



RESPONSIBLE USE OF POLYPHOSPHORIC ACID (PPA) MODIFICATION OF ASPHALT BINDERS

WHAT IS PPA?

Polyphosphoric acid (PPA) is a non-asphaltic reactive oligomer or short chained polymer that has been used in asphalt binder formulations for more than 70 years. PPA can be used alone or in conjunction with polymer modification to provide improved performance of asphalt binders and asphalt mixtures.

HISTORICAL USAGE

PPA has seen success with responsible use as a modifier to enhance properties of asphalt binder in asphalt paving since 1973. The use of PPA to improve overall performance of asphalt binders has increased since the implementation of the Superpave performance grade (PG) binder specification.

Responsible use of PPA to enhance performance properties of asphalt binders has a long track record; however, its use has been debated with some State Departments of Transportation (DOTs) prohibiting use of PPA as an asphalt binder modifier. Other State DOTs allow restricted use with the common maximum use level being 0.5 percent and with some allowing up to 0.75 and 1.0 percent maximums.

COMMON CONCERNS

The common concerns regarding the use of PPA are:

- What are the potential adverse effects of PPA on asphalt binders?
- How can the presence of PPA in an asphalt binder be detected?
- How can the amount of PPA used in an asphalt binder be measured?

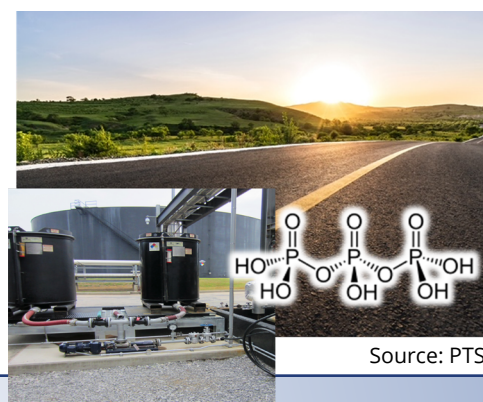
IMPACT OF PPA ON ASPHALT BINDER

Research studies and industry experience have shown the use of small amounts of PPA (alone or in conjunction with polymer modification) in the range of 0.25 to 1.0 percent as a tool for chemical modification of asphalt binders can improve the high-temperature PG without adversely affecting the low-temperature PG. PPA as an asphalt binder modifier has also been shown to possibly provide improved asphalt binder aging characteristics.

DETECTION AND QUANTIFICATION OF PPA

The presence of PPA can be indicated through chemical tests or via instrumental analysis. While chemical tests are limited to being qualitative, instrumental methods are available to efficiently quantify dosage levels of PPA in asphalt binders. A commonly accepted instrumental analysis method, known as a calibration or standard curve method, can be used to determine concentration of a substance in an unknown sample by comparing the unknown to a set of standard samples of known concentration. Using this method, several instruments, such as X-ray fluorescence (XRF), are available for detecting and quantifying chemical elements specific to PPA in an asphalt binder.

Read more about the use of PPA as an asphalt modifier in [Responsible Use of Polyphosphoric Acid \(PPA\) Modification of Asphalt Binders, Publication Number FHWA-HIF-23-005](#), Federal Highway Administration, Washington, DC, February 2023.



For more information or technical assistance, please contact:
Tim Aschenbrener, FHWA, timothy.aschenbrener@dot.gov

View cooperative agreement materials:
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