

Ivory Soap Science

The microwave oven is not just for warming leftovers. It's another tool in Steve Spangler's bag of science tricks. Wrangle up a bar of soap, clear out the microwave and get ready for the expanding soap trick.



www.stevespanglerscience.com

Picture from http://www.mysimon.com/9015-10955_8-41299649.html

Walk down the detergent isle and you'll see dozens of different kinds of soap. Green soap, smelly soap, big soap, even soap that floats. Ivory soap is famous for floating. How do they make some bars of soap float and others sink? Believe it or not, we're going to cook the soap in the microwave oven to uncover the secret. Just wait until you see what happens when the soap that floats also cooks. You get a bar of soap that grows bigger than a football.

Materials

- Bar of Ivory soap
- Various bars of another brands of soap
- Deep bowl of water (or a plastic tub)
- Paper plate
- Paper towels
- Microwave oven

Sink or swim?

Fill the bowl with water.

Collect hypotheses from youth about which soaps will sink and which will swim (float).

Drop the bars of soap in the bowl of water to test hypotheses.

All of the bars of soap sink except for the Ivory brand soap.

Why does Ivory Soap Float?

Remove the Ivory soap and one other bar of soap from the water and break them in half and ask youth to compare. Ask, "What is different?"

There are tiny pockets of air hiding in the middle of the bar.

Place the bar of Ivory soap in the middle of a paper plate and place the whole thing in the center of the microwave oven.

Cook the bar of soap on HIGH for 2 minutes.

Don't take your eyes off the bar of soap as it begins to expand and erupt into beautiful puffy clouds.

Stop the microwave before burning the soap.

Allow the soap to cool for a minute or so before touching it. Amazing... it's puffy but rigid.

How does it work?

Ivory soap is one of the few brands of bar soap that floats in water. If it floats in water, it must mean that it's less dense than water. When you broke the bar of soap into several

pieces, no large pockets of air were discovered. Ivory soap floats because it has air pumped into it during the manufacturing process. The air-filled soap was actually discovered by accident in 1890 by an employee at Proctor and Gamble. While mixing up a batch of soap, the employee forgot to turn off his mixing machine before taking his lunch break. This caused so much air to be whipped into the soap that the bars floated in water. The response by the public was so favorable that Proctor and Gamble continued to whip air into the soap and capitalized on the mistake by marketing their new creation as “The Soap that Floats!”

Why does the soap expand in the microwave? This is actually very similar to what happens when popcorn pops. Here's the secret: All soap contains water, both in the form of water vapor inside trapped air bubbles (particularly important in the case of Ivory) and water that is caught up in the matrix of the soap itself. The expanding effect is caused by the heating of the water that is inside the soap. The water vaporizes, forming bubbles; the heat also causes trapped air to expand. Likewise, the heat causes the soap itself to soften and become pliable. This effect is actually a demonstration of Charles' Law. When the soap is heated, the molecules of air in the soap move faster, causing them to move far away from each other. This causes the soap to puff up and expand to an enormous size. Charles' Law states that as the temperature of a gas increases so does its volume. Other brands of soap without whipped air tend to heat up and melt in the microwave.

Adult Warning! You will not be able to sneak co-workers into the cafeteria to see the incredible expanding soap trick without filling the office with the lovely smell of Ivory soap. Besides, the chorus of ooohs & ahhs erupting from the cafeteria is a dead giveaway.



Ann Marie's Chemistry Blog