Evaluation of the Effectiveness of Salt Neutralizers

Background

The corrosion of snow and ice equipment is a major issue causing increased maintenance and repair costs. Washing of the winter equipment after exposure to ice control chemicals has been suggested as one possible solution to minimize corrosion. This research is to determine the effectiveness of different wash systems at preventing corrosion for the need of a reliable and easy to implement corrosion prevention strategy.

Research Context

This research performs a thorough literature search on effectiveness of salt neutralizers as reported by other state DOTs; assesses selected, commercially-available salt neutralizer products in removing salt residue and preventing corrosion in the laboratory on various bare and coated metal surfaces; performs a cost-benefit analysis of the top-performing salt neutralizing product, and proposes a deployment strategy for the salt neutralizing product consistent with current ODOT practices.

Research Approach

A parallel study of six commercially available salt neutralizers is carried out for comparison. Analysis of the salt neutralizer solutions was carried out using contact angle, Ultra Violet-visible spectroscopy (UV-vis), and Scanning Electron Microscopy imaging (SEM). Corrosion inhibition for several metals treated with salt neutralizer was determined using potentiodynamic measurements and accelerated weight loss analysis (ASTM B117). When considering the effects of corrosion on winter maintenance equipment, it is important to study not only steel but also various "soft metals" (copper, aluminum, brass, etc.) that can be found in the wiring and other parts of the fleet. Electrical Impedance Spectroscopy and visual inspection were used to determine the ability of coated metal samples to prevent corrosion. A cost benefit analysis was completed to determine what specific conditions directly impact the cost effectiveness of corrosion prevention strategies.

Key Points

- An email survey results showed that 37% of ODOT districts use a salt neutralizer to prevent corrosion due to exposure to deicing solutions, and 80% listed cost as the main reason for discontinued use of salt neutralizer solutions in corrosion prevention.
- The cost to thoroughly wash a single truck is significant and can vary by more than 300%.
- Assuming replacement cost of ODOT tandem track is about $140,000 ($125,000 single axle) and the neutralizer solution can increase the useful life of the truck by 6 months to 1 year, washing the trucks with Salt-Away 5 to 18 times per year is cost-effective. The benefits could be even greater if the maintenance costs associated with wiring etc. are also reduced.

This research project was sponsored through the Ohio Department of Transportation and Federal Highway Administration.

RESEARCH FINDINGS AND RECOMMENDATION

Overall, Salt-Away™ is the most effective salt neutralizer was for reducing corrosion of bare metal and coated surfaces. For garages that still have Neutron-Wash or prefer to use Neutron-Wash, the dilution concentration should be increased to at least 14% (volume %) to make it effective at reducing corrosion. For garages using any of the neutralizer solutions listed in Table 3, they should use a minimum of the concentration (volume %) reported in Table 2.

Table 2: Results of accelerated corrosion testing for 6 commercially available salt neutralizers on bare metal samples at wash concentration recommended by manufacturer.

	Carbon Steel (A36)	Copper	Aluminum (2024T3)	Brass	Stainless Steel (410)	Aluminum (5086)	Stainless Steel (304)
BioKleen	Increases Corrosion	Increases Corrosion	Reduces Corrosion	No Effect	No Effect	No Effect	No Effect
ConSALT	Increases Corrosion	Increases Corrosion	Increases Corrosion	Increases Corrosion	No Effect	No Effect	No Effect
Eastwood	Increases Corrosion	Increases Corrosion	Reduces Corrosion	Increases Corrosion	No Effect	No Effect	No Effect
Neutro-wash	Increases Corrosion	Reduces Corrosion	Reduces Corrosion	Increases Corrosion	No Effect	No Effect	No Effect
Salt-away	Reduces Corrosion	Reduces Corrosion	Reduces Corrosion	Reduces Corrosion	No Effect	No Effect	No Effect
Winter Rinse	Increases Corrosion	Increases Corrosion	Reduces Corrosion	Increases Corrosion	No Effect	No Effect	No Effect

Table 3: Neutralizer solution cost for concentrated solution, tested dilution ratio, and usable solution cost for "modified" (i.e. increased dose of neutralizer) application

Neutralizer	Conc. Solution Cost ($/gallon)	"Modified" Dilution Ratio (Volume %)	Usable Solution Cost ($/gallon)	A36 Steel Corrosion Rate Reduction (%)
Salt-Away	$16.15	10.00	$1.62	32%
BioKleen	$17.50	17.00	$2.98	36%
Neutro-Wash	$36.95	14.00	$5.17	14%
ConSALT	$19.00	35.00	$6.65	9%
Winter Rinse	$30.00	10.00	$3.00	9%
Eastwood	$30.00	12.00	$3.60	16%

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