottle properly.
- Fill 80%-90% of sampling bottle with sample water from the bucket. Leave some space for oxygen to avoid killing the bacteria of sample water.
- Close the bottle tightly.
- Label the sample bottle with source, location, date and time. Ideally, the samples need to be tested within 12 hours sampling.

PHYSICAL TEST

Physical test includes:

1. Taste (Using your tongue)
2. Color (By looking at the color of water)
3. Odor (By smelling the sample water)
4. Transparency / Turbidity (By looking for the clarity of water)
5. Temperature (measured using thermometer)



Testing water color/ clarity



Testing Turbidity



Testing Odor

CHEMICAL TESTS (USING WATER TESTING KIT)



The water Testing Kit being used for testing water purity comes from People's Science Institute, Dehradun.

NOTE: - The kit should be kept in a cool and dry place.

Components of the Water Testing Kit

Physical Component



The physical component consists of:

- Sample Collection Bottles
- Distilled Water Bottle
- 50ml Beaker
- Measuring Cylinder
- 500ml Beaker
- 100 ml Conical Flask
- 25 ml Test Tubes
- Test Tube Stand
- Coli form Bacteria Bottle
- 4-5 Syringes of 5ml each
- Wire-net Sheet
- Small Spoon
- Thermometer
- Tailoring tape
- Disposal Surgical Hand Gloves
- Breathing Mask
- Glasses

Chemical Components



The chemical components consist of:

- Litmus Paper
- Chloride Re-Agent A
- Chloride Re-Agent B
- Fluoride Re-Agent A
- Total Hardness Re-Agent A
- Total Hardness Re-Agent B
- Total Hardness Re-Agent C
- Nitrate Re-Agent A
- Nitrate Re-Agent B
- Iron Re-Agent A
- Iron Re-Agent B
- Iron Re-Agent C
- Iron Re-Agent D
- Fecal Coli form Media A
- Dissolved Oxygen Reagent A
- Dissolved Oxygen Reagent B

Additional components



TDS Meter and Ph Meter



Bucket and Gas Stove

Additional components consist of:

- TDS Meter
- PH Meter
- Plastic Bucket
- Kerosene Stove

CHEMICAL TESTS

PH Test

(A) Test with Litmus Paper

- Pour the sample water in a beaker.
- Dip the Litmus Paper (provided in the kit) in it for a second.
- Observe the change in color. Match the resultant color against a list of colors on the ph color strip and note the number besides it (provided in the kit).



Dipping Litmus paper in water



Matching with color strip

- If the color changes to any color (less than 7), the sample water is acidic.
- If the color changes to any color (greater than 7), the sample water is acidic.

(B) Test with PH Testing Machine

- Pour the sample water in a beaker.
- Dip the PH testing machine in the sample water.
- Take the reading on the digital display on the machine.
- If the reading is less than 7, it is acidic.
- If the reading is greater than 7, it is alkaline.



Testing PH with digital device

NOTE: -The portable range of PH is between 6.5 and 8.5.

TDS (Total Dissolved Solids) TEST

- Pour the sample water in a beaker.
- Dip the TDS testing machine in the sample water.
- Take the reading on the digital display on the machine.
- If the reading is between 700 and 1000, it is absolutely potable. A reading up to 2000 is permissible to be considered as potable.



Testing with the TDS meter

NOTE: -The device reads 1/10th of the actual reading, i.e. if the reading is 70 means TDS is $70 * 10 = 700$.

- Any reading more than 2000 is non portable.

CHLORIDE TEST

- Pour the sample water in a measuring cylinder. Fill it up to 25 ml mark.
- Transfer the sample in a conical flask. Sample won't have any color.
- Add 6 (six) drops of Chloride Re-Agent A into the sample and shake the flask gently, while adding reagent.



Taking 25ml water sample



Adding chloride Reagent A



Adding chloride Reagent B

- The color of solution turns light yellow.
- Take 5ml of Chloride Re-Agent B in a syringe and add it to the yellow solution drop by drop; at the same time shaking the flask gently until it turns red. If 5ml of Re-Agent is not sufficient, add more of Re-Agent B in the same way till the solution becomes Red.
- Multiply the total ml of Re-Agent B consumed with 20 viz. $14\text{ml} \times 20 = 280$ mg/liter. The result shows the amount of chloride present per liter of water.

TOTAL HARDNESS TEST

- Take 25ml of sample water into measurement cylinder.
- Transfer the water from measuring cylinder to a conical flask. Water is colorless.
- Add 1ml of Total Hardness Re-Agent B with the help of spoon (provided in the kit) into the flask. Shake the flask gently after adding the reagent.



Taking 25 ml Sample water



Adding Reagent B



Resulting Solution

- Add 10 drops of Total Hardness Re-Agent A to the solution.
- Add Total Hardness Re-Agent C, drop by drop while shaking the flask gently, till the color turns light blue.



Adding Reagent A



Adding Reagent C in drops



Light blue solution attained

- Multiply the consumed Re-Agent C with 80 and the result shows amount of total hardness in mg/liter viz. $3 \times 80 = 240$ mg/liter.

FLOURIDE TEST

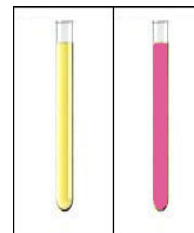
- Pour 25ml of sample water into measurement cylinder.
- Transfer the water from measuring cylinder to a test tube. Water is colorless.
- Add 30 drops (1.5ml) of Fluoride Re-Agent into the test tube.



Taking sample water



Adding Fluoride reagent



Possible colors

- Leave it for an hour (1 hr). The color turns light yellow.
- If the color stays yellow, the sample is non-potable and the Fluoride level is around 3.5 mg/liter.
- If the color changes to light pink, then the sample is potable and the Fluoride level is around 1.5mg/liter.

NITRATE TEST

- Pour 25ml of water into measurement beaker
- Transfer the water from measuring cylinder to a conical flask. Water is colorless.
- Heat it on low flame (using stoves or gas burner) till entire sample in the flask evaporates.



Taking water sample



Evaporating the sample water

- Let the flask cool off.



Adding Nitrate reagent A

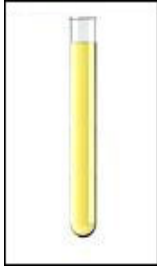


Measure and add 25 ml distilled water

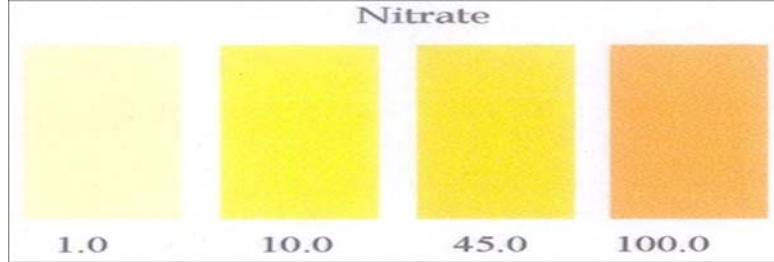


Adding Nitrate reagent B

- Add 20 drops of Nitrate Re-Agent A into the Flask.
- Add 25ml of Distilled water into the Flask.
- Add 3ml (60 drops) of Nitrate Re-Agent B into the flask (drop-by-drop).
- The color of the mixture turns yellow.
- Match the color of solution with the green chart (given in the booklet) to find out the Nitrate quantity.



Resulting
color
solution



Standard Nitrate Chart

- If it measures till 10 mg/liter, the water is portable.
- If measurement goes above 45 mg/liter, the sample is non-potable.

IRON TEST

- Pour 25ml of water into measurement beaker
- Transfer the water from measuring cylinder to a conical flask. Water is colorless.
- Add 1 mg (20 drops) of Iron-Re-Agent A and 0.5 mg (10 drops) of Iron Re-Agent B into to flask.
- Heat the solution on low flame till 5 ml of water remains in the Flask.



Taking Sample



Adding Reagent A followed by
reagent B



Heating the solution till 5 ml is
left in the flask

- Add 5 ml (100 drops) of Iron Re-Agent C into the remaining 5 ml solution drop by drop.
- Add 2 ml (40 drops) of Iron Re-Agent D into the solution with the help of syringe, drop by drop.
- Add 15ml (40 drops) of Distilled Water into the flask.



Adding Reagent C

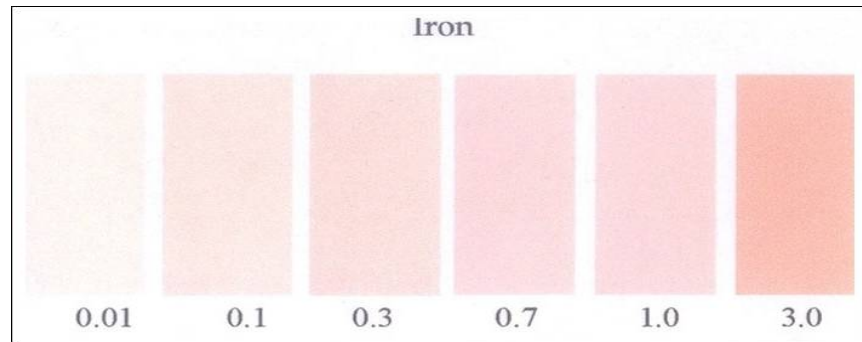
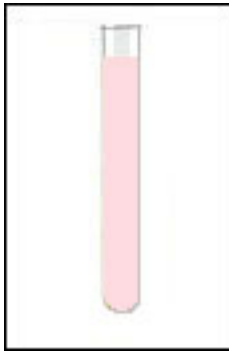


Adding Reagent D



Adding 15 ml distilled water

- Shake the flask swiftly and let it rest for 15 minutes.
- Observe the change of color of the resulting solution. The color may change.
- Match the color of solution with the Standard Color Chart of Iron to find out the appropriate Iron quantity.



- If it measures till 0.7 mg/liter, the water is potable.
- If measurement goes above 0.7, the water is non-potable.

BACTERIAL OR COLIFORM TEST

- Pour 50ml of sample water into measuring cylinder.
- Pour 50 ml of Coli form Media to the Coli form Testing Bottle.
- Add sample water to the Coli form Testing Bottle. The solution would turn Pink.
- Leave the solution for 12 hours around 30°C to 37°C.
- Observe the change in color.
- If the solution turns Yellow, then the bacterial presence is more than 10 mg/liter and it indicates that the sample is non-potable.
- If the solution remains Pink, it means no bacterial presence and then it is safe to drink and potable

RECORD KEEPING - DATA FORM FILLING IN PHYSICAL FORMAT

- Record keeping has to be done by filling the form format provided by the implementer.

GENERAL INSTRUCTIONS

The place immediately surrounding the Hand pump, Tanka, or Well should be kept clean to avoid seepage and other ailments. This is just a general hygienic practice but it must be drilled into the common village folks to ensure safe drinking water for them.



**For more Information
Contact**

Digital Empowerment Foundation
3rd Floor, 44, Kalu Sarai
Near Narayana IIT Academy
New Delhi – 110016

Email: defindia@gmail.com, neerjaal@defindia.net

**DIGITAL
EMPOWERMENT
FOUNDATION**

