Polarity of Food Coloring

Recommended for Chapter(s): 17

Demo #045

Procedure

1. Pour ~500 mL of water into the 1000 mL Erlenmeyer flask.
2. Ask students what will happen when you pour oil into the Erlenmeyer flaks.
3. Pour ~250 mL of oil into the 1000 mL Erlenmeyer flask.
4. Ask students what will happen when you put food coloring into the Erlenmeyer flaks.
5. Put a dropper full of food coloring into the Erlenmeyer flask.
6. Ask students if the food coloring is polar or non-polar.
7. Put the stopper on the Erlenmeyer flask and lightly shake the flask to show that even when mixed the water and the food coloring will separate from the oil.

Clean Up

1. Stopper the Erlenmeyer flask.
2. Return the materials to the cart in the demonstration library room.

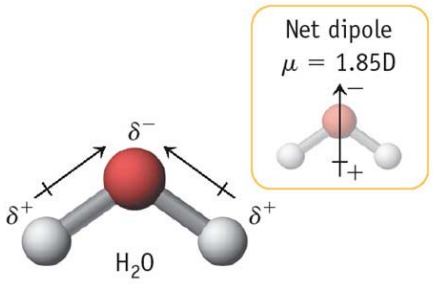
Stockroom Notes

1. Pour the waste down the drain.
2. Replace the glassware with clean glassware.
3. If needed refill any materials that have been used up.
    a. Do not throw away the oil bottle. It can be refilled from a larger bottle.
4. Return items to demonstration tub.
5. Return tub to the demonstration library.

Discussion

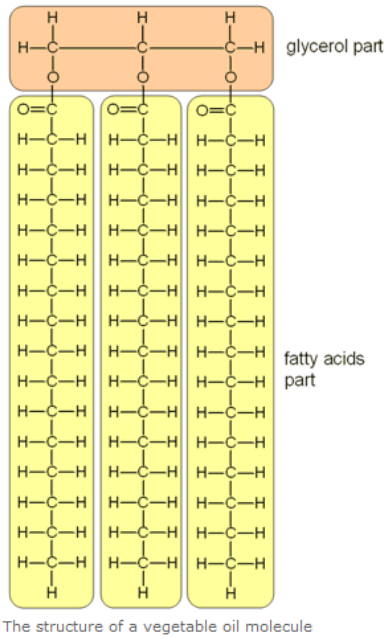
Polar molecules are molecules in which the overall dipole moment in a molecule does not cancel out.

The chemical structure of water is seen below.



Since water has a bent shape and the hydrogen-oxygen bonds have significant dipole moments that do not cancel out; water is a polar molecule.

The chemical structure of vegetable oil is seen below:



The structure of a vegetable oil molecule

The long fatty acid chains mainly contain carbon-hydrogen bonds which have essentially no dipole moment. Therefore oil is non-polar.

Liquids will mix when both are polar or both are non-polar but do not mix when one is polar and the other is non-polar. This phenomenon happens because polar molecules have partially positive and partially negative sides to them. When they are next to other molecules that are polar the partially positive side of one molecule can align with the partially negative side of another molecule making the system more stable than if there were no other charges in solution (the case for non-polar solutions).

Since the oil and water do not mix, this shows that polar and non-polar solutions do not mix. When the food coloring is added to the mixture it goes into the water and not the oil. Therefore, the food coloring must be polar.

Materials for demo 045

1. 1000 mL Erlenmeyer flask with stopper
2. Tap water
3. Oil
4. Red food coloring in dropper bottle