

Liquid Kaleidoscope

The Action

A kaleidoscope of colours will be created in milk.

Grade Level

Grade 10 - Life Sciences, Food Additives and Human Nutrition

Materials

- Milk
- A shallow container and lid
- Food colouring
- Liquid dish washing soap
- Toothpicks
- Cotton swabs
- Rubbing alcohol

Instructions

- Have milk at room temperature; pour milk into the shallow dish and let sit for a minute so there are no currents in the milk.
- Put one drop of food colouring in at a time in various parts of the dish.
- Put one drop of dish washing soap into the lid. Dip the toothpick into the soap and place in the center of the dish. The colours should move to the outside of the dish. Now, dip the toothpick in the soap and place in the food colouring. The colours should move away from the soap.
- Dab the bottom of the food colouring bottle in the soap and set in the milk. The colours will swirl for a few minutes. Instead of dabbing the food colouring bottle in the soap, the experiment may be continued using the toothpick, in which case the effect will last for 20 minutes or so.
- For the colours to move fore quickly, pour a new dish of milk and add food colouring. Dip the cotton swab into the rubbing alcohol, then into the dish as before, in the middle and then in the colour.
- Dispose of the materials down the drain.

Safety

No safety concerns, just be careful not to get food colouring on your clothes.

Hints

The higher the fat content in the milk the better, 2% or whole milk works the best.

Science Principle

Simple Explanation

Water has surface tension, a stretch membrane like surface. If you add soap to a water drop, it flattens, reducing the tension of the surface. Milk is mostly water, therefore it has surface tension. When the soap touches the surface of the milk, you reduce the tension. Since the tension at the spot being touched is weaker compared to the rest of the bowl, the water molecules elsewhere in the bowl pull water molecules away from the soapy spot. The food colouring reveals the currents in the milk.

Complex Explanation

A soap molecule, which is water soluble, consists of two ends. The carboxylic acid group, which contains a hydrogen atom, two oxygen atoms and a carbon atom, and a hydrocarbon chain attached to the acid (consisting of a long straight chain of carbon atoms and two hydrogen atoms). The carboxylate end of the soap molecule is hydrophilic (water loving) and the hydrocarbon chain,

which is attracted to the fat and repelled by the water, is hydrophobic (water hating) end.

When the soap is dipped into the milk, the carboxylate end attracts the water, pulling the water molecules towards that end. The hydrocarbon chain attracts the fat and pulls it in the opposite direction of the water. What you see is the colouring moving in the currents of the milk, but this enables you to imagine the liquid being separated into water and fat. The rubbing alcohol has turbo colours because it becomes soluble in water more quickly than soap; therefore, it has currents moving faster and the separation occurs more quickly.