PREWETTING SALT

ANOTHER COST EFFECTIVE TOOL FOR YOUR WINTER MAINTENANCE TOOLBOX

PREWETTING SALT CAN RESULT IN SAFER ROADS AND REDUCED COSTS

Governments, whether they be state, local or provincial, have a responsibility to provide a safe transportation system. This means maintaining streets and roads in a safe condition during winter snowstorms. Winter storms can be devastating, not only to the safety of our road system, but also to our maintenance budgets. Snow and ice control becomes a major budget expense, one that can get out of control as fast as the winter storm hits the area.

In our continual fight with 'Old Man Winter', salt has been and still is our "#1 Deicer." Used alone or in combination with abrasives, salt has proved its effectiveness at a relatively moderate expense, considering other materials.

Winter maintenance personnel can, however, improve salt's effectiveness using the same spreading equipment through **prewetting** operations. Using prewetted salt can increase road safety and, at the same time, result in savings in that major budget expense.

To understand how all this is possible, let's first take a look at the characteristics of salt. Then we'll define prewetted salt and take a look at the materials and equipment used for prewetting. We'll also look at how prewetted salt works to the benefit of road safety and discuss the possible costs savings by looking at a specific example of the economics of a prewetting operation.

SALT (SODIUM CHLORIDE)

Salt is an effective deicer. It is most effective when temperatures are in the mid-twenties along with sunshine and traffic. As temperatures dip below 20° F. (-7° C), however, salt starts to lose its effectiveness. Even though salt's eutectic temperature (the lowest temperature at which a chemical solution will melt ice and snow) is –6° F (-21° C) at a 23% solution, the deicing effectiveness decreases dramatically as you approach this eutectic temperature. At these lower temperatures, winter maintenance personnel experience a need for higher application rates, repeated applications, and a longer time period to achieve the same deicing effect. Salt needs to form a liquid brine requiring moisture and heat to begin the melting action, two things often lacking on colder, dry winter days. Therefore, as the temperature drops, the melting action of salt slows down.

PREWETTED SALT

Prewetted salt is simply solid salt coated with a liquid prior to being spread.

PREWETTING MATERIALS

Prewetting can be accomplished by using salt brine or other liquid chemicals such as calcium or magnesium chloride. Calcium and magnesium chlorides are hydroscopic, exothermic materials. This means they attract moisture and give off heat when going into solution. These attributes along with lower eutectic temperatures bring added benefits to prewetting operations.

Although the chlorides mentioned are the most commonly used, a variety of other chemicals – acetates, CMA, formats and agricultural by-products – are also used.

The chart shows typical ranges for prewetting application rates in gallons of liquid per ton of salt for the three commonly used chemicals.

Prewetting Agent	Typical Application Rate (gallons per ton of salt)
Salt Brine	8-10
Calcium Chloride	6-12
Magnesium Chloride	6-8

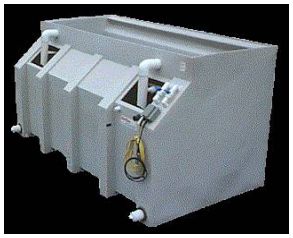
Several manufacturers offer equipment to produce salt brine for prewetting operations.

PREWETTING APPLICATION EQUIPMENT

The use of salt brine for prewetting salt is gaining in popularity with the availability of salt brine production units. Several manufacturers offer equipment to produce salt brine for prewetting operations. Both batch plants and continuous flow plants are available.

In the batch plants, water is added by gravity to rock salt to produce a saturated brine solution. The concentration is checked by a hydrometer or salometer. Continuous flow tanks are more common. In a continuous flow plant, water is forced through salt under pressure. Solution strength is metered and controlled automatically, but should still be checked periodically with a hydrometer to insure proper operation. The resulting salt brine can be pumped directly into storage tanks or truck mounted tanks for application.

A typical commercial brine production unit is shown in the photo. Some agencies have constructed their own units.

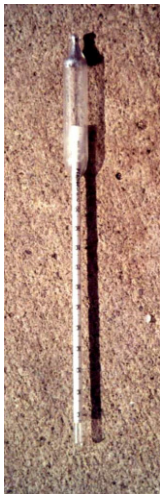


A hydrometer measures the specific gravity of the solution. The percent of saturation is determined by reference to specific gravity charts for the specific solution temperature. A specific gravity of 1.176 indicates we are at a 23.3% concentration of salt in the water by weight that provides the best overall lowest temperature (the eutectic temperature of –6° F) for snow and ice control when using salt brine, as shown on the sample chart.

Hydrometer / Salometer Chart for Salt Brine (59°F)

%Salt	Salometer Using 0 – 100%	Hydrometer Specific Gravity	Eutectic Temperature
0	0	1	32
1	4	1.007	31
2	7	1.014	30
3	11	1.021	29
4	15	1.028	27
5	19	1.036	26
6	22	1.043	25
7	26	1.051	24
8	30	1.059	23
9	33	1.067	21
10	37	1.074	20
11	41	1.082	19
12	44	1.089	17
13	48	1.097	15
14	52	1.104	13
15	56	1.112	12
16	59	1.119	9
17	63	1.127	7
18	67	1.135	4
19	70	1.143	2
20	74	1.152	0
21	78	1.159	-2
22	81	1.168	-4
23	85	1.176	-6
24	89	1.184	2
25	93	1.193	16
26	96	1.201	30
27	100	-	32

We could also use a salometer, testing the sample for salinity percentage. We would then look for a reading of 85, equating to 85% saturation of salt in water or 23.3% concentration by weight, as shown on the sample chart.



Prewetting application equipment is also available with several alternatives. There are stand-alone overhead spray systems that spray each bucket load as the truck is being loaded. This allows for loading the truck without any additional time needed for prewetting. Remote controls are available and can be operated from the truck cab. Application rate is preset and the prewet solution is delivered automatically.

The system shown in the photo has a telescoping pole support to allow different spray arm heights in order to keep the spray arm close to the truck to prevent loss of solution from over-spray and wind currents.

There are various manufacturers of truck mounted prewetting application equipment.

There are also various manufacturers of truck mounted prewetting application equipment. For tailgate spreaders, the systems may attach over the truck's tailgate or have tanks and spreaders built into special tailgates. For V-box spreaders, the tanks are designed to fit into the V-shape and are installed on one side or both sides for double capacity. These types are shown in the following photos.

Tailgate Spreader Prewetting System

V-box Spreader Prewetting System

Various homemade systems for prewetting have been fabricated by work crews, from stand-alone systems to truck mounted systems.

In truck-mounted systems, the prewet solution is sprayed directly on the salt as it comes off the belt or auger onto the spinner, immediately prior to application to the road. Only the material being spread is prewetted.

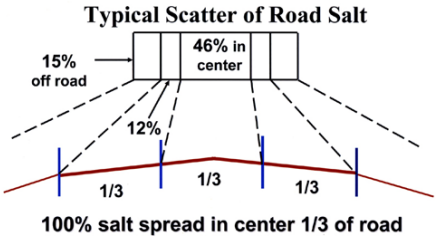
Truck mounted systems still require a separate larger storage tank for replenishing the truck mounted tanks.

HOW PREWETTED SALTS WORKS BETTER

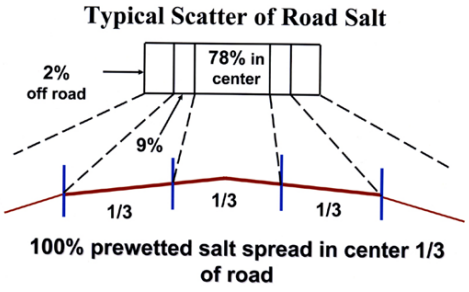
Prewetting the salt provides the moisture needed to start the brine formation to start the melting process. Thus, prewetted salt starts melting the snow and ice faster, providing more effective deicing action, and becomes especially beneficial when there is little or no moisture on the road. Prewetted salt will also imbed itself into ice much faster resulting in faster penetration and undercutting action. The faster more effective melting often eliminates the need to respread already treated areas, again saving time and costs in maintaining safe roads. Prewetted salt sticks to the road surface and results in less bounce and scatter, leaving more salt on the road surface. If more salt stays on the road surface and starts melting quicker, less total salt will be needed to get the desired results, and thereby, costs are also reduced.

A research project conducted by the Michigan Highway Department shows the effect of bounce and scatter between dry salt and prewetted salt. The following charts depict the results of the study showing typical scatter of road salt applied by a spreader to the center one-third of the road. As shown, only 46% of the dry salt compared to 78% of the prewetted salt remained in the center one-third of the road surface. A total of 24% of the dry salt compared to 18% of prewetted salt remained on the outer two-thirds of the road surface. And a total of 30% of the dry salt was not retrieved from the road surface compared to only 4% of the prewetted salt. Thus 26% additional dry salt was completely lost due to bounce and scatter, indicating that the prewetted salt application rate could be reduced by at least this 26% and still achieve the same results.

In fact, it has been shown, since prewetted salt has less tendency to bounce and scatter and begins to melt snow immediately, that a 30% reduction in application rates using prewetted salt can be taken as a reasonable minimum. In addition, environmental concerns from the impact of salt are also reduced if less salt is applied.



Using calcium chloride or magnesium chloride to prewet the salt also gives the additional benefit of melting action at lower temperatures. Since these chlorides have much lower eutectic temperatures, -60° F. (-51° C) for calcium chloride and –28° F. (-33° C) for magnesium chloride, there effective melting temperatures are also much lower than salt. This means that you can get better melting action when the temperatures drop below the 20's into the teens, melting the snow for safer roads in a more timely manner.



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Of course, using calcium chloride or magnesium chloride would not result in as much cost savings as using salt brine, since producing salt brine is much less expensive than purchasing the chloride solutions.

PREWETTING SAVES DOLLARS – AN ECONOMIC ANALYSIS

To demonstrate the cost savings potential due to prewetted salt, lets look at a typical economic analysis. For this example, let us prewet with calcium chloride (CaCl) and assume the following data:

Average salt usage: 1000 tons per winter (year)
Cost of salt: $35.00 per ton
Cost of CaCl: $0.65 per gallon
CaCl usage: 10 gallons per ton of salt

Using the above data and estimating a 30% savings in salt through presetting with calcium chloride, we can calculate material savings as follows:

Amount of salt saved:
1000 tons x 30% = 300 tons per winter
Cost of salt saved:
300 tons x $35.00 per ton $10,500
Amount of CaCl used:
700 tons salt x 10 gallons per ton =7, 000 gallons
Cost of CaCl used:
7,000 gallons x $0.65 per gallon .....$ 4,550
Annual Net Material Savings:
$10,500 - $4,550 ..... **$5,950**

Add to this material savings the cost of labor and equipment savings since we are spreading 300 tons less salt.

These substantial savings can easily offset initial equipment costs for implementing a prewetting system in one to three years depending on the type and extent of the equipment purchased. Truck mounted equipment would result in a faster payback period.

BENEFITS OF PREWETTING SALT:

As can be seen from all of the above data, using prewetted salt can result in safer roads at a reduced cost. With prewetted salt, melting action begins immediately. More prewetted salt remains on the road with less loss from bounce and scatter. And using calcium chloride or magnesium chloride will give faster melting at lower temperatures, again enhancing road safety in a shorter time period.

Prewetting salt is being used by more agencies than ever before. Their experience has proven the cost effectiveness and increased safety of prewetted salt. Is it not time for you to add this additional beneficial cost effective tool to your winter maintenance toolbox?