

Cover

A People's Manual on Water Quality



Janhit Foundation



About Janhit Foundation

Janhit Foundation is an independent, not-for-profit non-governmental organization, actively engaged in the promotion of human welfare through environmental protection since 1998.

Key areas of work include:

- Groundwater quality protection for human health
- Provision of safe drinking water to marginalized communities
- Protection of river water quality for aquatic ecosystems
- Enhancement of available water resources through water conservation measures
- Promotion of sustainable agriculture by organic farming methods
- Environmental education and empowerment of local communities

Janhit Foundation undertakes this work through scientific research, campaigns, advocacy and grass-root level community involvement.

As a public interest organisation, Janhit Foundation focuses on strengthening local communities through their active participation in decision making, to achieve sustainable development. We believe that environmental degradation can only be addressed adequately if local people are empowered in decision making at all levels and have control over resources.

To achieve our goals, we work in partnership with government, non-governmental, national and international organisations on environment and human rights issues.

Sonakshi Hudda, *Editor*

© Janhit Foundation, Meerut

Address

Rain Centre

C-28, Shastri Nagar, Meerut

Phones : 0121-2763418, 4004123

E-mail : info@janhitfoundation.org

Website : www.janhitfoundation.org

Printed by: Systems Vision

A-199, Okhla Phase-I, New Delhi - 110 020

Contents

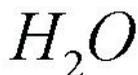
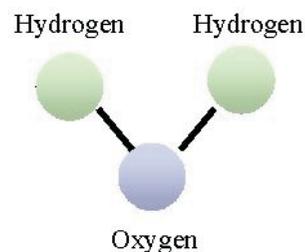
1. Introduction	4
2. Water availability	4
3. What is water quality	6
4. What affects the water quality	6
5. How is water quality measured	8
6. Effects of deteriorated water quality	8
7. How water quality affects our Ecosystem	9
8. Some cases on Water Quality Deterioration	9
9. A case study of Drinking Water quality (Handpumps) in Meerut	12
10. Water Quality Monitoring	14
11. Is your water clean.....	14
12. What should I do	15

Introduction

Water is a precious resource on earth. It is a naturally occurring and an essential part of our ecosystems without which life is impossible. All forms of life need water for their survival and sustenance. Although the form, amount and source of the water may differ for different species. Water plays an important role in sustaining the life of humans.

In the terms of Chemistry, water is a compound whose one molecule is made up of two Hydrogen atoms and one Oxygen atom (H_2O). It exists in all three forms of matter solid, liquid and gas but most of the water on earth is available in liquid form.

A Molecule of Water



Water Availability

Earth is a watery planet. About three-fourths of the earth's surface is covered with water. It is present in air (in the form of water vapours as moisture), on the surface and inside the ground. Water is available in abundance but is not uniformly distributed. Some areas are blessed with plenty of water while some are totally dry. The foremost reason for this is variation of rainfall.

Water Availability on Earth

Reservoir	Quantity (km ³)	Percentage
Plants and animals	700	0.000049
Rivers	1,700	0.0001
Atmosphere	13,000	0.0009
Soil	65,000	0.0046
Lakes, reservoirs, wetlands	125,000	0.008
Groundwater	7,000,000	0.498
Ice and glacier	26,000,000	1.8529
Oceans	1,370,000,000	97.633

Source: Park, C., (1997); *The Environment-Principles and Applications*.
Routledge publications, London

India is rich in water resource. It has a network of 14 major, 55 minor and several hundreds of small rivers. There are few large lakes like Dal in Jammu & Kashmir, Kolleru in Andhra Pradesh etc. and more than a thousand glaciers. India receives an average annual rainfall of about 1130 mm. Water resources can be broadly classified into the following two categories:

- Surface Water:** Water on the surface is available through various sources such as rivers, streams, lakes, reservoirs etc. Surface water is an important source as about 61.49% of all water exists as surface water. Thus it is vitally important to our everyday life. The uses of surface water include drinking, irrigation of agriculture, domestic, public supply, electricity-generation, industrial use etc.
- Groundwater:** This is water that underlies the Earth's surface including beneath hills, mountains, plains and even deserts. About 38.50% of total water source is available as groundwater. The groundwater level varies from place to place. It may occur close to the earth's surface and it may be hundreds of feet below the surface.

What is water quality?

Talking of water quality, its physical, chemical and biological characteristic comes into question. A healthy environment cannot be attained without good water quality, as water is essential to human life and to the health of the ecosystems.

Water quality is important for public health, commercial purposes (such as mining, fishing etc.) and also for recreation. If water quality gets degraded, this important resource will lose its value.

What affects the water quality?

Water sources such as rivers, lakes, seas etc. are of immense importance. However, due to incorrect management the same sources are now getting polluted. There is a high deterioration in surface as well as groundwater quality which is harmful to aquatic and terrestrial life. Major pollutants resulting in water pollution are:

a) **Industrial waste:** Today, the population of India is increasing at a rapid pace. Daily water requirements are also increasing for domestic and industrial purposes. Industry is a major factor leading to the pollution of water. Various harmful chemicals being used in industries are thereafter discharged by them as untreated



waste into open drains. The contaminated water in these drains is discharged to river water making it toxic. Untreated industrial effluents are often collected in ponds from

where this polluted water continuously leach to the ground aquifers. This polluted groundwater then poisons local water sources such as handpumps and tubewells causing serious ailments that may result in death.

- b) **Agriculture run-off:** The extensive use of chemical fertilizers and pesticides in agriculture also contaminates surface and ground water. These chemicals enter surface water bodies through soil erosion and water run-off. The chemicals also filter down through the soil to enter ground water. Pesticides are actually toxic to human health resulting in a range of diseases including organ failure and cancer. Such heavy metals enter human body through water brought into domestic use and many of them cause health problems such as cancer. When waste in the form of liquid manure enters water bodies, the amount of bacteria increases leading to a decrease in dissolved oxygen in the water. Without sufficient oxygen, the aquatic life within the water body leads towards extinction.
- c) **Untreated sewage from towns and cities:** In our daily routine, we use a lot of products such as detergents, phenyl, soda, soaps etc. at our homes, offices etc. The water coming out in the drains is quite toxic. Through drains it leads to rivers which again effects aquatic as well as terrestrial life.
- d) Other sources of pollution include:
- Radioactive sources.
 - Untreated waste from slaughter houses.
 - Disposal of plastic bags and solid waste into the water.

There is not much problem of water availability in our country, only the problem is the lack of its management

How is water quality measured?

Water quality is measured by checking the physical, chemical and biological characteristics of water and the presence of pollutants in it. Evaluating the aquatic community found in the water body can also assess surface water quality. Some water quality indicators include:

- **Biological:** Algae, Macrophytes, Microinvertebrates, fish
- **Physical:** Temperature, Colour, Dissolved solids
- **Chemical:** pH, Dissolved Oxygen etc.
- **Aesthetic:** Odour, Colour, Taste.

With the help of the above-mentioned indicators, we can monitor the water quality and suggest whether the water is suitable for use by different elements of the ecosystem.

Effects of deteriorated water quality

Bad water quality affects our environment in many ways.

- a) **On human health:** The adverse affects of bad water quality can be seen directly on our health. Intake of contaminated water gives rise to various serious ailments in our body such as cancer, neurological disorders, gastrointestinal disorders, skin related diseases and respiratory diseases sometimes even results in death. The reason of these disorders lies with the presence of pathogens and bacteria, heavy metals or other toxic chemicals in the contaminated water.



- b) **On aquatic and terrestrial ecology:** Apart from human beings, birds and animals are also being affected by bad water quality. Most of them depend on the natural water sources such as rivers, ponds, lakes etc. But due to the water pollution either they die out due to lack of drinking water or they suffer slow death by drinking this contaminated water.

How water quality affects our Ecosystem?

Aquatic ecosystem is home to many species including aquatic plants, insects, fish, birds, mammals and others. Aquatic biodiversity has a lot of economic and aesthetic value. We use aquatic sources for food, medicines, fishing and also for recreation etc. but pollution of these sources due to urban, industrial and agricultural wastes as well as many other human activities is gradually decreasing aquatic biodiversity in both marine and freshwater environments. It is necessary to conserve aquatic biodiversity as it maintains the balance of nature and supports the availability of resources for future generations.

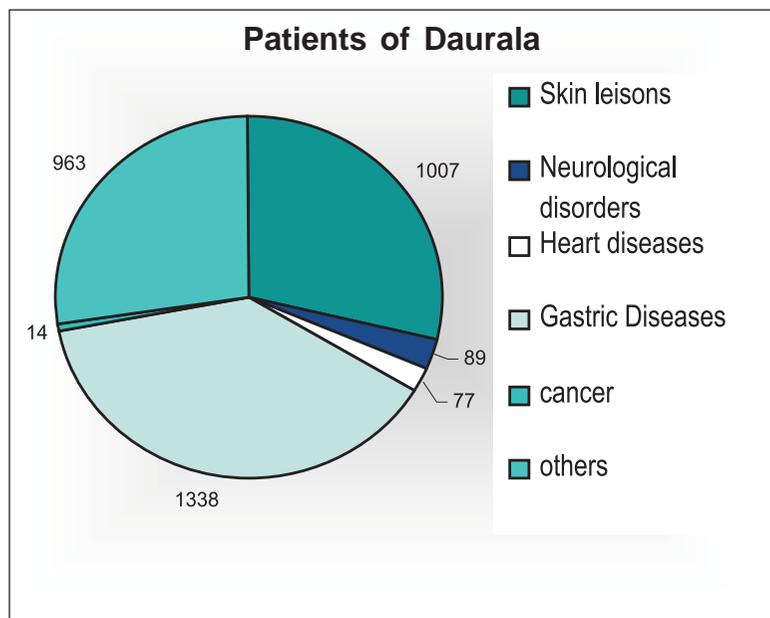
Some cases on Water Quality Deterioration

Daurala: Daurala, a suburb of Meerut City in Uttar Pradesh, is a small agricultural village with a population of about 18,000 people, where crops like rice and sugar cane are grown. It is also home for large industries, producing sugar and organic chemicals. Daurala Sugar Works is a distillery unit, and Daurala Organics manufactures various drug and pesticide. Among the products are organic chemicals such as d-phenylglycine, d-phenylglycine hydrochloride, and metaphenyl benzaldehyde. The village population was exhibiting elevated levels of ill-health and early death. Hundreds of people were dying of serious ailments like thyroid cancer, neurological disorders and gastrointestinal ailments. Even the agriculture land for thousands of acres surround-

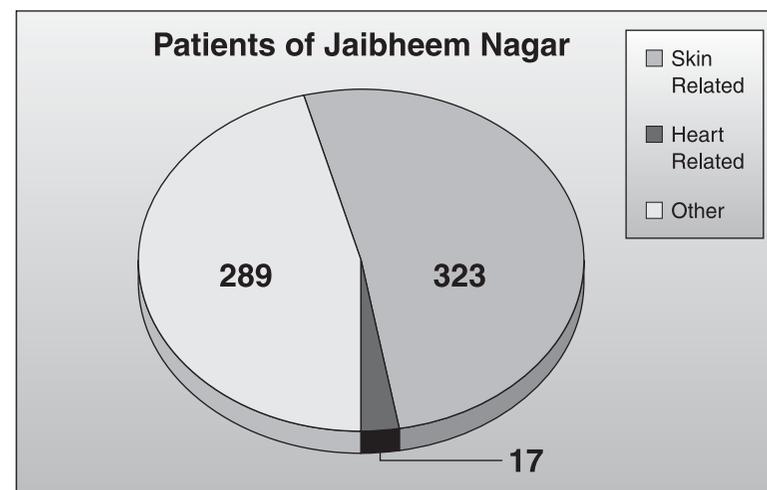
ing the village produced toxic crops. There was a gradual disappearance of aquatic life from the village ponds.

Why was this situation occurring? The reason for all this ill-health has come out to be polluted water. Janhit Foundation, conducted the study of drinking water, wastewater, agriculture soil and sludge samples of Daurala. The analysis revealed alarming levels of toxic heavy metals such as arsenic, lead, aluminium and cyanide in water samples. Levels found were many times more than their permissible limit for safe drinking water. The expected toxic effects of these metals on human health were evident by in the illnesses suffered by the villagers of Daurala.

According to the study the total number of patients suffering from serious ailments including cancer, neurological disorders, gastrointestinal ailments, asthma, blood pressure, heart diseases which may be directly attributed to heavy metal poisoning was 3488. The study also revealed that nearly 192 people lost their lives in last five years.



Jaibheem Nagar: Jaibheem Nagar, a slum in Meerut, has a population of about 15,000. The residents are mainly schedule caste, *dalits* and daily laborers mainly belonging to marginalized groups. They are forced to lead a life full of miseries since they do not have even a single drop of “safe” drinking water. Women and children especially young girls have to cover a tiresome journey of 2-2.5 kms everyday to fetch safe drinking water for their families and themselves. Janhit Foundation conducted drinking water samples analysis for physio-chemical parameters from Jaibheem Nagar.



The reports revealed the presence of excessive total dissolved solids (TDS). In addition to these, heavy metals (including iron, mercury, chromium, cadmium and lead content) were also found many times more than the desirable limits in safe drinking water.

Due to severe drinking water contamination the community suffers from epidermal, gastrointestinal, neurological disorders and cardiac ailments. Pregnant women and children are the worst affected. Again, these health effects seen at Jaibheem Nagar may be directly attributed to toxic

poisoning by heavy metals. The residents have abandoned a number of handpumps since the water coming out of them is severely contaminated.

A case study of Drinking Water quality (Handpumps) in Meerut

Janhit Foundation has been actively engaged in providing safe drinking water and sanitation to the deprived section of the society. In this direction Janhit Foundation has also done a comprehensive study of the drinking water quality of urban Meerut. The quality of 11 drinking water (handpumps) samples from different locations in Meerut were collected and analyzed for different physical and chemical parameters at the Pollution Monitoring Laboratory, CSE. The study has come out with alarming levels of physio-chemical parameters which is a serious threat to the residents of Meerut. The following is the table showing the water quality:

Location of the Water (Handpump) Samples Collected from Different Regions in Meerut City, Uttar Pradesh

S.N.	Name of the colony	Code No
1.	Medical College campus	1
2.	Behind Puri petrol pump	2
3.	Phool Bagh Colony, Gali No. 5 (opp. Jain Temple)	3
4.	Zakir Colony(Near slaughter house)	4
5.	L Block Shastri Nagar	5
6.	K Block Shastri Nagar (Pravesh Vihar)	6
7.	Near International public school, Cantt. Meerut Opp. Sophia School	7
8.	Mohanpuri (New)	8
9.	Rajban Bazar, Near Petrol pump	9
10.	Kasimpur (Opp. Central Distillery)	10
11.	From the field near Kali River	11

Physico-Chemical Parameters of Different Handpumps Sample Collected from Meerut City, Uttar Pradesh

Parameters	Desirable Limit *	1	2	3	4	5	6	7	8	9	10	11
Colour	-	Colour-less (CL)	Brownish	Yellowish	CL	CL	CL	CL	CL	CL	CL	Brownish
pH	6.5-8.5	7.56	7.20	7.28	7.35	7.33	6.54	7.10	7.11	7.30	6.93	7.15
Conductivity(25)	-	702	967	1085	1000	805	1597	877	770	702	1090	815
Turbidity (NTU)	5.0	0.31	383.1	86.57	0.89	1.34	5.50	0.93	2.51	1.71	0.60	96.93
DO (mg/L)	-	8.05	7.65	7.93	7.93	7.60	7.59	8.24	8.59	7.99	8.02	7.43
COD(mg/L)	-	25.88	14.04	16.37	10.67	44.61	31.72	34.68	36.44	49.35	51.79	66.49
Total Solids (mg/L)	-	606	686	1058	1188	546	1182	626	592	484	1214	800
TDS (mg/L)	500	514	612	1056	116	496	892	748	466	376	264.1	600
TSS (mg/L)	-	6.00	22.00	2.00	4.00	1.00	20.00	6.00	26.0	4.00	2.00	160
Chloride (mg/L)	250	39.98	42.98	83.97	137.95	64.97	257.62	60.92	37.98	42.98	74.90	227.4
Nitrate (mg/L)	45	2.30	0.42	2.00	11.60	6.20	13.60	9.60	0.40	4.60	15.20	10.45
Bromide (mg/l)	0.01**	0.68	ND	1.025	0.119	0.068	0.184	1.074	0.813	0.739	0.950	0.576
Fluoride (mg/L)	1.0	ND	0.550	1.277	1.409	1.965	1.241	1.831	1.403	1.148	1.853	0.198
Hardness(mg CaCO ₃ /L)	300	256.00	224.0	36.00	30.00	32.00	30.00	34.00	66.00	40.00	30.00	285.00
Calcium (mgCa/L)	75	102.6	89.77	14.42	12.024	12.82	8.016	13.62	26.45	16.032	12.02	114.22
Magnesium (mg/L)	50**	131.0	87.36	87.36	305.76	131.04	131.04	109.2	87.36	218.36	43.36	60.71
Phosphorus (mg/L)	-	0.033	0.1506	0.0766	ND	ND	ND	ND	0.082	0.0026	0.088	0.878
Iron (mg/L)	0.3	0.001	0.4254	1.0071	0.0097	0.0171	0.2135	0.098	0.177	0.1836	0.044	0.269
Aluminum (mg/L)	0.03	0.001	0.003	0.014	0.079	0.0017	0.0073	0.003	0.005	0.003	0.006	0.001
Chromium VI(mg/L)	0.05	ND	0.0063	ND	ND	ND	ND	ND	ND	ND	0.002	ND

*The MRL and Desirable Limits are of drinking water as specified by Bureau of Indian Standards.

**MRL as per USEPA Standards for Drinking Water

Water Quality Monitoring

One of the greatest threats to the environment and human health is the unavailability of clean drinking water. It is estimated that about 80% of the total population of India does not have any access to clean drinking water and also of the total water available, nearly 70% of it is polluted. Not only this, also groundwater is severely contaminated. There are many reasons for this pitiable condition. The most urgent need is to monitor the water quality and improve it.

Several parts of India are facing a serious scarcity of pure and safe drinking water. Most of the infectious diseases are water borne, killing more and more people with each passing year. The need of the hour is to understand the status of drinking water quality, problems related to the quality and their reasons. Water Quality Monitoring gives an in-depth understanding of status of water quality in different sources. Water is vitally important to every aspect of our lives. Monitoring the quality of surface water will help protect our waterways from pollution. Farmers can use the information to better manage their land and crops. Our local, state and national governments use monitoring information to check control pollution levels. We can use this information to understand exactly how we have an impact on our water supply and to help us understand the important role we all can play in water conservation.

Is your water clean?

Water contamination is a problem which is important for everyone and specially you. You should get your water quality tested, if:

- It smells bad
- It is coloured
- tastes saline

- family members are suffering from water borne diseases such as diarrhea, stomach ailments, skin diseases etc.

You can collect a sample of the water and can get it tested in any laboratory or can test on your own using the hydromet instruments such as ph meter, TDS meter, EC meter etc.

What should I do?

We can go for the following activities, to improve our water quality:

- Boil the water and then drink.
- Keep your surroundings clean.
- Go for water filters. Also you can place the drinking water in a copper vessel.
- If any of the handpumps in your house in your locality gives coloured water, then increase the depth of that handpump. If still the quality of the handpump remains same, then stop drinking water from it.
- If possible, do aware your friends about the ill-effects of bad water quality on their health. If the water of your village or locality has got polluted, then please meet or write to the authorities responsible for providing safe drinking water.