

Meltdown Showdown! Which Deicer Works Best?

You may have helped your parents spread ice-melting crystals on your sidewalk in the winter to melt the ice. Have you ever looked at the ingredients on the bag to see what the crystals are made of? All ice-melting products, known as chemical deicers, are not the same, but most are made from rock salt (sodium chloride, rightmost image in the photo at the right) or calcium chloride (leftmost image). Those made from rock salt are usually less expensive. In this Activity you will test two chemical deicers to determine which melts ice better and decide if it is worth the extra cost to buy a more expensive deicer.



Photo by Erica K. Jacobsen and Jerrold J. Jacobsen

Try This

You will need: rock salt or other sodium chloride deicer, calcium chloride deicer, water, large water-resistant disposable dinner plate (not a divided plate), bowl with a diameter slightly smaller than the plate, measuring cups and spoons, stirrers, marking pen, thermometer, crushed ice, six 3-oz disposable cups, access to a freezer.

I. Melting ice in the freezer

- ___1. Label two 3-oz disposable cups A and B. Place 2 tablespoons (30 mL) of crushed ice in each of the two cups.
- ___2. Add 1 teaspoon (5 mL) of sodium chloride deicer to cup A and mix with a stirrer. Add 1 teaspoon (5 mL) of calcium chloride deicer to cup B and mix with a stirrer. Immediately place both cups in a freezer and leave for 30 min. During this 30 min period, you can continue with the rest of the Activity. After 30 min, remove the cups, observe the contents of both cups, and record your observations.

II. Mixing deicers with water

- ___1. Label two 3-oz disposable cups A and B. Add 2 tablespoons (30 mL) of water to each cup. Measure the water temperature using a thermometer and record it.
- ___2. Add 1 teaspoon (5 mL) of sodium chloride deicer to cup A and stir with a stirrer until it dissolves. Measure and record the temperature of the solution.
- ___3. Repeat step 2 using calcium chloride deicer.

III. What happens when the deicers are exposed to air overnight?

- ___1. Label two 3-oz disposable cups A and B.
- ___2. Add 1 teaspoon (5 mL) of sodium chloride deicer to cup A and 1 teaspoon (5 mL) of calcium chloride deicer to cup B. Let the cups sit at room temperature exposed to air overnight.
- ___3. Observe the contents of both cups and record your observations.

IV. The Showdown

- ___1. Add 1/2 cup of water to a water-resistant disposable dinner plate (not a divided plate). Place it in a freezer until the water freezes completely. Remove the resulting ice disk from the plate and place it on top of a bowl with a diameter slightly smaller than the plate. Set the bowl on the plate to catch any drips of water.
- ___2. Based on your observations from parts I–III, which deicer do you think will melt through the ice disk faster? Place 1 teaspoon (5 mL) of sodium chloride deicer on the ice disk about 5 cm from the edge. Place 1 teaspoon (5 mL) of calcium chloride deicer on the other side of the ice disk 5 cm from the edge. What do you observe happening over time? Are your observations different for the two deicers? Does adding more deicer speed the process?

Questions

- ___1. Based on your observations in section II, suggest an explanation of the fact that one of the deicers works faster.
- ___2. For deicers to start working they need to be dissolved in water. How do your observations from section III help you explain the result from section IV?
- ___3. Which of the deicers should work better at lower temperatures? Explain.
- ___4. Sample prices for February 2002 are \$2 for 25 pounds of sodium chloride deicer and \$10 for 25 pounds of calcium chloride deicer. Would it be worth the price difference to a homeowner who uses a few pounds to clear sidewalks each winter? To a city that uses several tons to clear city streets? Consider damage the various materials would do to the surface to be cleared and to the surroundings when counting the cost. Explain your reasoning.

Information from the World Wide Web (accessed March 2002)

1. Why does salt melt ice? <http://antoine.fsu.umd.edu/chem/senesel/101/solutions/faq/why-salt-melts-ice.shtml>
2. Salt Institute; <http://www.saltinstitute.org>
3. Using salt and sand for winter road maintenance; <http://www.usroads.com/journals/plrmj/9712/rm971202.htm>

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