

# Water, Sanitation and Hygiene Training

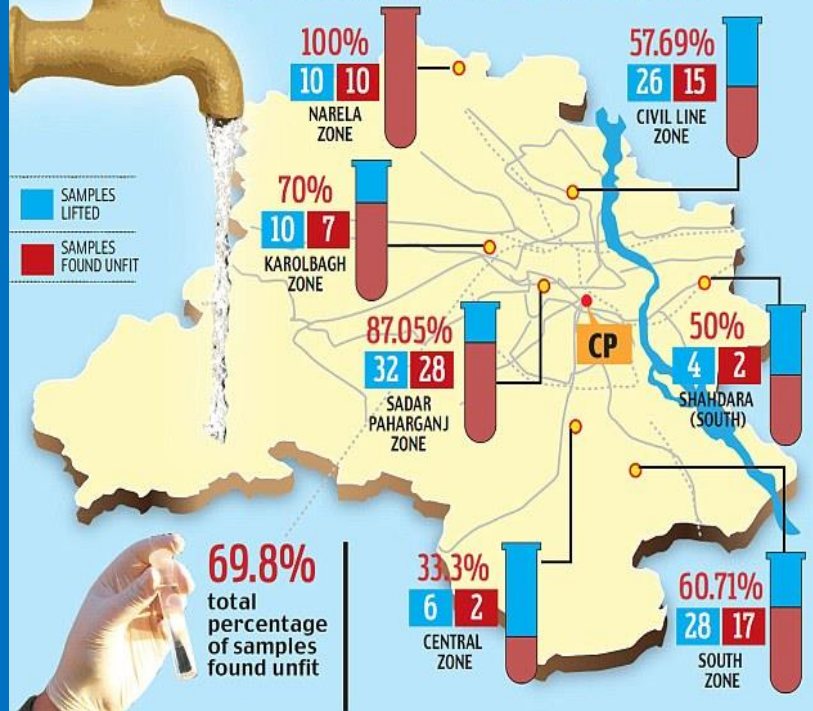
# DELHI WATER QUALITY SITUATION



- The drinking water that most Delhiites are getting at home has been found to be affected by chemical contamination of water and which is harmful to health.
- Around 60 per cent Delhiites consume DJB water. The others reside in resettlement colonies and bank on hand-pumps or water tanks.
- 70% of water in Delhi is unfit for consumption as liquid from drains is getting mixed with drinking water
- Use of pesticides, untreated sewage, effluents from factories, residue from power plants are all contributing to make the city's ground water unfit for consumption
- Consuming contaminated water can cause water-borne diseases like cholera, gastroenteritis, typhoid, jaundice among other. There is a need to adopt low cost household methods of handling and storing drinking water to improve our immunity and health conditions.

# FIGURE IT OUT

Zone-wise bacteriological report of DJB's tap water



## HEALTH WOES

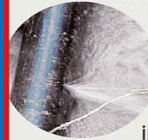
■ The contamination shows presence of coliform bacteria or E.coli in Delhi's water. This bacteria is responsible for gastrointestinal infections that can result in typhoid, cholera, gastroenteritis or jaundice



■ Posh areas of south Delhi and Karol Bagh are the worst affected

■ About 60 per cent of Delhi residents consume water supplied by the Delhi Jal Board. The rest get water from pumps or tankers

■ Drinking water sources in Delhi are contaminated by sewage overflow, septic tanks, leaking sewer lines, sludge and untreated waste water



■ Pipes supplying water to many areas of Delhi are old and have cracks

## THE WAY OUT

### HOME REMEDIES

■ Boil water to kill disease-causing bacteria and other germs

■ Sterilise water chemically. Household chlorine bleach can be used



■ Store water in a clean container and make sure if it is a metal container, it has not corroded

### CHLORINATION

■ The use of chlorine in water eliminates almost all germs that cause waterborne diseases. If your water comes from a private well, overhead tank or water tanker, chlorination is an effective way to purify it



■ Chlorine can be added to water by way of bleaching powder, chlorine tablets and

liquids. A four gram tablet purifies 2,000 litres of water

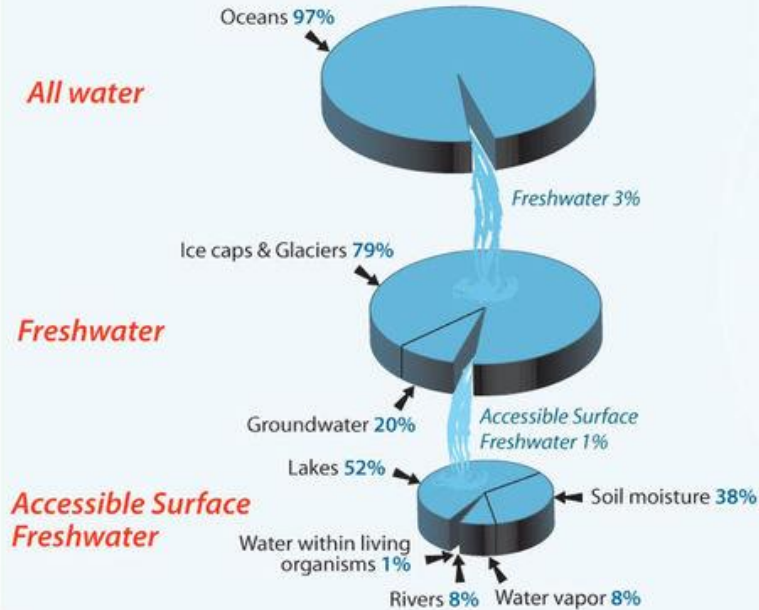


# SESSION 1

# WATER AND IT'S IMPORTANCE



## Distribution of the World's Water



We are all living on this planet, Earth. Almost 2/3 of our planet is covered by water. That is why Earth is often called "**the planet of water.**"

With two thirds of the earth's surface covered by water and the human body consisting of 75 percent of it, it is evidently clear that water is one of the prime elements responsible for life on earth.

Water makes up more than two thirds of human body weight, and without water, we would die in a few days.

H<sub>2</sub>O - two parts hydrogen and one part oxygen. This substance also known as water, is one of the most essential elements to health and is so important that your body actually has a specific [drought management system](#) in place to prevent dehydration and ensure your survival.

# THE HUMAN BODY



Water circulates through out the human body, transporting, dissolving, replenishing nutrients and organic matter, while carrying away waste material.

Further in the body, it regulates the activities of fluids, tissues, cells, lymph, blood and glandular secretions.

An average adult body contains 42 litres of water and with just a small loss of 2.7 litres he or she can suffer from dehydration, displaying symptoms of irritability, fatigue, nervousness, dizziness, weakness, headaches and consequently reach a state of pathology.

# FACTS ABOUT WATER



composes 75% of your brain



makes up 83% of your blood and carries nutrients and oxygen to your cells



moistens oxygen for breathing and helps carry nutrients and oxygen to your cells



helps convert food to energy and regulates body temperature



removes waste and protects and cushions your vital organs



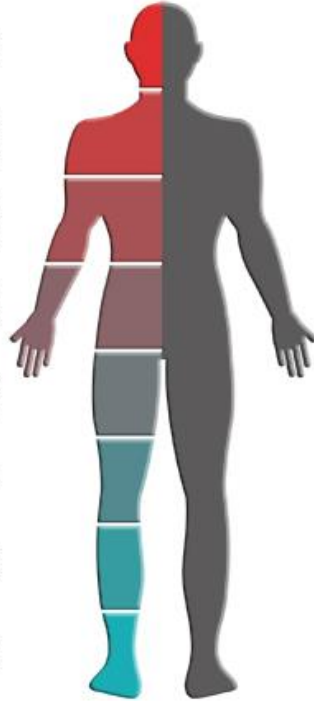
cushions your joints



composes 22% of your bones



makes up 75% of your muscles



Today's Fitness Trainer.com

The human brain is made up of 95% water, blood is 82% and lungs 90%.

A mere 2% drop in our body's water supply can trigger signs of dehydration: fuzzy short-term memory, trouble with basic math, and difficulty focusing on smaller print, such as a computer screen.

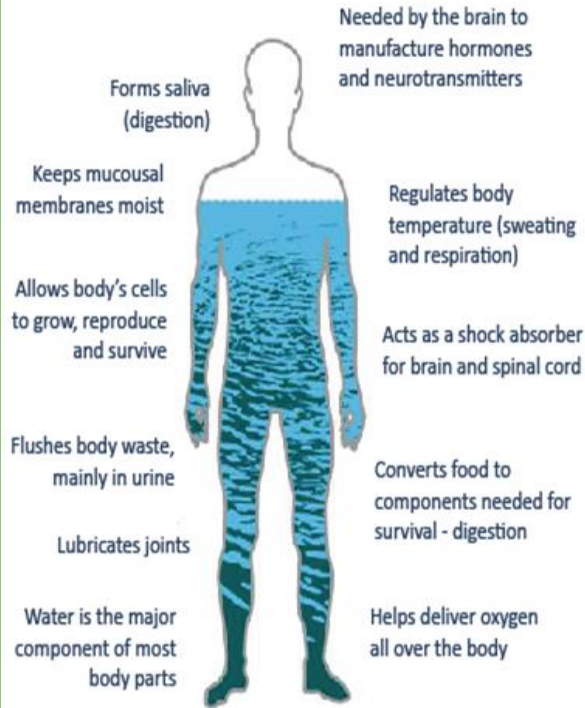
Mild dehydration is also one of the most common causes of daytime fatigue.

Water is important to the mechanics of the human body. The body cannot work without it, just as a car cannot run without gas and oil.

In fact, all the cell and organ functions that make up our entire anatomy and physiology depend on water for their functioning.



## What Does Water do for You?



### Water serves as a lubricant

Water serves as a lubricant in digestion and almost all other body processes. The water in our saliva helps facilitate chewing and swallowing, ensuring that food will slide easily down the esophagus.

Water also lubricates our joints and cartilages and allows them to (pardon the pun) move more fluidly. When dehydrated, the body rations water away from the joints.

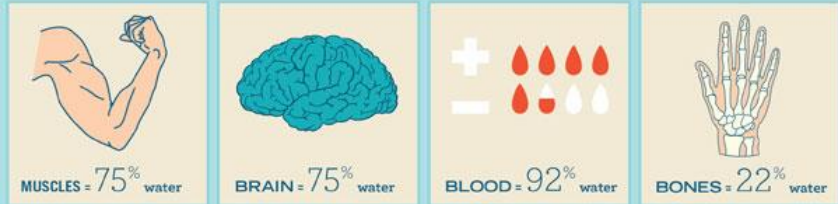
Less lubrication equals greater friction and that can cause joint, knee and back pain potentially leading to injuries and arthritis. Even our eyeballs need plenty of lubrication to work well and remain healthy.

## Water regulates body temperature

Our bodies can control over-heating through perspiration from sweat glands in the skin and from evaporation which produces a cooling effect.

Blood is also routed into areas close to the surface of the skin where it can be cooled and then carried back to the interior of the body. Conversely in a cold environment, the skin maintains proper body temperature by shunting the blood away from the exterior surface thereby conserving heat within the body.

### WATER & THE HUMAN BODY...



The movement of water within our cellular systems also transports vital blood plasma which is 92% made of water.

Blood plasma play a critical role in buffering the body's pH, circulating antibodies from the immune system, and regulating osmotic balance which all helps to maintain proper body temperature.

# DRINKING WATER

at the correct time  
maximizes its effectiveness  
on the human body

2 GLASSES AFTER WAKING UP  
helps activate internal organs

1 GLASS 30 MINS BEFORE A MEAL  
helps digestion



1 GLASS BEFORE TAKING A BATH  
helps lower blood pressure

1 GLASS BEFORE GOING TO BED  
avoid stroke & heart attack

Live life. Love life  
- Yunny Versace

## Importance of water

Water is needed for most body functions, including to:

- maintain the health and integrity of every cell in the body
- keep the bloodstream liquid enough to flow through blood vessels
- help eliminate the byproducts of the body's metabolism, excess electrolytes (for example, sodium and potassium), and urea, which is a waste product formed through the processing of dietary protein
- regulate body temperature through sweating
- moisten mucous membranes such as those of the lungs and mouth
- lubricate and cushion joints
- reduce the risk of cystitis by keeping the bladder clear of bacteria
- aid digestion and prevent constipation
- moisturise the skin to maintain its texture and appearance
- carry nutrients and oxygen to cells
- serve as a shock absorber inside the eyes, spinal cord and in the amniotic sac surrounding the fetus in pregnancy.

# SESSION 2

# WATER CONTAMINATION AND ITS SOURCES



## Water Contamination

Water pollution can be defined in many ways. Usually, it means one or more substances have built up in water to such an extent that they cause problems for animals or people.

The Safe Drinking Water Act (SDWA) defines "contaminant" as any physical, chemical, biological or radiological substance or matter in water.

Drinking water may reasonably be expected to contain at least small amounts of some contaminants. Some contaminants may be harmful if consumed at certain levels in drinking water.

As industrialization has spread around the globe, so the problem of pollution has spread with it. When Earth's population was much smaller, no one believed pollution would ever present a serious problem.

It was once popularly believed that the oceans were far too big to pollute. Today, with around 7 billion people on the planet, it has become apparent that there are limits. Pollution is one of the signs that humans have exceeded those limits.





## Causes of Water Pollution

### 1. Industrial waste:

Industries produce huge amount of waste which contains toxic chemicals and pollutants which can cause [water pollution](#) and damage to us and our environment.

They contain pollutants such as lead, mercury, sulphur, asbestos, nitrates and many other harmful chemicals.

Many industries do not have proper waste management system and drain the waste in the fresh water which goes into rivers, canals and later in to sea.

The toxic chemicals have the capability to change the color of water, increase the amount of minerals, also known as Eutrophication, change the temperature of water and pose serious hazard to water organisms.



## 2. Sewage and waste water:



The sewage and waste water that is produced by each household is chemically treated and released in to sea with fresh water.

The sewage water carries harmful bacteria and chemicals that can cause serious health problems.

Pathogens are known as a common water pollutant; The sewers of cities house several pathogens and thereby diseases.

Microorganisms in water are known to be causes of some very deadly diseases and become the breeding grounds for other creatures that act like carriers.

These carriers inflict these diseases via various forms of contact onto an individual. A very common example of this process would be Malaria.



### 3. Mining activities:

Mining is the process of crushing the rock and extracting coal and other minerals from underground.

These elements when extracted in the raw form contains harmful chemicals and can increase the amount of toxic elements when mixed up with water which may result in health problems.

Mining activities emit several metal waste and sulphides from the rocks and is harmful for the water.





#### 4. Marine dumping:

The garbage produce by each household in the form of paper, aluminum, rubber, glass, plastic, food if collected and deposited into the sea in some countries.

These items take from 2 weeks to 200 years to decompose. When such items enters the sea, they not only cause water pollution but also harm animals in the sea.

#### 5. Accidental Oil leakage:

Oil spill pose a huge concern as large amount of oil enters into the sea and does not dissolve with water; there by opens problem for local marine wildlife such as fish, birds and sea otters.

For e.g.: a ship carrying large quantity of oil may spill oil if met with an accident and can cause varying damage to species in the ocean depending on the quantity of oil spill, size of ocean, toxicity of pollutant.



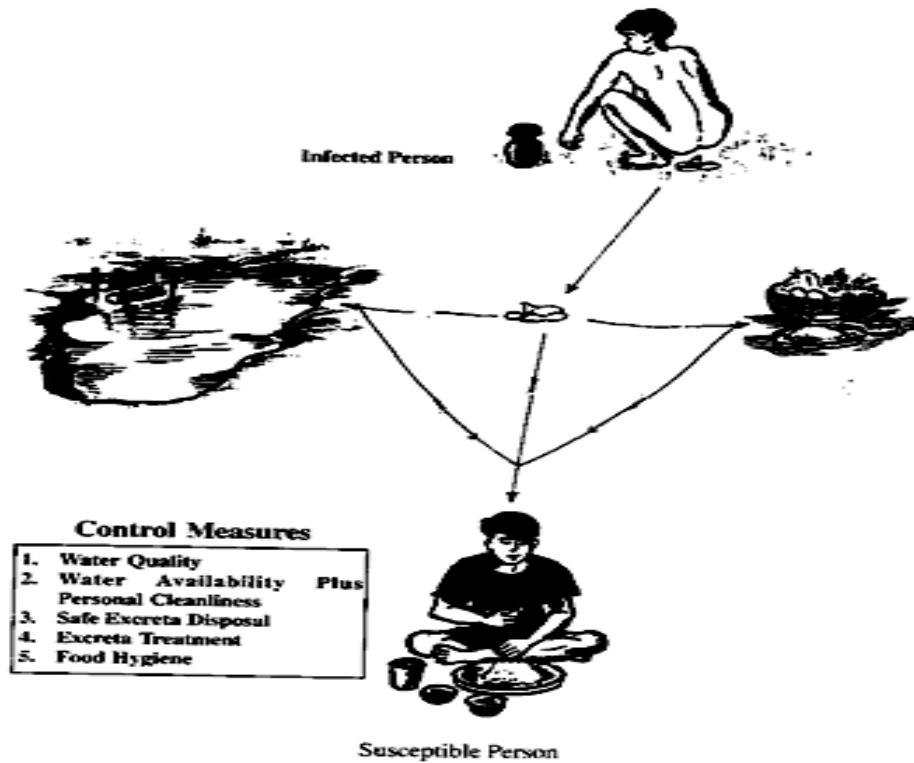


Figure 3.3

The Transmission and Control of Poliovirus and Hepatitis-A Virus

## Routes of Water Related Infection Transmission

# Water Contaminants

- **Physical:** pH, Temperature, Turbidity
- **Chemical:** Fluoride, Chloride, Residual Chlorine, Phosphorous, Hardness, Nitrate, Iron, Ammonia, Dissolved Oxygen
- **Biological:** Coliform Bacteria, Benthic Diversity

## *Other Major Contaminants of Concern*

- Colour & odour
- Pesticides
- Suspended solids
- Phosphates



# SESSION 3

# TECHNIQUES OF WATER QUALITY ASSESSMENT

# Water Quality Monitoring



# Why monitor water quality ???

## Water Quality Monitoring helps in :

- ❖ Describing water resources and identifying actual and emerging problems of water pollution in water sources
- ❖ Formulating plans and setting priorities for water quality management
- ❖ Developing and implementing water quality management programmes
- ❖ Evaluating the effectiveness of management actions



# Water Quality Testing

## 1. Field Testing Method:

Using water testing Kit. Useful for affordable and speedy, water sources surveillance to a larger area

## 2. Laboratory Method:

Through laboratory for exact quantification of problem



## Low cost methods (using field testing kits)

### Advantages

- Easy and simple to use
- On-site testing
- Gives immediate results
- Contains ready made reagents
- Can be used by the community directly
- Can be used by any person who has done schooling

### Limitations

- Less accurate
- Semi quantitative limits of detection

## Water quality monitoring programme

### Basic steps :

1. Selection of sampling site
2. Collecting the samples
3. Analyzing the sample
4. Taking action

## Preservation and storage of samples

- It is recommended that the sample should be examined preferably within one hour after collection but this period, in no case should exceed 24 hours. Efforts should be made to keep the temperature of the sample as close as possible to that of the source of water. It is considered necessary to preserve the sample in ice until analysis of the sample (if the sample can not be analysed within 24 hours). For bacteriological analysis, sample is unfit for analysis after 72 hours
- When the waters have high coliform count originally, icing of sample is not necessary if the object of analysis is only to detect pollution. However, if the object is an accurate examination of coliforms, icing of water samples is considered necessary. Hence it is clear that icing of water samples is not strictly necessary for routine bacteriological analysis of water.





Development Alternatives has designed the **Jal-TARA Water Testing Kit** to conduct water quality tests.

Jal-TARA Kits are Lightweight and Field-Ready and have elegant water and leak-proof cases. Also this is in market

## Field based Testing/Monitoring Tools (cont..)

### Portable Drinking Water Quality Monitoring Kit



#### Jal-TARA Testing kit

*Unique feature Find the presence of coliform bacteria without an incubator*

- **Physical:** pH, Temperature, Turbidity
- **Chemical:** Fluoride, Chloride, Residual Chlorine, Phosphorous, Hardness, Nitrate, Iron, Ammonia, Dissolved Oxygen
- **Biological:** Coliform Bacteria, Benthic Diversity

#### *Other Customized Jal-TARA water test kits*

- Fluoride test kit
- Nitrate test kit
- Iron test kits
- Arsenic test kits
- Residual chlorine test kits

# Types of Water Purification

स्वच्छ पानी क्यों महत्वपूर्ण है?



The most common HWTS options are:

- Straining
- SODIS – Solar Disinfection of water
- Chlorination
- Filtration (Candle, UV Filter, RO)
- Boiling

## STRAINING:

It is a process of pouring turbid or dirty looking water through a piece of fine, clean cotton cloth. It removes a certain amount of suspended solids and insect larvae present in water.

Straining alone is unlikely to make water free from contamination and safe to drink. But it makes household water treatment easier and effective.

It is recommended that turbid water be strained before SODIS, boiling and chemical disinfection.

# boiling water



## BOILING

Boiling is an effective method of water purification. Boiling destroys all Bacteria, Viruses and Protozoa that cause Diarrheal Diseases.

### How to use it?

Water is heated over a fire or stove using different fuel sources depending on local availability and cost (e.g. wood, charcoal, biomass, biogas, kerosene, propane, solar panels or electricity). Heat kills pathogens (harmful microorganisms such as Viruses and Bacteria). Heat the water till it starts roll boiling and let it roll boil for two minutes so that all pathogens are killed.

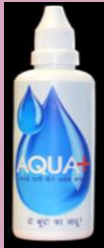
Chlorination is one of the most popular methods of water disinfection. Chlorine is added to the drinking water to make it safe for human consumption. Chlorine kills the microorganisms present in water.

## Chlorine Tablets

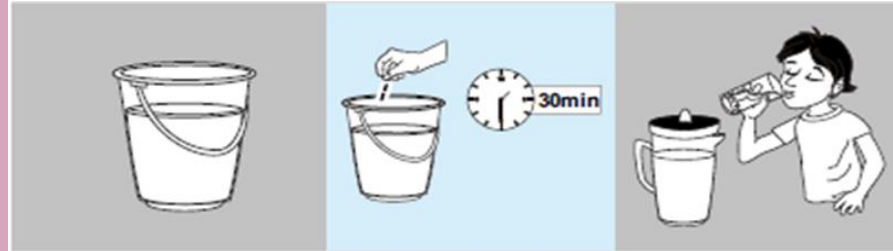
The tablet can be put directly into water or broken in parts for quicker action. The tablet must be left in water for 30 minutes. The tablet should not be used after 6 months of manufacturing and should be stored in a brown bottle away from sunlight.

## Liquid chlorine

Liquid Chlorine (0.8%) can be kept in 1 litre clean bottles and used when ever required. Different concentrations of liquid solutions require different dosage of chlorine. During disinfection 2 capfuls should be put in 20 litre Matkaas (Earthen Pots) or 20 litre plastic bucket and left for about 25-30 minutes to kill the pathogens present in water.



*Do boondo ka jadoo!*



# सोडिस की प्रक्रिया



1. 'पेट' बोटल को पानी से अच्छी तरह धो लें



2. बोटल को साफ पीने के पानी से भरें और ढक्कन को अच्छी तरह बंद कर दें



4. अब पानी पीने योग्य है



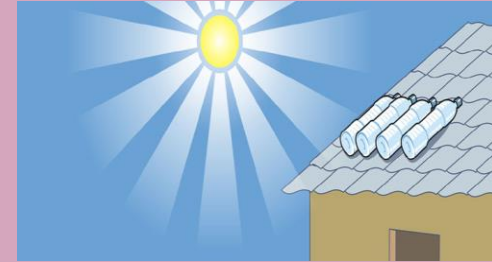
3. उन्हें एक एल्यूमीनियम शीट पर धूप में 6 घंटे के लिए रखें (बादल होने की स्थिति में लगातार दो दिनों तक)

# SODIS

SODIS method is a simple, inexpensive and effective procedure to disinfect drinking water and make it fit for drinking. Thus, it prevents water-borne diseases like diarrhoea.

## Advantages:

1. Inexpensive, simple and effective method
2. Even kids can carry out SODIS easily
3. Reduces the risk of water borne diseases and epidemics
4. Unlike boiling and chlorination, SODIS doesn't change the smell or colour of water.



## Precautions:

1. Use water with low turbidity else strain the water and then use it
2. Use only transparent (colourless) PET bottles
3. The capacity of the bottle should not be more than 2 litres and less than 1 litre
4. • Ensure that no shadow falls on bottles during exposure
5. • Replace bottles every 3 months (if used daily) and do not use heavily scratched and dented bottles

## FILTRATION

It is the process of removing undesirable chemicals, biological contaminants, solids and gases from impure water. Some low cost filters were Hul Pureit, Tata Swach and Lifestraw



## HUL PUREIT

Pureit is a low cost purifier. It involves 4 stages of purification i.e. removal of visible dirt, all invisible harmful bacteria and viruses by using chlorine, harmful parasites and pesticides and other contaminants to make water, odorless and great tasting. The cost of the filter available in market is Rs 1200/-.

### How to Use

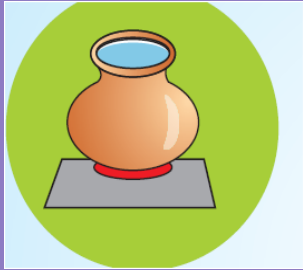
1. Open the box
2. Place top chamber and batching chamber on transparent chamber
3. Pour water in top chamber
4. Water will slowly come into the transparent chamber in a few hours
5. Remove the water from the transparent chamber
6. Pureit filter is now ready for use

# SESSION 4

# SAFE STORAGE AND IMPORTANCE OF ON ENSURING BASIC SANITATION



## SAFE STORAGE



Safe Storage means keeping the treated water away from sources of contamination and using a clean and covered container.

In most areas it is not uncommon for drinking water to be stored in a pot, jar or other containers at home.

Even if this drinking water at the source was of acceptable quality, it can still become contaminated by using unclean hands and utensils, such as dirty dippers and cups. Drinking water containers with "narrow mouth", save water from contamination while being stored at home.



A safe water storage container should have the following qualities:

- Strong and tight fitting lid or cover
- Tap or narrow opening
- Stable base so that it doesn't tip over
- Durable and strong
- Easy to clean

Other safe water handling practices include:

1. Use a separate container to collect and store untreated water and use it only for untreated water
2. Use a different container to store treated water. This container should not be used to collect and store untreated water
3. Clean the storage container with soap frequently
4. Store treated water off the ground on a raised platform in a place away from direct sunlight
5. Store treated water away from the reach of small children
6. Keep stored water on a raised platform to prevent animal access





Clean hands, safe hands.



## Hand Washing

Hand washing is the act of cleaning the hands with the purpose of removing soil, dirt, and/or microorganisms. Hand washing is generally considered to be the most important measure in preventing the spread of infection. Washing hands with soap can prevent Diarrhoea.



### When to Wash Hands?

Wash your hands before

1. Preparing, serving or eating
2. Treating wounds, giving medicine or caring for a sick or injured person

Wash your hands after

3. Preparing food, especially raw meat or poultry
4. Using the toilet
5. Touching an animal
6. Blowing your nose, coughing or sneezing into your hands
7. Treating wounds or caring for a sick or injured person
7. Handling garbage, household or garden chemicals, or anything that could be contaminated – such as a cleaning cloth or soiled shoes

Above Points to be considered while washing hands

- Use clean water to wash hands
- Use soap to wash hands
- Use a clean towel to dry hands



## Simple Steps For Sanitation And Hygiene

- The household has to ensure proper water storage, waste collection, waste water and solid waste disposal, cleanliness, personal hygiene of family members including bathing, hand washing, hair cleaning, nail cleaning etc, utensils and cloth cleaning. Adequate ventilation and sunlight are a pre requisite for sanitation and clean environment.
- The concept of sanitation must be taken forward even at the community level.