

SWEET PEE

A Teacher's Demonstration Activity

Activity Overview

This demonstration addresses the recycling of water as part of living and working in space. It illustrates the importance of the need to recycle water. Subsequent discussions can raise the level of awareness on how the Earth's environment recycles animal waste.

Time Required

- 10 minutes for preparation
- 10 minutes over a 45 minute class period

Preparation

Mix the following liquids in a 500 ml bottle, to simulate urine: approximately 100 ml of a clear or yellow soft drink (Example Gingerale, 7-Up) and 1-3 drops of yellow food colouring. Some experimentation with the correct size and number of drops may be required to give the correct appearance. Let this mixture go flat (can be accelerated by stirring).

2. Chop the raisins into very small pieces, and store in the plastic vial or bag. Label the vial with "Biologically Active Re-Processing Organism". On the label write an impressive looking number (e.g.AF-4366032-B2) and a recent past date. Place the top on the vial (a film canister works well as a plastic vial). This is the "biologically active agent".

3. Pour 450 ml of clear soft drink in the 500 ml clear bottle with a sealing top. Make sure to seal the top so that the carbonation is retained. Label this bottle "Citric and Carbonic Acid".

Materials

- **Simulated Urine**
 - yellow food colouring
 - clear carbonated soft drink
- **Simulated Biological Active Agent**
 - 8 raisins
- **Simulated mixture of Citric and Carbonic Acid**
 - clear carbonated soft drink
 - stirring stick or spoon
 - 500ml beaker or appropriate glass jar labeled "Sample Jar"
 - Two 500 ml clear bottles with sealing top
 - drinking glass (clear)
 - knife
 - coffee filter
 - small plastic vial or closeable plastic bag

In Class Demonstration

Remember that this is a simulation, so that if the audience knows what the actual components of the demonstration really are, the effect will be lost.

1. Prior to the presentation, place the plastic container with the “biologically active agent and the Citric and Carbonic Acid Bottles on the desk or some other observable spot. Beside them place the empty 500 ml beaker (sample jar) and the stir stick or spoon. The container with the simulated urine should be hidden in a bag or left in a room away from the audience.
2. Just prior to the presentation, the presenter takes the sample jar and the unseen “urine” to a private room and pours the mixture from the bottle into the sample container. The empty “urine” container is then again hidden.
3. Introduce the need to conserve materials such as food and water when living in Earth orbit. Note that for short missions, all the water that is needed for the mission can be taken on the flight. Water can be transported from the Earth’s surface to orbit, and all waste, including human waste, liquid and solid, can be brought back as needed. For extended missions, not all the water needed for “one time use” can be taken. Water will have to be recycled. This includes urine. At this point hold up the “urine” in the beaker and state that you will show them how this will be done. Be careful not to state what is in the beaker directly. Let the imagination of the audience carry the demonstration.
4. State that the process of “purifying” the water in the beaker to a drinkable state requires two distinct steps. The first is the dilution of “this” fluid in the “citric and carbonic acid” – this allows the second step to be more effective. Add the fluid in the citric and carbonic acid bottle to the mixture. If anyone is observant enough to comment that the fluid you are adding looks like 7-UP or Sprite, comment that a major portion of both 7-Up and Sprite are citric and carbonic acid and that they could be used.
5. Next, state that a biologically active agent that converts all the impurities in the “solution”, except the color, to harmless materials does the purification. It also removes any odor and any “bad taste”. Open the biologically active agent container and dump the agent into the fluid. The combination of the agent to the fluid to be purified will result in active bubbling. You can make the statement that “things seem to be working”. State that in normal water purification this process takes some time but that you can speed it up because of the small amount of solution and the large amount of reagent. State that stirring helps. Stir the container with the spoon.
6. State that the process will take about 30 minutes, and ask the students to remind you to stir the solution about every 5 minutes, to ensure that the appropriate reactions take place.
7. Over the next 30 minutes or so, stir the fluid and biological active agents. Comment that things seem to be progressing nicely.

8. When approximately 30 minutes are up, give the fluid one last stir to ensure that the fluid will be flat. State that you will now separate the fluid and the biologically active agent by filtering it. Place the filter paper in the drinking glass and slowly pour the solution through the filter paper.
9. Once the filtering process is complete, you quickly make the statement that “this should be purified enough to drink” and quickly drink some.
10. State that on long haul missions in space, nothing can be wasted, so that even the biological agent needs to be recycled. Ask what the audience thinks they would do with it. Field some answers. Add “eat it” as one possible answer at the end, and quickly eat a portion of the agent.
11. Drink all of the purified drink and continue with the lesson or discussion.