

Science Serial Based on Sustainable Development

Water the Interesting & Unique Chemical

Episode-17

Research and Script---

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English Translation ----Mrs. Savita Yadav

Participant and Artists Introduction:-

- Manohar : Father and Professor of Mathematics.
- Sarita : Mummy, An Engineer in Water Supply and Public Health Department
- Madhvi : Daughter
- Mohit : Son
- Rahman : Manohar's friend running an NGO which is engaged in water conservation and harvesting.

(There are four members of a family, father Manohar teaching Mathematics in a college and his wife Sarita is an Executive Engineer in Public Health and Water Supply Department. Their son and daughter are studying in school. One of Manohar friends, Mr Rahman is running an NGO to create public awareness on water management and water conservation)

#####Title Song/Signature Tune#####

Dear friends! All of you know the importance of water. There is no need of any comment on water or description of water. It is on your common sense what you imagine about it, its utilities and importance. Sometimes our imagination may not go up to the last drop of water that is essential for our survival.

Title Song/Signature Tune#####

Scene: Mohit is taking his bath inside the bathroom. Singing and murmuring some song. In the meantime water stops running in the tap. He is calling his mother....)

Mumma ! O...Mammy....there is no water in the bathroom. How can I take my bath? Please get some water from kitchen.

Madhvi: Mohit....see.....your tap was running continuously. Unnecessary flow of water. It is not water shortage. It is our bad habit that creates problem.

Manohar: Mohit this is routine for you. A problem not for you but we all suffers. I always advise you to fill water in your bucket, before your bath, but of no use. Neither have you used shower for your bath nor you save water. There is wastage of water. Same problem repeated time and again.

Sarita: Let him be clear about it. No excuse in future.

Madhvi: Mummy...it is surprising. You are an Engineer in water supply department and see what your loving son is doing? He is going to be a great engineer in the field of water mismanagement (laughing).

Mohit: Hello ! Are you listening to me? Is anybody going to have a bucket of water for me or should I leave the bathroom without taking my bath? Being a Professor of Mathematics, Papa always calculates the mathematics of loss and profit. Mummy has always her own limitation of water supply. Do you not want that I should take my bath?

Madhvi: Mohit please have some patience. Papa is arranging a bucket of water for you.

Manohar : (water flowing from tap) Listen Mohit! Here is your water. Take it inside the bathroom.

Mohit: Thank you papa for your support. Now I can enjoy my bath.

Scene Change: ##### Instrumental Music/ Kitchen effects #####

Manohar: Sarita, these days there are lots of carrots in the vegetable market. Let's have gajar halwa. (I can help you in it). Today I shall prepare some special snacks and kachori.

Mohit: (laughing). What an idea?

Sarita: Rahman Bhai is also coming at our home.

Manohar: Yes! Yesterday he called me. I forgot to tell you about him. He is just on the way and reaching soon.

Madhvi : How did you come to know about Rahman uncle?

Sarita: My children, I know the nature of your papa's friends. Last time when he was at our home, he requested your papa to have pakori, and that too be prepared by your papa. Your papa learned all these during his hostel life. That is why his friends call your papa's by their nick name, 'Kachori wala Manohar' (laughing).

Manohar: (laughing) Everybody can't be expert in kitchen engineering. It requires special experience as well as hard work.

Mohit: Mummy ...papa is right. I like food prepared by papa. Too tasty to narrate (everybody laughs)

Sound Effect of car horn

Sarita: Some car has just arrived. May be Rahman Bhai.

Scene change: ##### Change over music / Doorbell / door noise. #####

Manohar: Welcome dear! We are waiting for you.

Rahman: Namaste and Good morning dear. How are you?

Manohar: We were waiting for you. Nice to see you .Welcome.

Madhvi and Mohit: Namaste uncle !

Rahman: Namaste my young friends. Here are some special chocolate for you.

Madhvi and Mohit: Thank you uncle. You never forget our chocolate.

Sarita: Namste bhai sahib! You are visiting after long time.

Rahman: Namaste bhabiji ! I was busy in some special assignments. Going place to place for trainings and to deliver some lectures on public awareness.

Mohit: Vow! Uncle is enjoying too much outing. I too enjoy tour and travel.

Madhvi: Uncle is doing noble job and that too on public awareness.

Sarita: Mohit you need, training on water conservation (laughing).

Mohit: Mummy I never waste water.

Manohar: My son ,you can manage your bath in less water then what are you using. This is not advisable.

Mohit: It is confusing and difficult to understand, if our water tank on the roof top is full of water then what is harm in using it?

Rahman: My young friend! Such ideology is not good. It leads to water mismanagement and it wastage. We think the water that we have is meant for us. We have full right to use it or waste it. But this should not be our ideology. Everyone has right on Natural resources. They are meant for all living organisms on this Earth.

Mohit: I have read in our text books that two third part of our Earth is covered with water. Then what is the need to be so much worried?

Madhvi: Mohit you always have half knowledge of the subject. Actually what you are saying is half true. But you know, most of the water on this Earth is saline and

unfit to use. Only a fraction of the total water is usable and can be served for drinking purpose.

Sarita: 97.8% of the total water available on our Earth, exists in the oceans and seas. Owing to the presence of dissolved salts, sea and ocean water is unfit, to be used drinking purpose.

Rahman: BhabiJi, you are right. On Earth only 2.7% of water is pure and can be used in our day to day use. But....but.... out of this, most of the pure water exists on polar regions. It is too difficult to use it for our day to day needs.

Manohar: Thus a little amount of water is available for our day to day use. You can also say that it is the most valuable natural resource that we have. That is why we have to use it with much care.

Mohit: Papa you are talking like philosophers. Water....and that too invaluable, impossible (laughing).

Sarita: My son! Without water, it is impossible to imagine life. It is this reason that water is invaluable and life can't be imagined without water. Water is life.

Manohar: The history of human civilization is linked with water. All great civilizations of the world have been flourished and sustained on the river's banks or near great water bodies. You can take any one. All great civilizations like Sindhu Ghati, Nile and Mesopotamian civilizations had been flourished on the river banks.

Sarita: Water is the source of great civilizations to develop and flourish. Water is the base of our thoughts and ideologies. That is why; you can find so many references in our folk songs, art & culture, literature, religion and philosophy.

Rahaman: For good health purity, quality and sufficient quantity of water is very important. Water is an important constituent of our bodies.

Sarita: Without food we can survive for long period. But it is impossible to imagine life without water.

Rahaman: In living organisms, water is about 70 % of our body weight. No physiological activity is possible without water. Whether it is unicellular animals or multicellular, water exists in all parts of their body. You can take example like E-coli or multicellular animals; water is about 70% of their body weight. In body cells, water makes the maximum part of cell components.

Mohit: That means water is the main component of our body weight.

Rahman: Yes Mohit. In our body, water is about 60 to 70% of our body weight. In our blood, bone cells and even tooth enamel have maximum quantity of water. Water performs important roles in chemical reactions in our body.

Madhvi: (with surprise) Chemical reactions !

Manohar: Why so much surprise. Water is also a chemical. Its chemical formula is H₂O.

Sarita: H₂O , I mean water is a molecule made of..... Two atoms of Hydrogen and one atom of Oxygen.

Mohit: If it is so then water must have some chemical properties.

Sarita: Yes ! It is so .Madhvi do you know about the character of water?

Madhvi: O.K. In pure form, water is colourless, tasteless and having no smell.(odourless)

Mohit: But why the water in oceans and seas is salty in taste?

Rahman: My friend! It is not the taste of water. It is due to the presence of dissolved salts that are found in sea water. Water has a great quality. It can dissolve all form of salts in it. It is this reason that sea water is saline in taste.

Sarita: It is this character of water that makes it so important in our lives.

Rahman: Every single drop of water is important for life. Our body is like a small city. To run and sustain lives in cities, a feasible and efficient transport system is must to move from one place to other. Similarly water plays the role of an efficient transport system in our body. Besides an important constituent of our blood, water makes available all essential nutrients to all cells and tissues in our body. Simultaneously, it removes all waste products from our body.

Manohar: There are many other minerals in the water that we are using.Presence of these minerals enriches water that we are using. These minerals are varied from place to place and in different water bodies.

Madhvi: Papa, it may be this reason that taste of water is different from place to place.

Rahman: Yes. But do you know that water is a simple compound. But its physical and chemical properties are unique. It is water that make possible for organisms to survive and exist. Water had played and is playing animportant role in organic evolution.

Manohar: That is why we are worshiping water as god. We have great regard for water since our ancient civilization. Water is an important part of, “Panch-tatva” from which our body is made of.

Rahman: Yes. Since long back we are considering water as an important element. In ancient times too, Chemists were of the views that water is an important element that exist in Nature. It was Henry Cavendish who first in 1781, proved that water is not an element but it is a molecule.

- Mohit: Oh! This was also done by the scientists.
- Rahman: Yes Mohit. The father of modern science and great chemist of France, Lavoisier in 1783 proved by his experiments that water is a molecule made of hydrogen and oxygen.
- Manohar: After this, the interest of scientists diverted on water, throughout the world. Water which was so simple, attracted the attention of the scientists throughout the world.
- Sarita: Though water is simple in its structure. But its molecule is very special. It exists on Earth in all three forms that is liquid, solid and in gaseous forms.
- Mohit: Mummy ! Ice.....Oh! I like ice-cream. So delicious.....cool....cool.
- Madhvi: See...see...Mohit always ask for ice cream or chocolate. He needs simple excuses for ice cream.
- ##### (All are laughing) #####
- Madhvi: What make water so special? Please can you elaborate?
- Rahman: Madhvi really water is a wonderful chemical compound. The hydrogen bond in water is responsible for its unique properties and characters. It is these forces that make water so unique. It is interesting to know that the differences between the boiling and freezing points is highest than any other compound.
- Mohit: It is surface tension of water that make it possible for mosquitoes to sit and swim on its surface. Due to stress in surface tension, small animals and living organisms like insects don't drown in liquid water.
- Sarita: In stagnant water, mosquitos flourishes well. That is why kerosene oil is sprayed on the surface of water to prevent breeding of mosquitoes. It decreases the surface tension of water and when mosquitoes sit on water surface, they sink in water. This makes breeding impossible.
- Rahman: Yes Bhabi Ji, you are right. All the three forms of water are very important to sustain lives on our planet. We are aware about the importance of liquid water. The other two forms that is gas and ice are important. They help to maintain the temperature of our Earth.
- Mohit: Uncle..... What is the average temperature of our Earth?
- Manohar: The average temperature of our planet is 15 degree Celsius.
- Rahman: Young friends! Nobody was aware about the Hydrogen bond till the year 1930. But scientists were of the views that there is something in water that makes it special. In 1920 D.H.Lawrence pointed about hydrogen bond.

Hydrogen bonds are weak in strength. This is the Hydrogen bonds that give unique physical and chemical properties to water.

Mohit: Hellohello.....gentlemen! (Laughing) Are you listening me? No further discussion. It is time for interval. Rahman uncle needs some energy to continue his oral presentation.

#####(All are laughing)#####

Madhvi: Hurray..... Yes.....Mohit well said.....

Mohit: Mummy now it is your turn to show your art(Laughing). Please have some special coffee or tea.

Madhvi: Some snacks andand Papa.....where is your perfect hands to prepare special Manohar brand pakoras(laughing). Mummy was telling that Rahman uncle had taken a promise from your Papa to have pakoras of his college time.

Mohit: Mummy is on her project ...and Rahman uncle you are saying....

Rahman: Mohit you are so smart....O.K. What am I talking about?

Mohit: (song).. Ye bandhan to anokhabandhanhai.....Jeevan kaSpandanhai.....

All are laughing

Rahman: Wonderful....Mohit you are very poetic.

Madhvi: Uncle! Mohit is always ahead in raising such questions. But he is careless about his studies.

Rahman: Madhvi...it is not so. All such innovative ideas need brain (laughing). Today I realised that Mohit is super genius.

Mohit: Vow! Thank you uncle. You understand..... my duffer sister. (Laughing).

Manohar: My sonRahman uncle himself is a genius. He knows how to be friendly with children?

Rahman: Yes my young friend. I know you always get rank in your class. And it is among the first ten in the class. Am I right? Like water you are perfect in all form of arts. As water can flow, it can freeze and it can vaporise. Similarly you can behave differently in different situations(Laughing).

Manohar: If hydrogen bond was not there then water may be in grease like formsimilar to hydrogen sulphide.

Madhvi: If it was so...then what would happen to us?

Mohit: What happen.....You may not be my sister(laughing).

Sound Effects of kitchen/cup/plates#####

Sarita: Silence....silence.....Your coffee is here.....and for your special snacks, you have to wait for some more time.

Madhvi: Thank you mummy .You are so great.

Mohit: Uncle see.....didi is.....buttering mummy.

Madhvi: Uncle this is not buttering. If water bond were not there,water may not be in its present form. It is impossible to imagine water without hydrogen bond and similarly it is impossible to imagine tea and snacks without mummy (laughing).

Sarita: Without water it is impossible to imagine life on our Earth.

Manohar: Thank God! It is not so. Here water sustains life on planet Earth.

Rahman: You will be surprised to know that water supports all forms of lives.

Madhvi: When temperature falls below the freezing point the vapours of water in the clouds condense, causing snow fall. This is known as freezing temperature of water.

Rahman: Ice or snow is hexagonal in shape. In these forms molecules of water are held with other molecules by Hydrogen bond. The density of snow is less than water. It is this reason that makes possible for ice/snow to float on water surface. At 4 degree Celsius, water density is 1 gram per centimetre, which is highest

Manohar: As the temperature rises the surface gets expanded and density fall further. At 0 degree Celsius of temperature the density of ice and waters varies. At this temperature ice occupied 9% more space as compared to water. It is this reasons that one tenth of the snow's surface remains above the water surface.

Madhvi: It means what you are seeing is not the truth.

Sarita: Madhvi you are right. It is not good to believe what you are seeing. It may be an illusion.

Rahman: But as the pressure rise, the density of ice decreases. On poles one can find layers of ice which may extend up to miles. The lower surface of ice is under high pressure and stress. Due to high pressure, snow melts down even when the temperature goes much below freezing point. This melted snow flows just like water. Fishes and others living organisms can exist and survive under snow surface.

Madhvi: I like snow very much. Mohit do you remember our last Gulmarg trip in Jammu and Kashmir?

Manohar: Snow fall play an important role in conservation and maintenance of our ecosystem. It is an important component of it.

Rahman: Snow is popular among children and sportsmen for its slippery surface. It is this characteristic that makes skating and skiing possible on its surface.

Sarita: Madhvi, do you remember the hill top in Gulmerg?

Mohit: Mamma ! I still remember when Madhvi didi got injured while trying to learn skiing.

Manohar: Boats float on water surface. Man can swim in it. It is different experience to enjoy the beauty of rivers and their ecosystems.

Mohit : Papa, why not have a trip of river bank. Rahman uncle can accompany us. There will be lot of fun.

Madhvi: It is a good idea. For the first time, Mohit has some good suggestion. It is cloudy and we can enjoy alot. I think Rahman uncle will agree with me.

Rahman: I have no problem. It will be good to enjoy the special pakoras of Manohar on the river side. (Laughing)

Sarita: O.K. Everybody is ready. Yes or no....

In one voice

Yes.....we are ready. Let us have a river excursion today.

Scene change

Noise of door opening/ car start/ horn/ traffic on road side

Rahman: Vow ! Surprise to see all these changes. So many development works are going on.

Sarita: Dr Rahman see there. That is river bank beautification project. Government is going to spend hundreds of crores on this project.

Rahman: Development is good but it causes disturbance in the natural process of water harvesting. The city gets one third of its water supply from bore wells. In the long run it may be get disturbed.

Mohit: I am feeling thirsty.

Madhvi: On the river bank you are thirsty. Great wonder.

Manohar: But you can't drink this water. See ...see...its colour. It is too polluted to drink.

Sarita: We got package water. Mohit take that water bottle.

- Manohar: You can have lemon water. It is good to use lemon water during hot summer.
- Madhvi: Papa, I would like to take some lemon water. Rahman uncle you may also have lemon water.
- Mohit: Water is no less than any wonder. God might have been surprised on His own creation. You can dissolve anything in water, whatever you like. Not only lemon, one can dissolve sattu, mango and fruit pulps, sugar or whatever you like. (Laughing) It is universal in its acceptance.
- Sarita: We human beings should be of same attitude and behaviour. We should help others during scarcities and their hardships.
- Rahaman: Yes Dr. Sarita. (Laughing) We should be as soft and mobile as water. It is this character of water that makes it an universal acceptor. It can dissolve both carbonic and non-carbonic compounds in itself. This is due to special ionic quality of water. For ionic compounds water act as miracle.
- Mohit: Uncle, you will be surprised to know that my friend Raman is like water (laughing). He is friendly to one and each at the very first meeting.
- Sarita: Most of the things dissolve easily in the water. It is this reason that it can carry nutrients with itself in blood to different parts of the body. Water is the main source of hydrolysis in our body. During hydrolysis carbohydrates, proteins, fats etc. break in sub-particles, so that our body can use them easily. In body cells, most of the physiological activities are carried out through water.
- Rahman: It is interesting to know that sometimes such characteristics become suicidal for themselves. Water being a good solvent, hence it dissolves impurities in it. That is why; one can see so many impurities in the water of rivers and lakes. It is not good to use water directly from lakes and rivers for drinking purpose.
- Madhvi: We have to purify such water, before we can use it. Boiling process can be used to purify it.
- Rahman: Yes, not only for living organisms but water is important for our planet as a whole. Lots of energy has been consumed by water during transformation from one stage to others. 80 calories of energy is required to melt one gram of ice. For converting one gram of water into vapours needed 540 calories of heat.
- Mohit: Why so much heat is needed to boil water?
- Rahman: Specific heat of water is very high and it needs lot of energy to boil and convert it into vapours.
- Madhvi: What is this specific heat?

Rahman: It is that amount of heat, which is needed to raise the water temperature by one degree Celsius. In case of water, it is one calorie per gram, which is ten times higher than iron. It is this reason that we use water for cooling in industries and factories.

Sarita: That is why, water is important not only for living organisms but also for different activities in our day to day use. It is this reason that water is considered an essential component of our lives. It is true.....Jal hi.....JeevanHai!

Manohar: (Footsteps).... Here is lemon water for you.....andand

Sarita: And....(laughing).....where are the special kachori and pakora for Rahman Bhai.

Rahman: Why for Rahman alone ?

Manohar: Here are kachori and pakora for all of you. Enjoy the recipe of my hands (laughing).

Mohit: Looking tasty

Madhvi: Feel the flavour. Very attractive & delicious. Vow! Mohit don't be in hurry. (Laughing) First take the permission of Rahman uncle. Papa prepared all these as per request of Rahman uncle.

Rahman: My young friends. These are for you. Enjoy.....children first. With the needs of the growing body more you will eat, the more you will be healthy.

Sarita: And one thing more.....More water you will save, the more our future will be secure.

Rahman: Well said Dr.Sarita. We all must keep in mind that where there is water there is future.

Mohit: Uncle....uncle I shall keep in mind, "Save water...mean save our future"

Madhvi: It is better to take an oath that we shall save one and each drop of water. Water is life.

Title song/Signature Tune#####

Closing Announcement >>>>>>>>>>



Science Quiz:-

Question 1. What percentage of water on our planet Earth, exists in Oceans and seas?

Answer: 97.8%

Question 2. Water molecules are made of Hydrogen and Oxygen atoms. Is it true?

Answer: It is true. Water molecule is known as H₂O and made of two atoms of Hydrogen and one atom of Oxygen.