

Catalyst Regeneration of RAP-Binder in Asphalt

Developing a catalyst for use in Recycled Asphalt Pavement Binders for better preservation

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20BLSU19

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Tran-SET

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Total Project Cost:

\$74,998

Roads play a significant role in our lives, and asphalt is a key substance used to create roads. As asphalt material costs increase, federal and state agencies, design engineers, road contractors, and asphalt suppliers look for methods to decrease material costs without compromising the pavement quality. One such method is using recycled materials to compensate for part of the virgin materials. The use of recycled asphalt pavement (RAP), generated from milling of old pavements, can potentially protect the environment, and save resources; however, incorporation of RAP in virgin asphalt is challenging. The aged asphalt binder extracted from RAP generally cannot be used as a direct substitute for virgin asphalt binder due to its aging during service life and the resulting changes in chemical composition and properties. Asphalt binder's chemical composition has a delicate balance of polar to non-polar molecules, small to large molecules, and aromatic to paraffinic compounds. When there is an imbalance in composition, incompatibility between components can occur, resulting in poor performance. This kind of imbalance comes from asphalt binder aging. The blending process of RAP-binder with virgin asphalt binder is not fully understood yet, and the chemical composition of the RAP-binder makes it hard to use.

Problem Statement

Efficient ways to produce high quality products from low quality wastes are required to help industries that depend on nonrenewable resources. The study will apply fundamental research of catalyst use to RAP in Louisiana. RAP has been used with virgin asphalt in Louisiana and other states for a substantial time; however, agencies in other states are now worried that the use of a higher percentage of RAP (more than 25%) in virgin asphalt may adversely affect the performance of asphalt pavements, eventually resulting in higher pavement maintenance and rehabilitation costs.

Objectives

Recycled Asphalt Pavement (RAP) has been used with virgin asphalt binder in Region-6 states for a significant period; however, many state agencies are becoming concerned with the use of RAP percentages (over 25%) with virgin materials. This is a possible issue because the increasing percentage can negatively affect asphalt pavement performance, eventually resulting in higher pavement maintenance and rehabilitation costs. RAP binders are hard to reuse because they often contain molecularly heavy molecules. These heavy molecules are responsible for RAP binder's increased viscosity and certain deteriorated rheological properties. For this, rejuvenators, softening agents, softer binders, and antioxidants can be added to asphalt that contains high amounts of RAP/RAS-binder to rebalance their rheological properties. Another approach to increase the amount of RAP/RAS-binder would be to modify the binder's chemical composition with the reagents or catalysts. This research aims to effectively incorporate RAP mixtures into asphalt. The objective of this research project is restoring RAP-binder with new catalysts. Detailed chemical characterization of the RAP-binder before and after catalytic treatment will be studied to assess the changes occur due to catalytic treatment. The chemical properties will be compared to virgin asphalt.

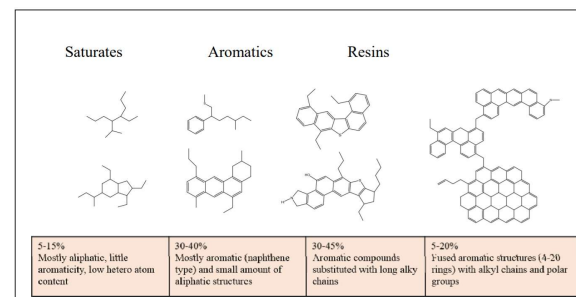


Figure 1: Representative structures of asphalt fractions SARA (Saturates, aromatics, resins and asphaltenes)

Intended Implementation of Research

Education and Workforce Development: The outcomes of this project will be presented to educate undergraduate students on the importance of the chemical research in the transportation industry.

Outreach: Undergraduate students will have the opportunity to work with the PI for RAP-binder regeneration.

Anticipated Impacts/Benefits of Implementation

The main benefits from this study are expected to be pavements with better rheological properties. The deliverables are: 1) a final report which will include the experimental data, analysis, marketing ideas, proposed specifications, and recommendations of this project, 2) presentations to be given at national and regional conferences.

Web links

- Tran-SET's website
<https://transet.lsu.edu/research-in-progress/>

Tran-SET

Tran-SET is Region 6's University Transportation Center. It is a collaborative partnership between 11 institutions (see below) across 5 states (AR, LA, NM, OK, and TX). Tran-SET is led by Louisiana State University. It was established in late November 2016 "to address the accelerated deterioration of transportation infrastructure through the development, evaluation, and implementation of cutting-edge technologies, novel materials, and innovative construction management processes".

Learn More

For more information about Tran-SET, please visit [our website](#), LinkedIn, Twitter, Facebook, and YouTube pages. Also, please feel free to contact Dr. Momen Mousa (Tran-SET Program Manager) directly at transet@lsu.edu.

