

НОВЫЕ ХИМИЧЕСКИЕ РЕАГЕНТЫ ИСПОЛЬЗОВАННЫЕ В РУМЫНИИ В ЗИМНОМ ПЕРИОДЕ

NEW CHEMICAL REAGENTS FOR WINTER USE IN ROMANIA

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Abstract: This paper presents the topical situation of deicing chemicals type used in snow, ice and black ice control from roads as well from footways.

Knowing all the types of used deicing chemicals, mainly their physico-chemical properties, is a compulsory demand, taking into consideration that some of them may produce damaging effects on pavements, soil, vegetation and may also affect the quality of the ground.

KEYWORDS: DE-ICERS, ENVIRONMENT, PERFORMANCE.

1. Introduction

Deicing represents the substance that together with other substance forms a compound with a melting point inferior to the melting point of the components.

In the hibernation period, the snow and ice coverings deteriorate the exploitation characteristics of the asphalt concrete or cement concrete blanket on the roads. The presence on the road of a snow – ice covering leads to a strong decrease in wheels adherence to such a covering and increase in resistance present in transportation means movement. Also, the ice formation slows down very much the pedestrians' moving conditions causing (in some cases) traumas and other unfortunate situations. [4]

Yearly, the companies that take care of winter interventions make supplies of necessary materials used for interventions in case of heavy snow and for glaze frost and ice removal out of the practicable part of the roads and of the pedestrian sidewalks. In this material ammunition are included the deicers that have the role of melting the snow and ice and cleaning the lanes of the road; this leads to an increase in traffic safety and also facilitates driving.

The most used deicing is the sodium chloride, best known as salt. Salt is effective because lowers the freezing point of water and prevents forming of snow and ice on the practicable side of the roads. The frequent use of salt is due to the fact that it is not very expensive in comparison with other deicers. Using salt is not without problems. Salt contributes to vehicle corrosion, damages the road blankets, damages the vegetation on the side of the roads, and has effect on the water courses near the roads and also on the ground water. [1]

The antiskid materials as sand and granulated clinker are often used together with deicers to ensure vehicle traction, especially for curves, crossroads and near pedestrian crossings. These materials are not lowering the melting point of ice, but increase the friction coefficient between tires and slippery surfaces. This materials' disadvantage is that they accumulate on road shoulders and are hard to be recovered. [2]

In table no. 1 is presented the influence of the snow-ice formations over the road blanket surface state.[3]

Table no. 1. Influence of snow-ice formations over the road blanket surface state

State type of the road blanket surface	Adherence coefficient of tires to the road ϕ	Resistance coefficient for wheel skidding f_{kar}
Clean and dry asphalt concrete	0.65 - 0.75	0.02 - 0.025
Covered with bulk snow - dry - wet	0.2 - 0.3 0.1 - 0.2	0.15 - 0.25 0.3
Covered with heaped snow - dry - wet	0.2 - 0.35 0.1 - 0.2	0.08 - 0.1
Covered with melting ice	0.05 - 0.1	0.05

2. Results and discussion

In Romania the main mean to fight against glaze frost, ice and snow on the roads is treating them with mixes of sand and salt.

It was noticed that fresh snow that was treated with this mix is heaping much slower and adheres to the tires of transportations means less than clean snow.

Beside sodium chloride is also used the calcium chloride. This deicer replaces most of the times the sodium chloride. The calcium chloride is also very corrosive, but has a smaller impact on vegetation and soil than sodium chloride.

Other deicers also used are:

1. **DEGIVRAMOLD:** the product is a complex of inorganic salts inhibited against corrosion, used in the cold season for infrastructure maintenance: roads, bridges, sewer systems, etc., having as effect a deicing action for melting the snow and the ice, and forming an anticorrosion film on the practicable road before snowing that prevents glaze frost formation.

The anticorrosion character and anticorrosion film formation has as consequence the considerable decrease of the maintenance and repair costs for road structures. Collaterally, this effect is advantageous also for vehicle car bodies. The anticorrosive feature is the main characteristic and that makes it superior to other existent solutions.

For preventive direct application are estimated the following quantities before freezing, respectively snowing.

- Solution: 105 l/km of the traffic lane;
- Granules: 35 kg/km of the traffic lane.

These values vary function of road nature, ice thickness, etc. The Degivramold deicer is effective for temperatures of -20°C .

Tabelul nr. 2. Proprietatile fizico-chimice ale produsului Degivramold

Physical and chemical properties	Freezing point, $^{\circ}\text{C}$	-19 $\div$ -22
	Density 20°C g/cm^3 , min	1.140
	pH	6-8
	Corrosion over metals, mg/cm^2 , max	
	Steel	0.1
	Aluminum	0.2
	Cast iron	0.1
	Brass	0.1
	Copper	0.1

The real effects of the products use are:

- protects the tires and car bodies during winter period reducing the vehicle maintenance costs
- reduces accidents number
- has no destructive effects over asphalt blankets of over cement concrete blankets.

The Degivramold solution was tested also in Laboratory of the Faculty of Civil Engineering and Building Services Iasi. After 10, respectively 50 cycles of freezing-deicing in Degivramold solution the samples of asphalt mix of type: BA8, BA16, BAPC8, BAPC16 were subject to water absorption tests and Marshall Test.

It was ascertained that the samples absorbed a very small quantity of water that is insignificant.

Also, there was ascertained a small decrease in resistance as a result of Marshall tests.

In table no. 3 and no. 4 there are presented the values resulted from Marshall tests in 10 and respectively 50 days of freeze – deicing cycles, and also the flow values.

Table no. 3 Marshall Test results

Mixture type	S, Marshall after 10 days (KN)	S, Marshall after 50 days (KN)
BA 8	9.4	7.9
BA 16	9.7	7.7
BAPC 8	9.0	9.3
BAPC 16	8.9	9.5

2. **ECOROUTE** is a non-polluting product used for ice and snow melting. Ecoroute is a non-corrosive liquid mix of substances with corroborated freezing points.

- pH: 4 – 6
- Specific density: 1.25-1.35 kg/liter at 20°C
- Color: dark brown

3. **30% SOLUTION CALCIUM CHLORIDE and GROUND CALCIUM CHLORIDE** to which is added a corrosion inhibitor. The calcium chloride is used for fighting against freezing due to the very low freezing temperature, and of its ability to rapidly absorb humidity and ability to relieve heat when dissolved in water. Application of calcium chloride is effective even under -30°C.

The main features of these products are presented in table no. 4:

In the following table are presented the type of treatment and the dosages, function of weather conditions:

Table no.4

CHARACTERISTIC	30% SOLUTION CALCIUM CHLORIDE	GROUND CALCIUM CHLORIDE
Aspect	clear or mild opalescent liquid	dust and irregular shape granules
Included in CaCl ₂ , % min.	30.0	90.0
30% solid pH	neuter	-
Included in insoluble substances in water, % max.	0.1	1.0
Alkaline and Mg chlorides expressed in NaCl, % max.	0.5	1.0
Included in iron, % max.	0.01	-

3. Conclusion

It is clear that there are advantages and disadvantages to all deicer compounds and alternatives. Planning and a combined chemical and mechanical approach to snow and ice control can often minimize the impacts of deicer compounds in the landscape. Consider the following suggestions:

- All compounds should be used according to label instructions. Products may have little or no adverse effect if used according to instructions, but cause significant problems if applied at rates or in a manner inconsistent with labeling.
- Use more mechanical removal. The more snow and ice present, the more deicing compound is needed for melting. Reduced amounts can be used if large accumulations of snow and ice are removed first. The cost of labor for physical removal may be offset by savings in reduced damage to the landscape.
- Use abrasive materials in conjunction with mechanical removal and/or chemical deicers. If possible, select abrasives that can be

incorporated into the landscape to reduce the need for removal after the deicing season.

- Use deicing compounds with minimal effects on plants. If possible, plant salt tolerant vegetation in areas receiving large amounts of deicing salt, or as a barrier between salt sensitive vegetation and the site of deicer application.

4. References

1. G.L. Karaban, B. A. Lifsit, V. B. Ratinov: „Compleknaia tehnologhia snegocistchi gorodskih dorog”, Stroizdat Moskova, 1990;
2. www.saltinstitute.org;
3. C. Chappelow, A. Dean McElory – „Handbook of Test methods for Evaluating Chemical Deicers” – Strategic Highway Research Program, Washington, DC 1992
4. United States Environmental Protection Agency – „Managing Highway Deicing to Prevent Contamination of Drinking Water, August 2002