

# Effect of Emulsification Asphalt Cold Mix Asphalt Demulsification

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**Abstract:** *This paper introduces the research on status and development of emulsified asphalt at domestic and international. Through the analysis of the formation mechanism and the mechanism of the emulsified asphalt, the effect of the compound emulsifier is better than that of the single emulsifier. Composite demulsification of emulsified asphalt by what factors affect and by these factors regulating speed of emulsified asphalt emulsion breaking and solve the engineering common emulsified asphalt mixture demulsification speed too fast.*

**Keywords:** emulsified asphalt; emulsifier; emulsion mechanism; demulsification

## 1. Background

With the development of highway construction, the traffic volume is increasing and the axle load is obviously increased, which brings the obvious damage to the asphalt pavement, especially the early damage. Asphalt mixture and cement concrete are generally used in the high level pavement structure, but because of the low flexural strength and rigidity of the cement concrete, the application of the pavement structure is influenced by the application in the highway. It is one of the effective ways to solve the problem that the emulsified asphalt mixture is still under the wet and low temperature condition. Emulsified asphalt is the main factor to determine the performance of emulsified asphalt mixture, it is good or bad to determine the performance of the mixture, and the performance of the emulsified asphalt is mainly determined by the emulsifier.

## 2. Significance

Emulsified asphalt and emulsified asphalt cold regeneration technology of can for the popularization and application of emulsified asphalt in highway maintenance in China to provide technical support to alleviate highway maintenance task is heavy and maintenance funds shortage of contradictions; on the road to timely and effective maintenance, to lower the cost and extend the pavement life, improve the pavement service performance; reduce the pollution of the environment, energy and resource conservation, development new maintenance construction technology; construction technology is simple, after the pavement compaction can immediately open to traffic and greatly relationship construction time, nearly half of the curing time can be saved, but also good curing effect; construction of seasonal and climatic influence smaller.

## 3. Development and Application of Emulsified Asphalt

### 3.1 Foreign Countries

In 1905, the first asphalt emulsifier products come out. The application of emulsified asphalt in road engineering is developed from the 30's in twentieth Century, In the

beginning, it was mainly made of water as diluent and made of anionic emulsified asphalt. In the 1950s, some countries have developed a cationic emulsified asphalt, in recent years, the almost eliminated the anionic emulsified asphalt and cationic emulsified asphalt gradually develops rapidly in all countries. Data show that [5], the development trend of the United States and Europe emulsified asphalt has the following aspects:

- 1) Emulsified asphalt can control the breaking time;
- 2) Modified Asphalt Emulsion Doped polymer;
- 3) High concentration of emulsified asphalt, the concentration reached 65% ~ 69%;
- 4) Refined emulsified asphalt, general asphalt emulsion particle diameter in the middle of the value is 3 ~ 5  $\mu\text{m}$ , and refined emulsified asphalt intermediate value is 1 ~ 2  $\mu\text{m}$ .

Asphalt emulsion demulsification performance, evaporation residue and modified emulsion technology is a research focus in the next few years.

### 3.2 Domestic

Emulsified asphalt and its application technology in China started late, five, sixty time is mainly open to the application of non - ionic, anionic emulsifier, emulsified asphalt in a certain range of application. By the late 1970s, the Ministry of Communications "cationic emulsified asphalt and road use performance research" subject cooperative group of cationic emulsified asphalt and road performance of thematic research and achieved good results, the mainly as follows[3]:

- 1) Development and production of cationic asphalt emulsifier;
- 2) Formulation of emulsion process and emulsion;
- 3) The development of emulsifying machine and the setting of the emulsion shop;
- 4) Test standard and test method of the cationic asphalt emulsion;
- 5) Mix design and test method of the emulsified asphalt concrete;
- 6) The cationic emulsified asphalt road construction and maintenance technology and other key issues.

## 4. The Formation of Emulsified Asphalt and Demulsification

The essence of emulsified asphalt is a kind of colloid, which consists of asphalt, emulsifier, stabilizer and water[2]. The asphalt particles are dispersed phase, water as the continuous phase, the emulsion is the dispersion medium, the viscosity at room temperature is very low, the flow is very good.

Also known as anti emulsification demulsification. Because the bitumen emulsion is thermodynamics unstable system, in the physical or chemical effect, resulting in oil phase and water phase fraction or complete separation phenomenon, scattered asphalt particles together, forming a continuous asphalt film covering on the aggregate surface and the material mutual bond dense, called demulsification.

Process of demulsification of emulsified asphalt, the color will gradually change, from brown to black to complete the restoration of demulsification of asphalt performance need certain time, is commonly referred to as the breakage rate. Some emulsion to demulsify the emulsion by adding demulsifier, and emulsified asphalt (especially the cationic emulsified asphalt) demulsification conditions is relatively easy, emulsion concentration, temperature and mechanical stirring effect can make emulsified asphalt demulsification. The major factors influencing the demulsification of emulsified asphalt [6]:

### (1) Composite emulsifier

Because a single emulsifier has a fixed hydrophilic oil balance, it can not meet the needs of the complex asphalt emulsion H.L.B. Therefore, two kinds of emulsifying agents, which are formulated in different proportion, form a composite emulsifier. At the same time, the composite emulsifier can play a synergistic role such as composite, prolong the breaking time. Because its molecules could insert into the gap in the asphalt surface arrangement of cationic emulsifier molecules, greatly improve the interfacial film strength, can also further reduce the interfacial tension, the electric double layer is more stable, thus delaying the breaking time.

### (2) Emulsifier concentration

In asphalt and water system after adding emulsifier, emulsifier is bound to be adsorbed on the interface, forming the boundary film. When emulsifier concentration is low, forming interfacial film of emulsifier molecules less, sparsely arranged, poor strength, poor preparation of emulsified asphalt stability, easy demulsification. Emulsifier concentration increased to a certain extent, interfacial film formation of emulsifier molecules are closely arranged, strength also increases accordingly, diffusion layer will be thicker, zeta potential is greater, so with contact cement, sand, emulsified asphalt droplets aggregation resistance increases, the slower the destruction of the electric double layer, and the breaking time is longer. Therefore, the concentration of emulsifier should be controlled in a certain range.

### (3) The pH value of the emulsion

PH of surface active agent on the solid-liquid interface adsorption effects also vary with the system, but mainly

through the changes in the electrical characteristics of the solid surface, cationic emulsifier aqueous solution should generally be regulation for acidic or neutral to play better emulsifying effect. But the pH value can't be too low, because adding acid is excessive, counter ion concentration will become large and it will damage the electric double layer, the zeta potential decreased, causing the demulsification. When the acidity is too high, it will have an effect on the performance of the asphalt, so the pH value should have an optimal range.

### (4) Selection of additives

Mixing mortar with a certain amount of additives, additives after hydrolysis of ion, contrary to the charge and the mixture to the surface negative charge, and part of the negative ion, prevent electric double layer of demulsification, thus delaying the demulsification. The choice of the auxiliary agent is the more positive charge, the less dosage is appropriate, otherwise it will change the pH value of the emulsion, which affects the performance of the mortar. The addition of cement is an important factor to improve the technical performance of emulsified asphalt mixture. Due to the hydration of cement to water, heat, will inevitably lead to the demulsification of emulsified asphalt speed, so it will be as the cement emulsified asphalt a demulsifying agent.

### (5) Mixing water

Asphalt emulsion and aggregate mixture, to aggregate dry water mixing. If the emulsion and aggregate blending, dry aggregate surface to water wet, a portion of the water in the emulsion of such by absorption of stone, to break the emulsion of oil in water emulsion balance and therefore not the size of the mixing water or the mixing water will lead to premature demulsifying emulsion. Mixing water is, the longer the breaking time. Because the size of white water will directly affect the strength of cement mortar, pan pulp rate, expansion rate, durability and performance.

### (6) Mixture of surface properties

The mixture of solid surface properties can be divided into charge, surface roughness and surface area of the size of. Because of the natural aggregate solid surface is mostly a negative charge. Therefore, cationic surface active agent is easy to be absorbed, emulsion breaking easier. Mix surface roughness, specific surface area is greater, in contact with the emulsion, water is very strong, prompting the demulsification of emulsion premature, caused in the mixture of fine material is easy to agglomerate, and less coarse aggregate on the surface adsorption of emulsion, different particle size mixture asphalt coated uneven phenomenon.

### (7) Mixing temperature

Increased mixing temperature is high, the fiercer the Brownian motion, diffusion layer and absorption layer of molecules have separated from the absorption of the trend, the zeta potential will decrease, emulsion stability, and asphalt particles collided with each other, the probability will increase, mutual integration opportunities, emulsified asphalt the possible breaking emulsion.

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