HORIBA Scientific

Application Note

Particle Sizing of Asphalt Emulsions

AN137

Asphalt emulsions have made the manufacturing and storage of road construction materials simpler and less expensive than previous methods. Asphalt emulsions are droplets of asphalt dispersed in water with the aid of an emulsifying agent. The particle size of the asphalt droplets is critical to stability and application performance.

Introduction

Asphalt aggregate roads were traditionally made by an asphalt-coated aggregate that was hot-mixed in a central plant. The continued development of asphalt emulsions has increased the variety of types available, as well as improved application methods. These developments have lead to a growing use in road construction.

In contrast to the traditional hot-mixed asphalt technique, asphalt emulsions can be stored and used in an ambient temperature. These emulsions do not require a petroleum solvent and can be applied without additional heat. Both factors contribute to energy and cost savings, as well as reducing atmospheric pollution.

An asphalt emulsion consists of droplets of asphalt (from 55 to 70 percent) dispersed in water with the aid of an emulsifying agent[1]. The quality of water used is critical, as minerals or ionic species can affect the emulsion stability. The ionic charges of the emulsifying agent keep the asphalt droplets from coalescing, stabilizing the emulsion.

Emulsion Manufacturing

Asphalt emulsions are manufactured by a high-speed, high shear mechanical device (usually a colloid mill) that divides the asphalt into tiny droplets and disperses it in the water.

Typical products have a size range from sub-micron up to ten microns, with an average particle size in the 1 to 5 micron range. Variation in settings, raw materials, and requirements of the final product will affect both the average size and distribution width.

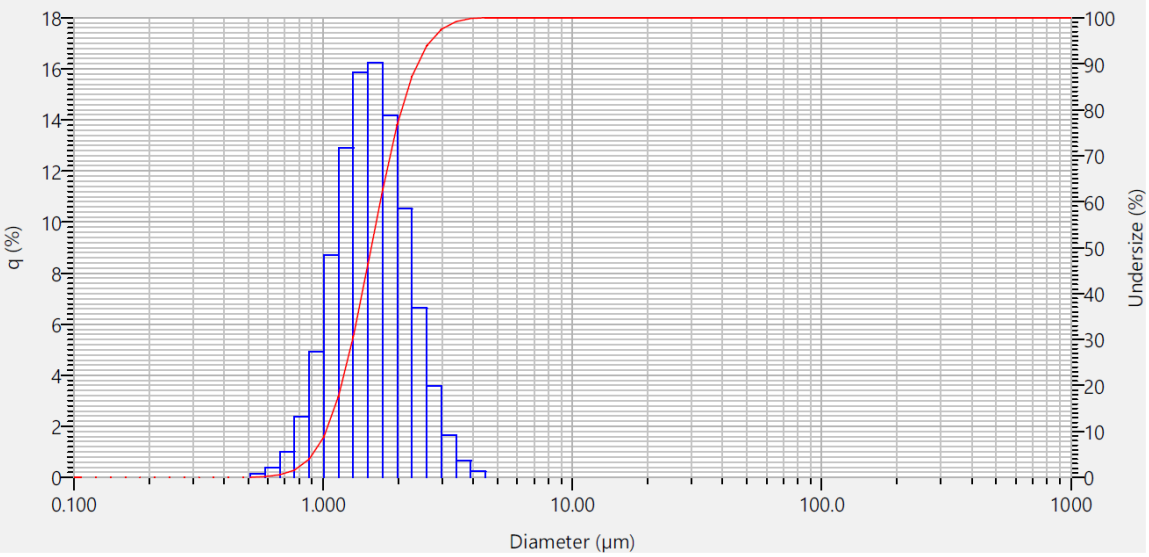
The HORIBA LA-350 particle size analyzer has proven to be very popular for this application. It is used by manufacturers to closely control the emulsification process, as well as to test products at storage facilities and conduct field trials as a portable field unit.

HORIBA LA-350 Particle Size Analyzer

The object is to make a dispersion that is stable enough for pumping, prolonged storage, and mixing. The emulsion should also break down quickly after contact with aggregate in a mixer, or after spraying on the roadbed. After curing, the residual asphalt retains all of the adhesion, durability, and water-resistance of the asphalt cement from which it was produced. A wide variety of grades are available that vary in strength, setting time, and viscosity.

Asphalt particle size is a vital factor in making a stable emulsion. Tight control during manufacturing, storage, and field checks prior to final application can aid in providing a stable, quality product.

The example below shows analysis results from a typical asphalt emulsion. Samples are usually dispersed in deionized water. Quick setting emulsions may require the addition of a compatible surfactant to stabilize the diluted dispersion.



Asphalt emulsion
Median – 1.56µm
D (10%) – 1.02µm
D (90%) – 2.40µm
Mean – 1.65µm

Analytical Test Method

RI of asphalt[2] – 1.63-0.10i
Dispersant fluid – deionized water with some surfactant.
Pump speed – speed 2 or 3 are sufficient for all grades

References

1. Transportation Research Circular, Number E-C102, August 2006

2. https://www.rpi.edu/dept/phys/ScIT/InformationTransfer/reflrefr/rr_content/refraction_15.html. Values of n come from the *CRC Handbook of Chemistry and Physics*.