



## Curiosity Guide #501

### Polymers

Accompanies Curious Crew, Season 5, Episode 1 (#501)

#### Growing Toys

Investigation #4

#### Description

What happens when polymer toys and water meet?

#### Materials

- Polymer grow toys
- Large clear containers
- Distilled water
- Digital scale
- Ruler

#### Procedure

- 1) Weigh each of the grow toys using the digital scale.
- 2) Measure the length and width of each grow toy.
- 3) Record the data.
- 4) Submerge each toy in its own container of distilled water.
- 5) Let sit for at least 1 day.
- 6) Weigh each of the toys and measure its length and width.
- 7) How did the toys change?

#### My Results

## Explanation

Polymer structures consist of long, linked molecules and look like long matrix chains. Grow toys are made of two kinds of polymers, one **hydrophilic** that likes water, and one that is **hydrophobic** that doesn't.

**Hydrophilic molecules love water!** When the toys are submerged in water, the water is drawn into the center of each of the hydrophilic molecules. The water will continue to absorb until there is an equal concentration of liquid both inside and outside the polymer.

**Hydrophobic molecules hate water!** The hydrophobic polymer structure makes up the shape of the toy. Because the hydrophobic polymer does not absorb any water, the shape gets larger but remains the same.

Weighing and measuring the saturated toy can determine the increased volume and mass. If the toy weighs 300 grams, it is holding 300 milliliters of water. The purer the water, the greater the change in mass and volume.

**Try this!** Leaving the toy out of the water allows the water to evaporate and shrink down again, although the toy won't get as small as its starting state because the polymer structure gets stretched a bit.

**Investigate further:** As an interesting extension, locate some superabsorbent crystals from the gardening section of your local hardware store. To see how this polymer works, place some of the crystals in a baggie of milk. The crystals will absorb the water and leave the fat. In orange juice, the crystals will absorb the water and leave the pulp. Small amounts of polymer gardening crystals placed in the ground with grass planted on top can help hold the moisture for plants and reduce the amount of watering from 50-80%!

**Think about this!** Polymers are made of long chains of repeating molecules that get bonded together when the molecules share electrons. When we feel the wet growing toys or gummies, they feel squishy, kind of like rubber. In fact, rubber is another example of a polymer that occurs in nature. Rubber is really useful because it has that elastic, stretchy quality. Engineers have figured out how to make different polymers that have different properties, not only elastic qualities, but inelastic, reflective, translucent, moldable, strong, weak, or soft. The structure of the polymer will determine its properties.

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