Brine Additives Demystified

Jason Bagley
Michelle Daum
Paul Johnson
Mark Devries

Additive Definition

• Additive: minor component of a deicing blend used to improve one or more properties
• Sometimes called agricultural byproducts or organic by-product enhancers/OBPE (why?)
• Not going to discuss MgCl2 and CaCl2 as additives to salt brine.

Common Deicing Liquid Uses

• Pre-wetting salt
• Direct anti-icing
• Stockpile treatment, including pre-treated salt
  – Caution: do not pre-treat stockpiles with salt brine

Survey

• Who uses deicing liquids in their program?
• Who purchases additives?

Known Additives

• Corn syrup, corn steeps, and other corn derivatives
• “Beet juice”- sugared or de-sugared
• Lignin/lignosulfonate
• Molasses (usually from sugar cane)
• Brewers/distillers byproduct/solids
• Glycerin

Tend to be low-cost products. Why?

Before you buy: Define your objectives and resources

• Temperature/Deicing Performance
• Corrosion inhibition
• Residual / stickiness
• Environmental
• Cost
• Storage / Infrastructure
• Availability
• Pre-blended with brine

Match the additive to your objective, not the other way around.
Performance

- Low temperature
  - Freeze point data helpful, but...
  - Not always indicative of low temperature performance
- Melting capacity
  - Reflects actual ice melting benefit of additives
  - Why not more data on low temperature melting capacity?

Freeze Point Example

```
Not a beneficial comparison
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Melt Capacity Example

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Not a beneficial comparison
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Corrosion Inhibition

- Sugar/organic molecules attract oxygen – slowing down iron oxidation (rusting)
  - "Oxygen scavenging"
- Can be difficult to quantify benefit, but consider:
  - Constituent vehicles
  - Rebar
  - Bridge decks
  - Concrete?
- Don’t ignore corrosion from deicing products

Residual

- Can spray roads with more lead time to storm events
- Keep brine on the road longer, reducing need for reapplication
- Most (not all) additives improve viscosity
  - Higher viscosity means less runoff and more “sticky” brine attributes which promote residual
- Frictional testing critical

Environmental

- State and local specifications
- PNS (Pacific Northwest Snowfighters)
  - Specify acceptable toxicity levels
  - Corrosion impact must be at least 70% less than salt
  - Don’t accept “qualifies for PNS list”
  - http://www.wsdot.wa.gov/partners/pns
- If product not on PNS list, ask for toxicity data
- Adequate containment
- Smell
Cost

- Consider percent needed to achieve your objectives, not just price per gallon
  - $5.00/gal x 3% = $0.15/gal brine
  - $1.50/gal x 20% = $0.30/gal brine
- Include the cost of application (trucks, overtime, fuel), especially if more product needed to control ice

$$$

Storage/Infrastructure Resources

- Tanks versus totes
- Eutectic temperature of product (indoor or outdoor storage, heated storage)
- Blending requirements (premixed vs. blend yourself)
- Mold/spoilage
- Agitation
- Salt brine freezes at -6 F

Don’t miss the mark

- Additives can help bridge between straight salt brine and high performance brines, such as magnesium chloride or calcium chloride
- Example:

<table>
<thead>
<tr>
<th></th>
<th>ADD</th>
<th>MAGCl</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unit Cost (per gallon)</td>
<td>$0.15</td>
<td>$0.80</td>
</tr>
<tr>
<td>Additive ($/gallon x 20%)</td>
<td>$0.40</td>
<td>-</td>
</tr>
<tr>
<td>Gallons per lane-mile</td>
<td>80</td>
<td>50</td>
</tr>
<tr>
<td>Total miles</td>
<td>200</td>
<td>240</td>
</tr>
<tr>
<td>Cost per storm</td>
<td>$8,500</td>
<td>$8,000</td>
</tr>
</tbody>
</table>

Vendors Claims versus Reality

- Independent testing – ask to see verification of claims
  - Does it improve temperature performance of salt brine?
  - Will it freeze up in the tanks outside?
  - How much will it reduce corrosion?
  - Why is the product environmentally friendly?
- Work with reputable companies (including carriers) to avoid frozen syrup or sour milk
- Hold vendors accountable for performance claims

No “Magic Bullet”

- Different products with different attributes
- Establish a test program for your individual conditions
- Use objective test criteria
  - “We just liked it better”
  - “Everyone else is using it – we felt left out”
  - Side by side tests
- Choose the additive that meets your individual needs.

Industry Experience

- Paul Johnson: Wellington County, Ontario
- Mark DeVries: McHenry County, Illinois
Enhanced Brine

Components
- Salt Brine 85%
- Organic 10%
- Calcium Chloride 5%

We use organics as a portion of our mix.

Manifold Blending Systems

Components of the system

120,000 gallons of liquid

2010 Trial

Other Organics
Takeaways

- Define objectives before you buy
- Independent product analysis
- Hold vendors accountable for their products
- Use total cost, not just unit cost
- Evaluate multiple tools to find the right one for your application

Jason Bagley, North American Salt Company
(913) 344-9390; bagleyj@compassminerals.com

Michelle Daum, North American Salt Company
(913) 344-9388; daumm@compassminerals.com

Paul Johnson, Wellington County, Ontario, Canada
(519) 837-2601; Paul.Johnson@county.wellington.on.ca

Mark Devries, McHenry County, Illinois
(815) 344-4973; RMDevries@co.mchenry.il.us