Using Deicers – How Using Less Can Help You Do More

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SUMMARY

Winter maintenance efforts all work toward the same goal: making a safer winter environment. Sometimes there is a tendency to over-apply deicers in an attempt to achieve faster results, or a tendency to keep applying more of an under-performing deicer in hope that “more will work better.”

However, using more than the recommended amount of deicer won’t speed up ice melting or make an under-performing deicer work better. When used excessively, deicers may have an impact on the environment. Winter maintenance efforts require a balance between maintaining safe surfaces yet minimizing the impacts from the use of deicers; and yes, safety can be achieved with less deicer.

Achieving this balance requires choosing the right deicer for the job, and then applying the deicer correctly. Choosing the right deicer will provide fast melting speed and reliable performance. Applying the deicer properly is a key part of an effective, responsible, and economical snow and ice control program.

OxyChem®

CHOOSING THE RIGHT DEICER

A variety of deicer products are available for maintaining safe sidewalks, steps, entryways, parking lots, and driveways. Two of the most common, premium deicers for walkways are calcium chloride and magnesium chloride. Table 1 compares some of the key characteristics between these two deicers.

Table 1 Comparison of Key Calcium Chloride and Magnesium Chloride Characteristics

	Calcium Chloride	Magnesium Chloride
Lowest Effective Temperature	-25°F	0°F
Application Rate[(1)]	28 lb/1,000 ft^2	50 lb/1,000 ft^2
Ice Melting[(1)]	5.7 lb ice per lb deicer	3.2 lb ice per lb deicer

[(1)]Based on ice penetration testing (SHRP-H-205.3) at 20°F after 30 minutes

By choosing the right deicer and applying it properly, you can reduce deicer application rates and still achieve safe walking and driving surfaces. Not only does this achieve results, but a reduction in application rate will also save you money and time. Additionally, applying a deicer properly is friendlier to the environment by introducing less chloride, and reduces the likelihood of deicers being tracked indoors and causing slippery floors.

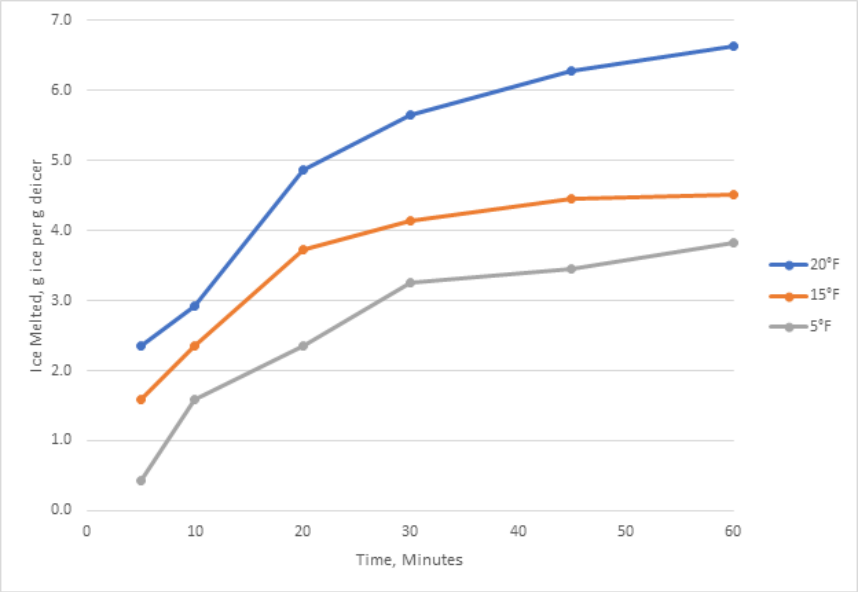
Deicers – How Do They Work?

To evaluate the performance, reliability and speed of melting associated with different ice melting materials, it helps to understand that solid deicers must first dissolve before ice melting can begin. It is the resulting deicer solution that melts surrounding ice on contact.

Even though it may not be visible, water is always present on the surface of the ice. The amount of water increases as temperatures rise and is reduced when temperatures drop. During colder conditions, when there is little water on the surface of ice, deicers can take longer to dissolve, resulting in slow melting action. Figure 1 shows the impact of temperature on the amount of ice melted by PELADOW® Premier.

Some deicers can accelerate melting by releasing significant heat while dissolving. Deicers that release heat are commonly labeled as “exothermic”; these deicers, such as calcium chloride-based deicers (PELADOW Premier, DOWFLAKE® Xtra), melt ice more quickly and can melt ice at colder temperatures. Other deicers are “endothermic”. Rather than releasing heat, they must draw heat from their surroundings to dissolve. Endothermic deicers work slower than exothermic deicers, especially when temperatures are cold and when little surface moisture is present to help them dissolve.

Figure 1 Ice Melting of PELADOW Premier at Various Temperatures



Properties of Calcium Chloride and Magnesium Chloride

As previously mentioned, two of the most common, premium deicers for walkways are calcium chloride and magnesium chloride.

Calcium chloride is the one of the most commonly used premium deicers. Its lowest effective temperature, -25°F, is below that of other common deicers, providing reliable performance in the widest range of temperatures. Calcium chloride also releases a significant amount of heat while dissolving, which speeds up the melting action compared to other deicers, particularly at lower temperatures. Calcium chloride can also melt more ice at colder temperatures than other products. Calcium chloride can be sold in pellet form with the calcium chloride content exceeding 90%, or in flake form with calcium chloride contents typically at 83%.

Magnesium chloride has a lowest effective temperature of 0°F. While magnesium chloride also releases heat while dissolving, magnesium chloride does not release as much heat as calcium chloride, as shown in Table 2. Magnesium chloride solids are sold as a hexahydrate salt, meaning it contains a large amount of water bound in the solid magnesium chloride. A solid magnesium chloride product on the market contains, at most, 52% magnesium chloride.

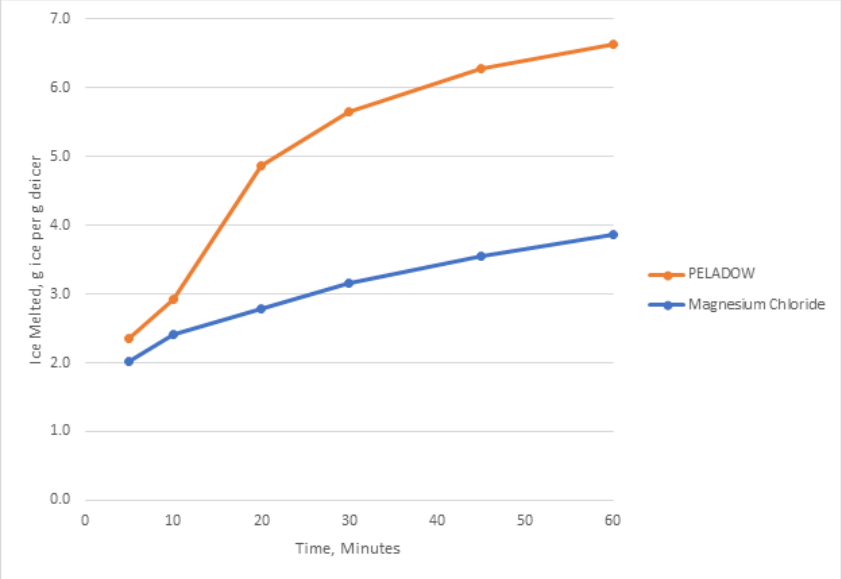
Table 2 Key Physical Properties of Calcium and Magnesium Chloride Hydrates

	Calcium Chloride Anhydrous	Calcium Chloride Monohydrate	Magnesium Chloride Hexahydrate
Composition (%)	100	86.3	46.8
Heat of Solution in Water[(1)] To Infinite Dilution[1,2]	-317.2	-174.3	-30.0

[(1)]Negative sign means that heat is evolved (process is exothermic)

Figure 2 shows the results of ice penetration testing completed using the methods outlined in SHRP-H-205.3 "Test Method for Ice Penetration of Solid Deicing Chemicals." Using the dimensions of the apparatus, the mass of ice melted can be determined.

Figure 2 Ice Melting of Calcium Chloride and Magnesium Chloride



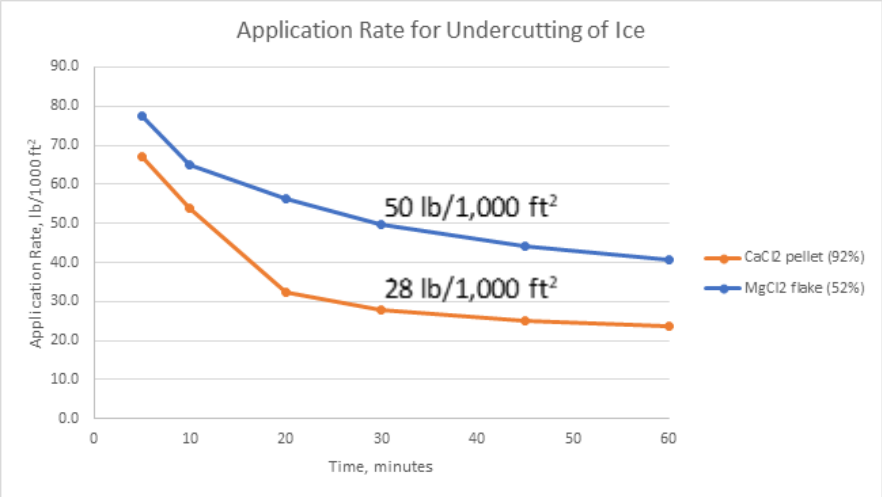
PROPERLY APPLYING DEICERS

Understanding Application Rate

The application rate is determined based on the ice melting capabilities of the deicer in the environment you're dealing with. For example, based on the ice melting capabilities of calcium chloride after 30 minutes at 20°F for a thin layer of ice, calcium chloride should be applied at 28 pounds per 1,000 square feet (4 ounces per square yard). Similarly, based on the ice melting capability of magnesium chloride after 30 minutes at 20°F for a thin layer of ice, magnesium chloride should be applied at 50 pounds per 1,000 square feet (a little more than 7 ounces per square yard).

Figure 3 details the application rate of calcium chloride and magnesium chloride based on the ice melting rates at 20°F shown in Figure 2. Thick layers of ice or lower temperatures may require slightly more product to disbond the ice from the pavement.

Figure 3 Application Rate for Undercutting of a Thin Sheet of Ice at 20°F



Steps to Remove Snow and Ice

Every facility should have a well-documented plan for managing snow and ice, and have staff ready to implement it when a winter storm hits. A plan should include the following steps:

1. **Mechanical Removal**

The purpose of a deicer is to penetrate the ice layer and separate the ice that is bonded to the pavement. Mechanical removal is the most economical and lowest impact method of snow and ice control, and facilities should make this method a priority. Prompt removal of snow and ice from walkways and parking lots minimizes compaction by foot a vehicle traffic. Additionally, mechanically removing existing snow before applying deicer reduces the amount of ice melter required. When snow is removed, a deicer will penetrate and break the bond between the ice and underlying pavement faster.

2. **Calibrate Application Equipment**

Calibration of application equipment is important for cost-effective use, especially where large quantities of deicer are applied from spreaders across broad surface areas. Handheld spreaders should be calibrated to control application rates.

3. **Apply Deicer**

Following the application rate guidance on the package, apply the deicer evenly over surfaces – preferably using a spreader. Use of a handheld, mechanical dispersing spreader is a far better choice than using a simple scoop: spreaders provide more even distribution patters, avoid forming piles of deicer that lead to tracking in a mess, and, in the case of a properly set spreader, help make sure the proper amount of deicer is used.

4. **Remove the resulting slush and ice mechanically**

Give the deicer time to loosen the bond between the ice and the pavement, then remove the resulting slush and ice mechanically. Removing slush mechanically allows for a lower application rate of deicer, but also reduces the chance of a slipping hazard from the slush being tracked into the building.

For more information regarding OxyChem's calcium chloride products, please visit our website at www.OxyCalciumChloride.com.

[1] Occidental Chemical Corporation, "Calcium Chloride Handbook", https://oxycalciumchloride.com/siteassets/documents/guides/calcium-chloride-handbook.pdf
[2] Green, Don W. & Perry, Robert H., "Perry's Chemical Engineers' Handbook, 8th Edition, 2008. Table 2-182: *Heats of Solution of Inorganic Compounds in Water*.