Practical investigation - Density

Our scientists and engineers use properties of substances to help separate mixtures. Learn about density and how it can help us design processes in water treatment and management.

Need some lesson ideas? Our High school webpage has syllabus linked lesson plans to support this experiment.

How can we use density in wastewater treatment?

Water is an excellent solvent. We use it every day for washing our dishes, our clothes, ourselves and flushing toilets. All the water you've used inside your house, go down drains. This mixture is called wastewater, its 99% water. The remaining one per cent is made up of things you've added as you've used it. To protect the environment, we separate and treat wastewater to reuse it as recycled water or safely discharge it into the environment.

Density of items is an important physical property to consider when separating wastewater. Density is how tightly packed a substance is and can be measured in as mass per unit of volume. For example, water has a density of about 1 g/cm^3, honey has a density of around 1.4 g/cm^3. So, honey is denser, you can fit more grams of honey in a smaller space than water. What does this mean when we have substances of different densities in a mixture like wastewater? Let's build some wastewater density columns to find out.

Did you know?

We use physical, chemical, and biological properties in wastewater treatment. Find out more on our Wastewater treatment webpage.

Example of materials for your experiment

Find out more

See our *What's in wastewater factsheet* in our High School resources in HSC Chemistry for ideas on what to put in your column. Find out what's in your wastewater by doing a Wastewater audit.

What you'll need?

Safety first! Adult supervision is required. Follow all safety instructions as directed on product packaging.

Choose as many or as few household items to build a wastewater density column. Here are some suggestions.

Required	Optional ideas
• 1 clear narrow container • 1 measuring or pouring jug • tap water • dishwash liquid • honey or syrup • cooking oil • food colouring • stirring rod	• methylated spirits or rubbing alcohol • milk • food scraps like rice, pasta, peas, corn, choc chips, sprinkles, grapes • small pieces of plastic like straws, cotton buds and floss • toilet paper (ripped in small pieces) • tissues or wipes (ripped in small pieces) • rocks or gravel • other items like ping pong balls, plastic cars, coin or metal bolt

Activity

1. (Optional) Look up or measure the density of liquids in your wastewater density column. Record in the table below. Build one based on your hypothesis if you can't get the data.
2. Write a hypothesis for the following scenarios in the results table.
   - **Column (before):** A column with the densest liquids at the bottom and continues in descending order to the least dense at the top. For example, items in the table below, would be honey at the bottom, dishwash liquid, water, and cooking oil at the top.
   - **Column (mixed):** Stirring the column, what happens when you break the column and wait for it to settle.
3. Gather all the items required to build your density column.
4. Gently squeeze or pour the densest liquid into your container. Make a 1cm thick layer. Allow contents to settle.
5. Follow with the next densest liquid. **For water make a thick 5cm layer and no colour**. For other liquids add food colouring if required. Gently pour 1cm thick layers trying not to disturb the last layer.
6. Repeat steps 4-5 for all liquids in your column.
7. (Optional) Gently add one solid item at a time and allow a couple seconds to settle.
8. Record your observation and draw your density column.
9. Mix your column thoroughly, using a stirring rod or chopstick.
10. Allow your mixture to settle for at least 10 minutes record observation and draw.

Step 7

Results

	Column (before)	Column (after)
Hypothesis		
Observations		
Illustration		

Items	Density (g/cm^3)
Water	~1.00
Dishwash liquid	~1.05
Honey	~1.40
Cooking oil	~0.90

Discussion

- Why did the liquids form layers?
- What happened when they mixed? Did they form the same or different layers?
- How can we use density to separate items from wastewater?
- Which items require use of other properties and separation techniques to remove from water?

Want to know more?

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