



Ice Melting Compounds

Do you live in one of the five snowiest cities in the U.S.?¹

- Truckee, Calif. — 202.6 inches of snowfall annually
- Steamboat Springs, Colo. — 179.6 inches of snowfall annually
- Oswego, N.Y. — 141.0 inches of snowfall annually
- Syracuse, N.Y. — 123.8 inches of snowfall annually
- Marquette, Mich. — 117.2 inches of snowfall annually

Even if you don't, chances are good if you live in any of the lower 48 states, you'll probably experience snow or ice at one time or another this winter. In fact, on Jan. 11, 2011, there was snow recorded in 49 of the 50 states — the only state spared at that time was Florida.

There are many ways to deal with snow and ice, from plowing and shoveling to scraping and using ice-melting compounds. This document addresses the advantages and disadvantages of the different ice-melting options available.

¹ Source: WeatherDB.com

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The science behind these products is such that throwing more ice-melt compound on the ice won't help it melt faster; it will just waste resources. The compound will not dissolve or melt and will simply be dragged into buildings and cars or affect landscaping. Here are some key points to keep in mind:

- Ice-melt compounds are only effective down to specific temperature limits that vary by compound. Know these temperatures, referred to as eutectic temps, and monitor them to ensure effective use of your ice-melt compound. Remember, adding additional ice-melt compound to areas already well-treated will be simply wasting compound.
- Periodically inspect areas where ice-melt compound has been spread — has the melting action of the compound been reduced as the solution concentration has changed? Should more compound be spread to increase the solution concentration?
- The higher the air temperature, the more effective the melting action of the ice-melt compound. Knowing the outdoor air temperature and the lowest temperature for effective use of your ice-melt compound should guide you when ice-melt should be applied to walking surfaces and up to what point it will no longer be effective.
- The temperature of the air, pavement, and the type of ice-melt compound used will affect the rate at which the ice melts.

There are many different ice-melt compounds available from traditional rock salt (sodium chloride) to ice-melt pellets (calcium chloride). Each compound has unique properties and costs that should be factored in when determining what ice-melt compound is best for your use.

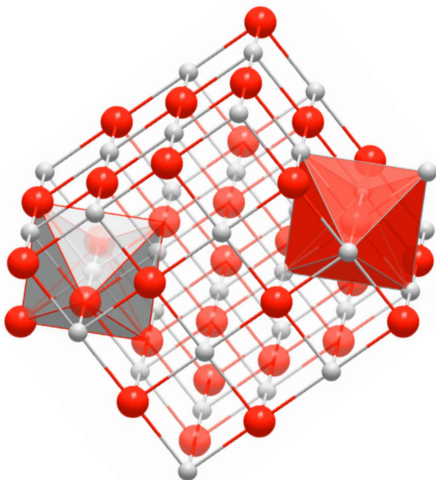
Both sodium chloride and calcium chloride can be acquired in bulk quantities at relatively low cost. The disadvantage of these compounds is they tend to be corrosive to concrete or steel and can be harmful to vegetation. However, other less corrosive or less toxic compounds tend to be more expensive and may make it more difficult to treat needed areas.

Wondering what the science behind ice-melt is?

Ice-melting compounds lower the freezing point of water. These products attract moisture to themselves to form a liquid brine solution which can generate heat and melt the ice. The amount of ice that is melted by a given quantity of ice-melt compound will decrease as the temperature of the mixture is lowered. As the ice melts, the compound solution's concentration is reduced and the freezing point of the water starts to increase until such time that more ice-melt compound is spread on the ice and water.

The lowest melting point of the water and ice-melt compound solution is termed the "eutectic" temperature. At this limiting eutectic temperature, solutions of the ice-melt compound aren't effective and the melting action on the ice will cease.

The quantity of ice-melt compound needed to lower the freezing point of ice to the eutectic temperature is called the "eutectic concentration." At this lowest temperature, the rate at which ice melts is very slow. When this melting action slows, adding more compound has no impact on lowering the eutectic temperature, thus, the ice melts no faster.



Knowing what to use

It's important that your organization assess your needs for application of ice-melt compounds. Consider the areas to be covered, access to traffic and sunlight, (which improve the effectiveness of ice-melt compounds), methods for treating needed areas, and cost. The chart below offers some guidance on materials to consider, as well as pros and cons for each compound.

Type	Uses	Advantages	Disadvantages	Notes
Sodium Chloride (Rock Salt) — NaCl	<ul style="list-style-type: none"> Plain Wet with CaCl₂ Wet with NaCl brine 	<ul style="list-style-type: none"> Low purchase price 	<ul style="list-style-type: none"> Can be corrosive to concrete, structural steel in bridges and cars. Potentially harmful to roadside vegetation. Can contaminate surface water and drinking water supplies. 	<ul style="list-style-type: none"> Workhorse of de-icing chemicals. Works to 15°F
Sodium Chloride (Salt), Brine — NaCl	<ul style="list-style-type: none"> Pre-wetting other chemicals Anti-icing 	<ul style="list-style-type: none"> Low purchase price Little to no residue on pavement Doesn't draw moisture and leave road wet and slick 	<ul style="list-style-type: none"> Can be corrosive to concrete, structural steel in bridges and cars. Potentially harmful to roadside vegetation. 	<ul style="list-style-type: none"> Used primarily as pre-wetting and/or anti-icing agent Works to 15°F
Calcium Manganese Acetate (CMA) — Ca(O ₂ CCH ₃) ₂ Mg(O ₂ CCH ₃) ₂	<ul style="list-style-type: none"> CMA liquid mixed with salt or sand Liquid alone 	<ul style="list-style-type: none"> Less corrosive than salt Reduces corrosion on steel bridges 	<ul style="list-style-type: none"> Need to use twice as much CMA as salt High concentrations can reduce oxygen levels in streams and lakes Pavement appears wet 	<ul style="list-style-type: none"> Best product available from an environmental standpoint Works to 15°F
Magnesium Chloride — MgCl ₂	<ul style="list-style-type: none"> Sprayed directly on road Mixed with sand or other de-icers 	<ul style="list-style-type: none"> Attracts moisture from the air, which hastens dissolving and melting Does not require post distribution cleanup Doesn't appear to contribute to air pollution 	<ul style="list-style-type: none"> Keeps pavement wet if it attracts too much moisture from the air Cost Corrosive to metal 	<ul style="list-style-type: none"> Liquid used as an anti-icing agent when air temperatures exceed 10°F Can be applied to busy streets and intersections before light snow storms to melt snow as it hits the pavement Works to -13°F Costs approximately two times more than salt
Calcium Chloride — CaCl ₂	<ul style="list-style-type: none"> Used as a pre-wetting agent for solids like sand, salt, urea, or CMA 	<ul style="list-style-type: none"> Requires fewer applications Performs very well Safer than salt for structural steel and reinforcing steel Noncorrosive, biodegradable 	<ul style="list-style-type: none"> Cost Could cause slickness on pavement Lowers oxygen levels in bodies of water 	<ul style="list-style-type: none"> Liquid works best as a de-icer if applied in narrow bands May be used alone if needed Works to -75°F Costs approximately eight times more than salt
Carbohydrate-based solution (corn- or beet- based)	<ul style="list-style-type: none"> Liquid typically mixed with MgCl₂ and other salts 	<ul style="list-style-type: none"> Cost No adverse effects on roads and infrastructures Corrosion inhibitor 	<ul style="list-style-type: none"> Some products may have an odor 	<ul style="list-style-type: none"> Liquid is thick Biologically and environmentally safe Contains agricultural by-products
Sand	<ul style="list-style-type: none"> Provides traction 	<ul style="list-style-type: none"> Cost 	<ul style="list-style-type: none"> Cleanup cost of sediment in storm drains 	<ul style="list-style-type: none"> Some products are available that have a mix of other de-icing materials and sand

* Chart adapted with permission from: Technology News, August 1995, Iowa Transportation Center, Iowa State University; "Safer De-icing Chemicals - Home Steading," Mother Earth News, December 2003; and the University of Minnesota Extension Service Yard & Garden Brief: Effects of De-icers on Trees and Shrubs.



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