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G. Mingjun
V. Kovalskiy
M. Bondar

THE EFFECT OF ANTI-ICING REAGENTS ON THE FROST RESISTANCE OF ASPHALT CONCRETE

Vinnytsia National Technical University;

Анотація

Проаналізовано та встановлено основні протиожелндні реагенти для танення снігу на автомобільних дорогах. Досліджено вплив протиожеледних реагентів (15% сечовини (CH_4N2O), 20% промислової солі (NaCl) і 20% абсолютного етанолу (CH_2CH_3OH)) на морозостійкість асфальтобетону.

Ключові слова: протиожелндні реагенти, автомобільні дороги, морозостійкість, асфальтобетон.

Abstract

The main anti-icing reagents for melting snow on roads were analyzed and established. The effect of anti-icing reagents (15% urea (CH_4N_2O), 20% industrial salt (NaCl) and 20% absolute ethanol (CH_2CH_3OH)) on the frost resistance of asphalt concrete was investigated.

Keywords: anti-glare reagents, highways, frost resistance, asphalt concrete.

Introduction

At present, China has the largest mileage of highways in the world and a large number of national roads, provincial roads, rural roads, and urban roads of different grades, and more roads will be opened to enrich the highway system [1-4]. However, the use of a large number of deicing salt will greatly reduce road performance and service life of roads [5-7]. But, there is no technology that can perfectly replace the deicing salt to achieve the purpose of removing ice and snow in winter, so it is of great significance to systematically research the effect of deicing salt on road performance [8-10].

The purpose of the work is to study the effect of anti-icing reagents on the frost resistance of asphalt concrete samples.

Results of the research

The research group selected several commonly used chlorine deicing salt and non chlorine deicing salt for freezing point test. The test instruments used include: TR6602 double channel contact thermometer, constant temperature refrigerator, thermistor, etc., as shown in Fig. 1.

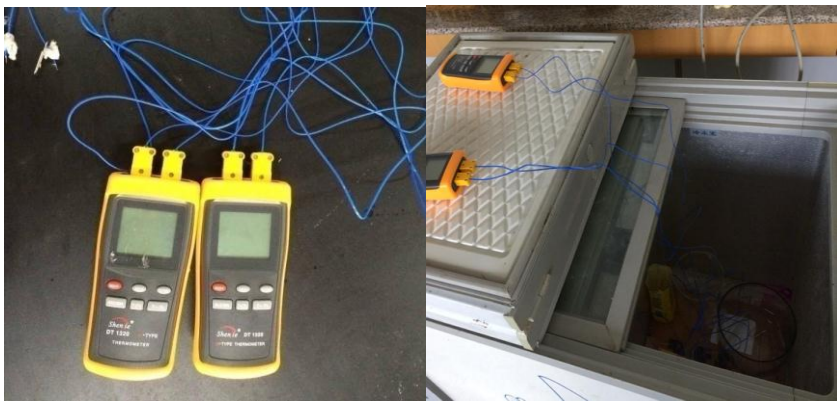

Fig. 1 Test of freezing point of deicing salt

15% urea (CH_4N_2O), 20% industrial salt (NaCl) and 20% absolute ethanol (CH_2CH_3OH) were prepared as the solutions for the wet-dry cycle. Considering the volatile nature of CH_2CH_3OH, the CH_2CH_3OH solution was reprepared for each cycle, and the solutions were reprepared once for the three cycles of CH_4N_2O and NaCl. Marshall samples, rut samples and beam samples of Ac-13 and AC-16 were prepared for freeze-thaw splitting test. For AC-13 gradation, the splitting strength and its loss rate under multiple dry-wet cycles are shown in Fig. 2.

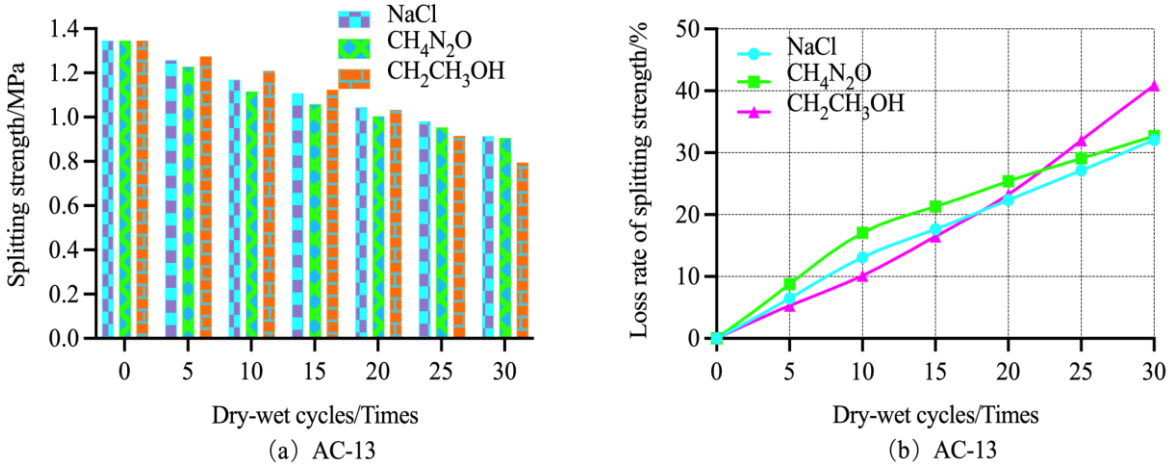

Fig. 2 Splitting strength of AC-13 under multiple dry-wet cycles

It can be seen from Fig. 2 that when the gradation of asphalt mixture is AC-13, the splitting strength corresponding to the three kinds of deicing salts decreases with the increase of dry-wet cycles. Under the same number of dry-wet cycles, there is no significant difference in the splitting strength of the three kinds of deicing salts. In the process of 0 to 30 dry-wet cycles, the damage rate of splitting strength corresponding to CH_2CH_3OH is 40.9%; The damage rates of NaCl and CH_4N_2O are 32.1% and 32.7%, respectively.

For AC-13 gradation, the tensile strength ratio and its loss rate under multiple dry-wet cycles are shown in Fig. 3.

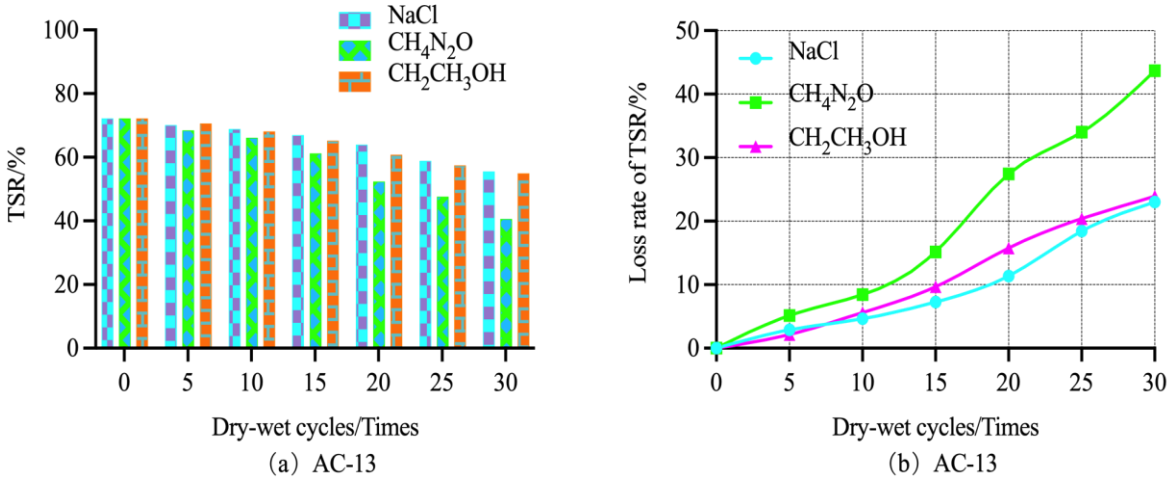

Fig. 3.10 Tensile strength ratio of AC-13 under multiple dry-wet cycles

It can be seen from Fig. 3 that when the gradation of asphalt mixture is AC-13, with the increase of dry-wet cycles, the tensile strength ratio (TSR) corresponding to the three kinds of deicing salts shows a decreasing law. Under the same dry-wet cycles, the influence of CH_4N_2O on the TSR is significantly greater than that of the other two kinds of deicing salts, furthermore NaCl and CH_2CH_3OH have little difference in influence on TSR. At the 5th dry-wet cycle, the TSR of CH_4N_2O is 68.5%, while at the 10th dry-wet cycle, the TSR of CH_2CH_3OH and NaCl are 68.1% and 68.8%, respectively, which all cannot meet the minimum value of 70% specified in the specification.

For AC-16 gradation, the splitting strength and its loss rate under multiple dry-wet cycles are shown in Fig. 4.

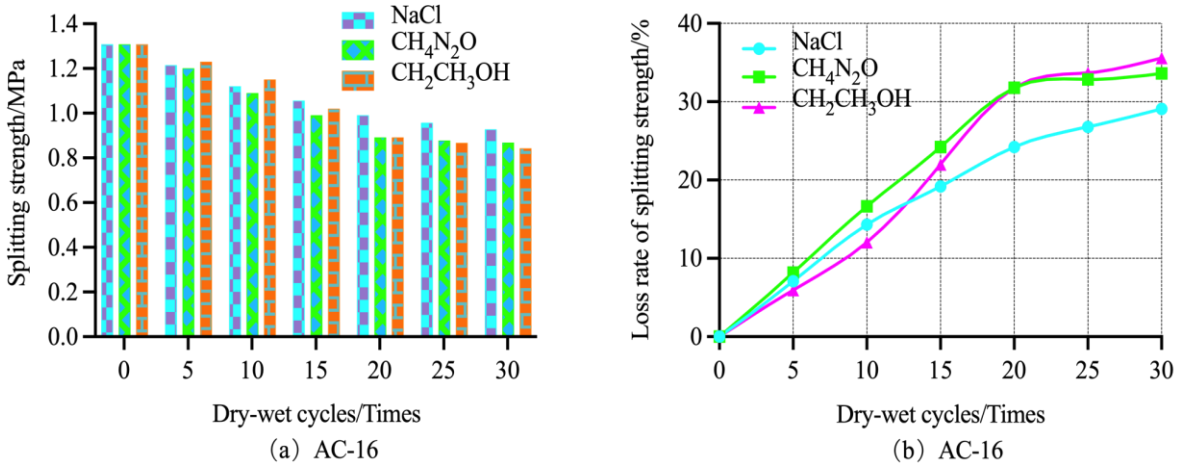

Fig. 4 Splitting strength of AC-16 under multiple dry-wet cycles

It can be seen from Fig. 4 that when the gradation of asphalt mixture is AC-16, the splitting strength corresponding to the three kinds of deicing salts decreases with the increase of dry-wet cycles. Under the same number of dry-wet cycles, there is no significant difference in the splitting strength of the three kinds of deicing salts. In the process of 0 to 30 dry-wet cycles, the damage rate of splitting strength corresponding to CH_2CH_3OH is 35.6%, which is the most obvious; The damage rates of NaCl and CH_4N_2O are 29.1% and 33.6%, respectively.

For AC-16 gradation, the tensile strength ratio and its loss rate under multiple dry-wet cycles are shown in Fig. 5.

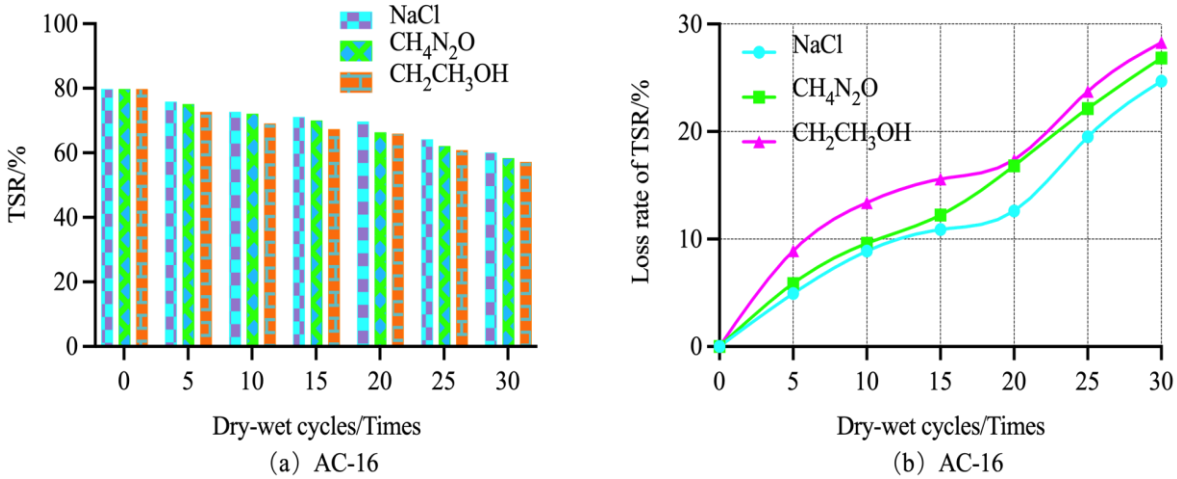

Fig. 5 Tensile strength ratio of AC-16 under multiple dry-wet cycles

It can be seen from Fig. 5 that when the gradation of asphalt mixture is AC-16, with the increase of dry-wet cycles, the TSR corresponding to the three kinds of deicing salts shows a decreasing law. Under the same number of dry-wet cycles, there is no significant difference in the TSR of the three kinds of deicing salts. At the 10th dry-wet cycle, the TSR of CH_2CH_3OH is 69.1%, while at the 20th dry-wet cycle, the TSR of NaCl and CH_4N_2O are 69.7% and 66.4%, respectively, which all cannot meet the minimum value of 70% specified in the specification.

Conclusions

By studying the effect of different types of deicing salts on the water stability of the two asphalt mixtures

under the conditions of freeze-thaw cycle at different temperatures, the damage laws of various factors on the asphalt mixture were analyzed, which provided a basis for spreading deicing salts in winter and predicting the life of the road surface.

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Го Мінцзюнь, аспірант кафедри *будівництва, міського господарства та архітектури*, *Вінницький національний технічний університет.* e-mail: guo19920408@hotmail.com

Ковальський Віктор Павлович — *к.т.н., доцент, доцент кафедри будівництва, міського господарства та архітектури, Вінницький національний технічний університет. Email: kovalskiy.vk.vntu.edu@gmail.com*

Бондар Михайло Дмитрович — студент групи БМ-21 мс, факультет будівництва цивільної та екологічної інженерії, Вінницький національний технічний університет, Вінниця, e-mail: m1507200bondar@gmail.com

Guo Mingjun, Postgraduate Department of Department of Construction, Urban Management and Architecture, Vinnytsia National Technical University, Vinnytsia, e-mail: guo19920408@hotmail.com

Kovalskiy Viktor P — Ph. D., Associate Professor, Associate Professor of the Department of Construction, Urban Management and Architecture, Vinnitsa National Technical University. Email: kovalskiy.vk.vntu.edu@gmail.com

Bondar Mykhailo D – student of BM-21 ms group, Faculty of Civil and Environmental Engineering, Vinnytsia National Technical University, Vinnytsia, e-mail: m1507200bondar@gmail.com