

Chapter – 13: Wastewater Story

- All of us – use water – make it dirty
- Black-brown water, mixed with oil, lather – goes into drains – wastewater
- This – used water – not to be wasted – cleaned up – use again

Water – Our Lifeline

- Clean water – basic need of human being – used for many purpose
- Clean water – fit for use – not available to all
- Reports – 1 billion people – no access to safe drinking water – lots of water related diseases and deaths
- People – walk for many kilometres – collect clean water
- Increasing scarcity (short supply) of fresh water – population growth, pollution, development and many other factors
- World Water Day – 22 March 2005 – General Assembly of United Nations – declared – 2005-2015 – International Decade for action on ‘Water for Life’
- All efforts – this period – aim to reduce the people by half – who do not have access to safe drinking water
- There has been – lots of progress – BUT – there is a lot to achieve
- Cleaning of water – process – removing pollutants – before entering water body or reused
- This process – commonly known as Sewage Treatment – several steps

What is Sewage?

- Sewage – wastewater released by – homes, industries, hospitals, offices, etc
- Also includes – rainwater – run down the street
- Water – washes off roads, rooftops – lots of harmful substances
- Sewage – liquid waste – most of it – water with dissolved and suspended impurities
- Activity –
 - Find an open drain near your home – observe the water (from a distance)
 - Record odour, colour, and anything else
- Sewage – complex mixture – suspended solids, organic and inorganic impurities, nutrients, saprophytes, disease causing bacteria, etc
- Organic impurities – human faeces, animal waste, oil, urea, pesticides, herbicides, fruits and vegetable wastes, etc
- Inorganic impurities – nitrates, phosphates, metals, etc
- Nutrients – phosphorus, nitrogen
- Bacteria –
 - *Vibrio cholera* – causes cholera
 - *Salmonella paratyphi* – causes typhoid
- Other microbes – protozoans – cause dysentery

Water Freshens Up – An Eventful Journey

- In homes or public buildings – one set of pipe – bring fresh water – another set of pipe – takes away wastewater
- Imagine – you can see through ground – you will see – network of big and small pipes – sewers – forming sewerage
- This system – transport system – carries sewage – point of production (houses, etc) to point of disposal (treatment plant)
- Manholes – present every 50 to 60 m – at junction of 2 or more sewers – at points of change in direction
- Activity –
 - Take a paper – make lines on it – map out the sewage route in your house or locality
 - If sewerage system not visible – find out from elders – how the sewage is disposed off

Treatment of polluted water

- Activity –
 - Fill a glass jar – 3/4th water – add some grass or orange peels (organic matter) – add few drops of ink
 - Cap the jar – shake it well – keep it in sun – 2 days
 - After 2 days – shake it once again – pour a small amount into test tube – label it – ‘Before Treatment – Sample 1’
 - Use the oxygen machine from an aquarium – keep it attached overnight – in the jar
 - Next morning – pour another sample into test tube – label it – ‘After Aeration – Sample 2’
 - Make a cone from filter paper – pour some tap water on it – insert in a funnel – mount it on a funnel
 - Place layers of sand, fine gravel, medium gravel in the funnel
 - Actual filtration plant – no filter paper – layers of sand – several metres deep
 - Pour remaining aerated liquid – through filter – into beakers – if filtered liquid is not clear – filter it multiple times
 - Pour filtered water into test tube – label it – ‘Filtered – Sample 3’
 - Pour another sample into test tube – add a chlorine tablet – mix it well – until water is clear – label it – ‘Chlorinated – Sample 4’
 - Observe all the samples – just smell them – DO NOT TASTE

Wastewater Treatment Plant (WWTP)

- Treatment of wastewater – physical, chemical, biological processes – remove physical, chemical, biological contamination (impurities)
 1. Waste water – passed through bar screens – large objects – rags, sticks, cans, plastic packets, napkins – removed here
 2. Water – goes to grit and sand removal tank – speed – decreased – sand, grit (small stones), pebbles – settle down
 3. Water – allowed to settle in large tanks – slope towards middle – solids – settle at bottom – removed with scrapper – called sludge – skimmer – removes floatable solids – oil, grease – this water – clarified water
- Sludge – transferred to separate tank – decomposed by anaerobic bacteria – biogas produced in this process – used as fuel

4. Air – pumped into clarified water – aerobic bacteria grow – bacteria – consume (eat) human waste, soaps, other unwanted matter
- After several hours – suspended microbes – settle at the bottom – activated sludge – water is removed from the top
- Activated sludge – 97 % water – water removed by sand drying beds or machines
- Dried sludge – used as manure – returns organic matter back to soil
- Treated water – low levels of organic material and suspended matter – discharged into sea, river or ground
- Nature – cleans it further
- Sometimes – necessary – clean water with chemicals – chlorine and ozone

Become an active citizen

- Waste generation – natural part – human activity
- BUT – we can limit the waste
- Smell of open drain – disgusting – rainy season – worse situation – drains overflow
- Unhygienic conditions – flies, mosquitos, other insects breed in it
- Be a good citizen – approach the municipality or gram panchayat – ask them to cover the open drains
- If sewage of any particular house – makes the neighborhood dirty – request them to be more considerate

Better Housekeeping Practices

- Minimize or eliminate waste – at source
- Cooking oil, fats – not to be thrown in drain – hardens and blocks the pipe – open drain – fats block the soil pores – reducing the effectiveness – filtering water – throw oil, fats in dustbin
- Chemicals – paints, insecticides, motor oil, medicines – may kill microbes – helping in purifying – do not throw them in the drain
- Used tea leaves, solid food remains, soft toys, cotton, sanitary waste, etc – throw in dustbin – they may choke (block) the drain – do not allow free flow of oxygen – affects the degradation process

Sanitation and Disease

- Poor sanitation, contaminated drinking water – cause – lots of diseases
- Our country – lots of people – without sewerage facilities
- Lots of people – defecate in open – dry riverbeds, railway tracks, fields – many times – directly in water
- Untreated human excreta – harmful for health – cause water and soil pollution
- Both surface water and ground water – gets polluted
- Ground water – source of water – wells, tube wells, springs, rivers – common route – water borne diseases – cholera, typhoid, polio, hepatitis, dysentery

Alternative Arrangement for Sewage Disposal

- Improve sanitation – low cost onsite sewage disposal systems – used more
- Example – septic tanks, chemical toilets, composting pits

- Septic tanks – suitable for places – no sewage systems – hospitals, isolated buildings, group of 4-5 houses
- Some organisations – offer hygienic on-site human waste disposal
- These toilets – no scavenging – excreta from here – flows directly into biogas plants – through covered drains
- Biogas produced – used as source of energy

Sanitation at Public Places

- Our country – many fairs – organized periodically – lots of people
- Railway stations, bus depots, airports, hospitals, etc – busy places – lots of people
- Large amount of wastes – generated here – disposed of properly
- Government – prepared rules for sanitation – BUT – not followed strictly
- All of us – contribute – maintaining sanitation – public places
- Do not throw waste everywhere – if no dustbin available – carry your waste home – throw it in the dustbin